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#### Review

Various attempts have been made to imbue survey respondents with an appreciation of the importance of their individual contributions to the response rate by offering gifts or incentives. These attempts are measures designed to increase response to surveys or to improve the quality of response. Many attempts have been made to measure the effectiveness of incentives. A novel experiment by Chromy and Horvitz [4] offered set and variable incentives, the variability arising from the degree to which the respondent wanted to get involved; the higher the involvement, the higher the incentive payment. The variable incentive plan was adopted for use in later waves of the study because it was shown to be the most cost effective.

Several studies have analyzed the effects of offering incentives in mail surveys. Generally, the payment of incentives was found to improve results, and prepayment of an incentive more rewarding to the sponsor than promised payment. Linsky [14] in a review of the use of incentives in mail surveys states that "cash rewards invariably increased returns over the level of response for no-reward control groups" in ten experimental studies. His interpretation of these results suggest that the "motivating power of the (incentive) is not in terms of its monetary value but in its symbolic, or token value". In the area of personal interview surveys, the use of incentives has come about either as a curative for or a preventive against unacceptably low response rates. Ferber and Sudman [8] reviewed the effectiveness of compensation in consumer expenditure surveys, finding variable results. They hypothesized that the success of offering compensation could be due to the auspices under which the incentive is offered, the income level of the recipient, or the subject of the study. In other diary surveys, Sudman[22] found no important differences in recording levels due to the offer of compensation, and no change in reporting levels when the level of compensation is changed in followup contacts. But in a later study, Sudman and Ferber[21] found that the offer of compensation improved the level of cooperation 14 to 17 percent. Kemsley and Nicholson[13] in England also found an increase in response rates as a function of the amount of monetary compensation offered.

For the most part, the use of incentives seems to be effective in raising response rates, especially in mail surveys, but also in diary and panel surveys, where the impetus is to encourage respondents in a task requiring more commitment than the usual one-time interview. The next section of this paper will report on an attempt by the U.S. Bureau of the Census to secure cooperation on a diary survey.

# The 1972-73 Survey of Consumer Expenditures

Sudman and Ferber[21] point out in their review that very little work has been done to validate results in compensation experiments. This paper attempts to assess the effectiveness of compensating respondents, and what changes may be

measured in item response rates and in the frequency of reporting of expenditures. Work done in the area has generally examined only the improvement in the response rate as a measure of the effectiveness of offering incentives. And in most diary studies validation is extremely difficult, so the efforts undertaken make the assumption that "more is better", since the major problem in diary surveys is underreporting. Since validation is very difficult, this paper will also make the assumption that more is better. trusting in the efforts of earlier researchers in this field. An earlier report (Walsh[23]) was made of the response rate differences for this survey due to use of incentives. The results show no significant differences in the overall response rate to the survey, the rate climbing from 72 percent to 77 percent, the standard error of the difference being approximately 5 percent. The Consumer Expenditure Survey (Pearl[15]) was conducted by the Census Bureau for the Bureau of Labor Statistics in calendar 1972 and 1973 to obtain comprehensive information on consumer expenditures to revise the National Consumer Price Index. The diary was a stratified multistage design consisting of 13,500 sample units in each year distributed among 30 self representing primary sampling units. The unit of analysis was the consumer unit (CU), which is essentially a family, or a group of people living together who pool their resources. The sample was systematically divided into 52 weekly subsamples to control for seasonality. In anticipation of difficulties in securing respondent cooperation in completing diaries in each of the two weeks a CU was in sample, an experiment was designed to test the effectiveness of offering an incentive to sample households for participating. The experiment was conducted for eight weeks of the survey. The treatments were to offer no payment to a randomly designated one third of the sample, five dollars to one third, and ten dollars to the remainder of the sample. Each interviewer handled only one treatment since it was felt that the burden imposed on the interviewer of keeping track of incentive offerings would be too great. The sample consisted of about 1850 eligible units, with 1472 units completing one or both diaries as requested. This experiment was admittedly a very small scale effort, but the results after eight weeks were considered definitive enough to terminate the experiment with the decision not to offer incentives.

# Results

Table 1 presents results for 72 expenditure categories covered by the diaries. The figures in the first three columns represent average weekly expenditures in dollar amounts reported by the respondents under the varying levels of payment. Column four shows the F statistic from a one-way analysis of variance (ANOVA) on the mean level of expenditures. An F value of 3.00 would be significant at the 95 percent confidence level, given 2 and $\infty$  degrees of freedom. The degrees of freedom for the denominator of the test actually varies, since the number of observations varies due to missing observations for various expenditure categories, but is always greater than 2800. The last column, eta-squared, reports the proportion of variance explained by the differences in the means between payment levels.

Three assumptions underlie the use of the F-statistic in analysis of variance: equal variances between treatments, normality of observations on the dependent variable, and independence of observations. To test for equality of variances, Cochran's test was used. Of the 72 expenditure categories, only 3 showed an indication that the variances were different, and these items were items which were infrequently bought (in any one week period), so that a few households reporting purchases of an item may cause a change in the variance estimated from a relatively small sample.

Regarding normality, the assumption depends on the expenditure category. Categories like total food expenditures and total other expenditures appear to be normally distributed, though no formal test was employed to make the determination. In categories involving infrequent expenditures, like medical expenditures, the distribution is bimodal, with a number of reports of zero expenditures for those respondents with no purchases of the item, and the remainder of the observations being actual expenditure amounts. ANOVA has been shown to be robust under departures from normality, and in view of the results shown later, it is not believed that the departure from normality is serious.

The final assumption is independence of observations. The sample consists of 1472 consumer units drawn at random in a two-stage stratified sample, each unit filling out a diary in each of two successive weeks. This gives 2944 observations total, except that many respondents failed to fill in various sections of the diary, so the number of observations ranges between 2835 and 2944. Sample units are independent, and reports within the sample unit for the first and second week of reporting evidence a low level of correlation. Observations are treated as independent for the purpose of this analysis<sup>2</sup>.

The statistic eta-squared is computed as the ratio of the explained sum of squares to the total sum of squares. Eta-squared is used in this paper only for descriptive purposes, to make the point that statistical significance, estimated by the probability of a Type I error less than 5 percent, does not necessarily indicate meaningful or substantial results that would lead to the adoption of the use of incentives. In no case is even one percent of the variance explained by the payments.

Table 2 presents the proportion of zero responses to an expenditure category. A zero response means that the respondent did not report buying an item in the diary. To further the analysis of people's response to incentives, a device will be employed here to focus on a specific type of behavior. Changes in reporting observed between treatments can be due either to a respondent reporting a purchase where he otherwise would have reported no purchase, or a respondent who was reporting purchases, now reporting more purchases under the influence of the incentive payment. However, the changes in the mean expenditures between treatments can be examined as a function of the decrease in the proportion of zero responses to a question, and the change between means for those who do report purchases. The former case can be taken as a nonresponse or the tacit reporting of no purchase. Were the proportion of zero expenditures to decline as a function of the incentive payment, then one could conjecture that some underreporting due to a lack of effort by the respondent was lessened by use of incentive payments.

A careful study of table 2 shows that for most items the proportion of zero responses does indeed go down, at least between the nonpayment and the combined five and ten dollar treatment groups. For the first category, Total Food and Beverages at Home, a comparison of the three proportions of nonreporters yields a Chi-Square of 14.02 ( $\alpha < .001$ ) with two d.f., and a z-test between the respondents receiving no payment and respondents receiving either five or ten dollars is 3.38 ( $\alpha < .001$ ), so it appears that incentives may increase the number of reports in the diary.

An examination of levels of expenditures, again for Total Food and Beverages at Home, with the zero expenditure reports removed yields average expenditures of \$21.40,\$22.69, and \$23.15 for no payment, five, and ten dollars compensation respectively. The zeros removed may have been legitimate nonpurchases, but what is being analyzed here is an increased reporting of expenditures. The range between low and high expenditure levels between treatments has been reduced. The F value for the difference in the above means is 2.05, not significant at  $\alpha = .05$ , and the proportion of variance explained by the different levels of compensation was half of the variance explained by the original model in Table 1 (.0017 of .0036). This analysis was not extended to other categories because of the relatively low response rates to individual items. Besides the low purchase rates, only 14 of the 72 categories showed statistically significant improvement, and some of these tests were correlated with one another because some categories are aggregates of several others. The other direction of interest in the analysis is whether response to incentives is interactive with any variable that may be used in stratification of the sample. A number of demographic variables were used in the analysis presented in Table 3, where Total Food and Beverages at Home is the dependent variable in a two-way analysis of variance, with incentives and one of the demographic variables as the independent variables in each analysis. The first three columns of Table 3 are mean expenditures for Total Food and Beverages at Home for the differ-ent incentive levels adjusted for the other variable in the analysis. The adjustment of the means is calculated as the deviation from the grand mean estimated for the row variable after the effects of the column variable have been removed. The adjustment process accounts for any correlation between incentives and the demographic variables. For example, the first line in Table 3 presents the mean expenditures unadjusted The second line presents the means adjusted for urbanicity. The next four columns are F values for the main effects, the incentive treatments,

the other variable in the two-way analysis of variance' listed at the left hand side of the table, and the interaction between the incentive variable and the demographic variable on the dependent variable. The main effects represent the linear effect of incentives and the demographic variable in the analysis. Because of the missing data and the vagaries resultant from lack of control in sampling housing units, incentives is slightly correlated with each of the demographic variables, and so main effects accounts for the predictive power of the two independent variables. The final two columns give the etasquared values for the incentives and the dependent variable. All F-values for main effects. incentive (row) effects, and column effects are significant (a(.01), and F-values for the first six interaction effects are significant ( $\alpha \langle 01$ except for the age-sex combination,  $\alpha$  (.02). The next section will consider if these effects are meaningful.

#### Conclusions

In the above presentation, F-values and their significance levels have been dutifully presented but without commentary regarding the interpretation of the results. The F-values generated are"significant" but not too exciting in the sense that none of the items examined displayed an overwhelming response to the payment of incentives. The small differences between incentives groups noted in Table 1 were found to be an increased reporting on the part of those respondents already listing expenditures without incentives. Additionally, there does seem to be

## some interaction between incentives and certain demographic variables, meaning some subgroups of ' respondents are more responsive to incentives than others. But if the reader will refer back to Tables 1 and 3, the eta-squared values show much less than one percent of the variance of reporting explained by incentives, and no more than 1.2 percent of the variance explained by the interaction of incentives and the demographic variables. These minor improvements signified by the eta-squared values seem to indicate that it was not worth the cost of paying incentives to the respondent in this survey, especially when one considers that the overall response rate to this survey did not change significantly. The expenditure to be made for incentives payments in the full-scale survey were undoubtedly better spent on other response improvement techniques outlined by Walsh [23]. Better training of interviewers to improve respondent commitment to completing the diary provided results as good as, and hopefully better than, those obtained above. A system of telephone or postcard reminders in the middle of the diary week might also improve response in future efforts. Because of the general favorable results other researchers have found, future experimentation with use of incentives may yield more satisfying results. One possible experiment would be to administer the diary to all sample households, and offer an incentive to those refusals in a random half-sample to determine if response rates and reporting behavior differ significantly.

## Table 1: Average Weekly Expenditure Levels by Amount of Incentive

Table	2:	Proportio	on d	of Respo	onde	ents	s Wł	10
		Reported	No	Expendi	itur	re I	for	А
		Category	by	Amount	of	Ind	cent	tive

Expenditure		Payment		1/	2	•		<b>#</b> 10	m - + - 1	
Category	\$0	\$5	\$10	<u>F='</u>	Eta	\$0	\$5	\$10	Total	
Total Food at Home 2/	\$17.84	\$20.21	\$20.16	5.2	.0036	.166	.109	.129	.134	
Concal & Concal Prod.	.47	.57	.59	4.8	.0034	.580	.516	.488	.528	
Bekery Products	1.74	1.92	1.94	2.4	.0017	.213	.177	.184	.192	
Meat	5.40	5.71	5.86	.9	.0006	.246	.229	.211	.229	
Poultry	.72	.81	.74	.8	.0006	.688	.680	.661	.677	
Fich & Seafood	.40	.71	.52	5.4	.0037	.737	.676	.683	.699	
Comb Meat & Poultry	.00	.00	.00	.2	.0001	.998	.997	.998	.998	
Dainy Products	2.67	2.87	2.94	2.3	.0016	.176	.147	.156	.159	
Milk Cream & Milk Prod	. 2.62	2.82	2.85	2.0	.0014	.178	.154	.159	.163	
Othen Dairy Products	05	.05	.08	2.8	.0019	.944	.941	.925	.937	
Fourte	1.55	1.61	1.54	.4	.0003	.330	.321	.317	.322	
Fruits Enach Enuits	.95	1.03	.97	.8	.0005	.429	.443	.431	.435	
Fresh Fruits	.02	.01	.01	.6	.0004	.986	.983	.983	.984	
Conned & Dried Fruits	.23	.20	.21	.6	.0004	.769	.763	.764	.765	
Empit Juices	.35	.36	.34	.2	.0001	.674	.654	.686	.671	
Vegetables	1.49	1.54	1.65	1.6	.0011	.327	.312	.287	.309	
Ench Vegetables	.99	1.01	1.05	.5	.0003	.399	.384	.368	.384	
Fresh Vegetables	.14	.14	.17	1.4	.0010	.827	.837	.779	.815	
Corned & Other Vegetabl	es .38	.39	.42	.7	.0005	.634	.631	.597	.621	
Canned & Other Vegetabl	.52	.58	.61	2.3	.0016	.539	.500	.450	.498	
Sugar & Other Sweets	1 63	1.76	1.91	4.1	.0028	.325	.285	.265	.291	
Nonal condition Develages	88.	.94	1.06	3.4	.0023	.511	.491	.439	.482	
Carbonated Drinks	.00	.82	.84	1.2	.0008	.533	.519	.479	.511	
Uther NonalConolle Bev.	07. bo	.17	.10	7.6	.0051	.965	.945	.960	.956	
All Other Food at Home	2.76	2.84	3.04	.8	.0006	.245	.213	.186	.215	

## Table 1 (Continued): Average Weekly Expenditure Levels by Amount of Incentive

## Table 2 (Continued): Proportion of Respondents Who Reported No Expenditure For a Category by Amount of Incentive

Expenditure	De				Catego	ry by A	mount	of Inc	entive
Category	<u>+0</u>	yment ⊄r	\$10	F	Fto <sup>2</sup>	<b>\$</b> 0	¢E	¢10	Totol
		<del>\</del>	<u></u>	<u> </u>			<u></u>	<u>_\$10</u>	<u>10tai</u>
Total All Other Expenditures	\$134.01	\$116.20	\$123.42	.9	.0006	.127	.087	.082	.099
Food & Bev. Away from Home	6.48	7.00	8.25	6.5	.0044	.335	.310	.248	.299
Personal Care Products	1.28	1.37	1.65	3.9	.0026	.551	.496	.478	.508
Personal Services	1.23	1.17	1.29	.4	.0003	.756	.770	.743	.757
Household Supplies	2.41	2.62	2.78	2.2	.0015	.293	.261	.210	.256
Housekeeping Services	2.99	3.33	3.50	•4	.0003	.708	.672	.655	.679
Household Help	1.17	1.67	1.73	1.2	.0008	.920	.903	•888	.904
Laundry & Dry Cleaning	.90	.90	.91	.0	.0000	.781	.759	.748	.763
Other Services	•92 <sup>·</sup>	.76	.86	.1	.0001	.961	.959	.969	.963
Housing Costs(Rent,Mortgage)	32.03	22.20	20.32	1.9	.0013	.822	.830	.836	.829
Alterations & Repairs	4.25	3.30	7.93	1.7	.0012	.855	.850	.843	.850
Fuels and Utilities	11.07	9.30	9.82	1.4	.0010	.636	.627	.615	.627
Textile Home Furnishings	1.50	1.37	1.52	.1	.0001	.842	.835	.810	.829
Furniture	2.19	1.29	4.85	2.0	.0013	.972	.961	.965	.966
Household Appliances	2.43	1.84	2.93	.4	.0003	.962	.958	.966	.962
Other Household Equipment	2.52	2.13	2.72	.5	.0003	.727	.727	.707	.721
Household Items	.80	.47	• 50	1.7	.0012	.911	.930	.923	.921
Outdoor Items	.42	.34	.26	.2	.0002	.958	.965	.964	.962
Hardware, etc.	.12	.19	.07	.6	.0004	.971	.979	.974	.975
Other	1.18	1.13	1.90	1.5	.0010	.816	.796	.779	.797
Insurance, etc.	.98	.64	.66	.4	.0003	.985	.988	.993	.988
Clothing & Related Items	8.94	9.76	10.75	1.4	.0010	.568	.547	.510	.543
Clothing, All Persons	6.72	7.20	8.03	1.1	.0007	.639	.640	.576	.620
Footwear	1.43	1.70	1.69	.7	.0005	.866	.851	.863	.859
Infant & Toddler Wear	.22	.18	.16	.7	.0004	.952	.939	.959	.949
Other Clothing	.57	.66	.87	.3	.0002	.946	.948	.920	.938
Private Transportation	15.00	15,14	17.55	.1	.0001	.372	.341	.325	.346
Vehicle Purchases	5.81	5.40	6.71	.0	.0000	.991	.993	.993	.993
Gasoline, Motor Oil, Etc.	5.19	6.19	5.85	3.2	.0022	.399	.366	.362	.376
Parts & Equipment	.70	.95	1.57	3.1	.0021	.967	.957	.947	.957
Maintenance & Repair	1.97	1.56	2.07	.5	.0003	.934	.920	.908	.921
Other	1.33	1.14	1.34	.3	.0002	.799	.805	.756	.788
Public & Other Trans.	. 92	1.31	1.03	.4	.0002	.910	.870	.866	.882
Medical Care	7.96	9.30	6.30	2.1	.0015	.554	.548	.559	.554
Drugs & Medicine	2.24	1.77	1.73	3.2	.0022	.642	.666	.653	.654
Professional Services	1 15	4.56	3,19	8	.0006	876	.857	.859	.864
Other Medical Expenses	1 27	3.06	1 37	1 2	0029	.070	.875	.891	.888
Reading Materials	.97	1,18	1.12	1.4	.0010	.495	.482	.469	.483
Sporting Equip Toys etc	3.00	2 16	2.77	1 8	0012	654	.660	. 592	.637
Admission Fees	3 16	3 14	2 72	<b>1.</b> 0	.0012	722	703	651	.007 693
Miscellaneous Evnenses	1 78	3 92	3 51	۰. 8	.0006	639	.656	.683	.659
Education	2 11	5.52	2.01 85	1.3	.0000	.003	.983	.980	. 578
Tobaco	1 90	2 16	2 32	7 J	.0003	574	101	•000 508	• 57 G
Alcoholic Bevonagos	1 22	2.10	2.52	20	0022	• 374 715	• <del>•</del> 34 7∩4	.700	.706
At Home	1 /5	1 74	2.43	29	00020	711	720	.743	.738
Away From Homo	1.40	±•74 00-	1./1 70	5 /	0007	0/5	9/0	.902	. 933
Away From nome	15 00	11 00.	•/0 7 03-	J•4 7	00004	- 340 710	659	657	676
ATT Other, Expenses	10.00	TT.00	7.03	• /	•0004	•/12	.000	.057	.070

Degrees of freedom are 2 and 2900. The latter figure is approximate due to missing data, but differences in significance for such high degrees of freedom are small.

 $\frac{2}{}$  Subcategories may not add to a category total because of treatment of missing data. All values reflect respondent's answers, with no imputed values.

Table 3: Two Way Analyses of Variance of Total Food and Beverages at Home by Incentives and Demographic Characteristics

	Adjusted Expenditure Means				F Values	Eta <sup>2</sup>			
	-ingetime			Main 27	In-	Vari-3/	Inter-4/	In-	Inter-
Variables	<u>\$0</u>	<u>\$5</u>	<u>\$10</u>	Effects	centive	able	action _	<u>centive</u>	action
Incentive Alone(3) $\frac{1}{2}$	17.84	20.20	20.16	*	5.2	*	<u>*</u>	.0036	
Incent.& Urbanicity(5)	17.77	20.28	20.15	4.0	5.7	3.3	4.2	.0039	.0115
Incent.& Ages & No.				*	×	×	×		
of Children(4)	18.02	20.44	19.69	79.5	5.1	128.6	3.7	.0031	.0067
Incent.& No. of HH				×	×				
Members(6)	18.04	20.54	19.55	107.8	5.9	148.3	2.3	.0032	.0064
<pre>Incent.&amp;Race of Head(3)</pre>	17.88	20.21	20.11	7 <b>.</b> 1	5.0	8.9	6.4	.0034	.0089
Incent.& Age & Sex				×	ж	*	**		
of Head(12)	17.77	20.62	19.76	28.6	7.0	32.8	1.7.*	.0043	.0117
Incent.& Ed. of Head(6)	17.92	20.21	20.07	7.3	4.8	8.3	3.5	.0033	.0118
Incent.& Work Exper.				×	¥	×			
of Head & Wife(15)	17.78	20.53	19.84	25 <b>.7</b> ^	6.7	28 <b>.</b> 5 <sup>°</sup>	1.4	.0041	.0119
Incent.& Housing Owned/				×	¥	*			
Rented(4)	17.69	20.54	19.93	30.0	6.8	46.4	.6	.0045	.0012
Incent.& Income of				×	×	×			
Consumer Unit(7)	17.82	20.46	19.89	29.4	6.0	37.3	1.2	.0039	.0045

significant at  $\alpha \langle .01$ 

\*\* significant at α 🔾 02

1/ numbers in parentheses are numbers of categories for that variable

- 2/ see text for explanation of main effects; in brief, "main effects" is the combined effects of the row and column variables, i.e. the linear effects
- 3/ F-values for the second variable in the two-way analysis of variance, the second variable being defined in the column on the left hand side of this table.

5/ Degrees of freedom for the numerator are as follows: Main effects: d.f. = 2 + (c-1) Variable: d.f. = (c-1) Incentives: d.f. = 2 Interaction: d.f. = 2(c-1)

where (c-1) is one less than the number in parentheses listed after the variable name on the left hand side of the table. d.f. for the denominator are approximately 2900.

## Footnotes

<sup>1</sup> Dixon and Massey [6], p. 310.

<sup>2</sup> See Scheffe [17], Chapter 10 "The Effects of Departures from the Underlying Assumptions".

<sup>3</sup> Fleiss [10], p. 93.

 $z = (p_0 - p_c) / (p_0 q_0 / n_0 + p_c q_c / (n_5 + n_{10}))^{\frac{1}{2}}$ 

where  $p_c = (n_5 p_5 + n_{10} p_{10}) / (n_5 + n_{10})$ 

<sup>5</sup> Andrews, Morgan and Sonquist [1].

 $^{6}$  Urbanicity is the household's location in a central city, a suburb, or a rural area.

<sup>7</sup> Kendall and Stuart [12].

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