Adjusting Diary Ratings
For Misreporting

Ed Cohen
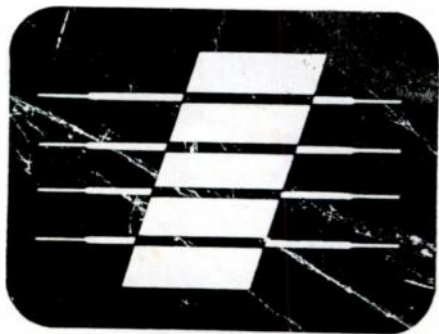
Independent
Television

ADJUSTING DIARY RATINGS FOR MISREPORTING

Prepared for

INTV

by

Jay Magidson, Ph.D.

Statistical Innovations Inc.
Belmont, Massachusetts

December 15, 1987

TABLE OF CONTENTS

1.0 BACKGROUND AND STATEMENT OF THE PROBLEM

By comparing viewing rates among metered households to viewing rates reported by diary households in the same market, it is known that overall, diary households tend to underreport viewing. However, underreporting does not occur for all station/quarter hours and in some cases viewing tends to be overreported.

In metered markets, both Nielsen and Arbitron adjust for under and overreporting by calibrating diary-based demographic ratings to agree with meter ratings at the household level. These adjustments are performed separately for each station/quarter hour. In nonmetered markets, no calibration is performed (e.g., unadjusted demographic ratings are reported). Since meters are not used in these smaller markets, any biases in the reported ratings that are due to diary misreporting remain.

The problem considered here is to determine (1) which of several factors are associated with systematic misreporting (either under- or overreporting), and (2) how to adjust for these factors. More specifically, the purpose of this research is:

(1) To identify variables associated with diary misreporting

and (2) To use these variables to develop a calibration model which adjusts diary ratings to remove systematic differences between diary and meter ratings at the household level

The resulting calibration model might be used as a tool to adjust for diary misreporting in diary-only markets and/or to suggest changes in the current diary methodology to reduce the amount of misreporting.

2.0 General Approach

Separate analyses were performed within each of the following day parts using Nielsen household viewing data from 126 selected quarter hours, for all affiliate and independent stations in 5 metered markets over four consecutive measurement periods from May 1985 through February 1986:

- Early Fringe   - Prime Time
- Late Fringe   - Daytime

Taken as a whole, several million pieces of viewing data were analyzed. The results of these analyses were then used to develop the calibration model.

The variables which were analyzed as part of this project consisted of those household characteristics, station characteristics, and program characteristics listed below. Those variables included in the calibration model are marked by "*":

Table 1.1: Ratios of Diary to Meter Ratings for Daytime

	Total	Boston	Chicago	Dallas	LA	DC
Overall	0.79	0.81	0.84	0.88	0.75	0.73
Day						
Monday	0.83	0.83	0.88	0.94	0.79	0.75
Tuesday	0.77	0.76	0.82	0.90	0.74	0.67
Wednesday	0.78	0.78	0.83	0.90	0.74	0.68
Thursday	0.92	0.90	0.96	1.05	0.88	0.84
Friday	0.87	0.89	0.93	0.96	0.82	0.78
Saturday	0.68	0.75	0.70	0.69	0.65	0.66
Sunday	0.71	0.74	0.77	0.71	0.66	0.73
Aff/Ind						
Affiliate	0.89	0.88	0.94	1.00	0.86	0.80
Independent	0.61	0.59	0.66	0.61	0.61	0.56
Program Type						
movie	0.54	0.57	0.58	0.56	0.50	0.55
sports	0.85	1.00	0.93	0.78	0.79	0.86
news	0.96	0.91	1.08	1.07	0.89	0.91
children's	0.65	0.67	0.66	0.66	0.62	0.67
sitcom	0.60	0.62	0.61	0.62	0.64	0.48
drama/adv/mystery	0.62	0.52	0.65	0.65	0.62	0.58
game show	0.84	0.87	0.87	0.98	0.81	0.69
talk/interview	0.83	0.76	0.92	0.90	0.86	0.69
religion	0.72	0.73	0.74	0.85	0.74	0.50
music	0.63	0.61	0.68	0.64	0.64	0.54
variety	0.53	0.53	0.50	0.22	----	0.77
soap opera	0.97	0.94	1.01	1.09	0.94	0.84
spec/mini series	0.80	0.81	0.72	0.81	0.83	0.94
other	0.60	0.63	0.44	0.49	0.64	0.39
Household Size						
1	0.71	0.68	0.85	0.82	0.67	0.58
2 or more	0.81	0.84	0.84	0.89	0.76	0.76
VCR						
yes	0.95	1.02	0.88	1.22	0.95	0.84
no	0.72	0.75	0.82	0.77	0.65	0.66

Table 1.3: Ratios of Diary to Meter Ratings for Prime Time

	Total	Boston	Chicago	Dallas	LA	DC
Overall	0.92	0.96	0.94	0.97	0.88	0.90
Day						
Monday	0.91	0.96	0.93	0.95	0.86	0.90
Tuesday	0.90	0.90	0.93	0.91	0.88	0.86
Wednesday	0.89	0.91	0.92	0.93	0.86	0.87
Thursday	1.01	1.07	1.05	1.07	0.97	0.96
Friday	0.92	0.99	0.94	0.98	0.85	0.93
Saturday	0.86	0.94	0.87	0.93	0.81	0.84
Sunday	0.92	0.95	0.93	0.99	0.89	0.93
Aff/Ind						
Affiliate	0.99	1.00	1.02	1.06	0.96	0.94
Independent	0.71	0.79	0.69	0.69	0.70	0.74
Program Type						
movie	0.80	0.84	0.82	0.82	0.77	0.84
sports	0.89	0.96	0.94	0.93	0.81	0.88
news	0.74	0.87	0.81	0.54	0.69	0.83
children's	0.79	0.99	0.79	0.68	0.76	0.73
sitcom	0.97	0.99	0.98	1.03	0.98	0.88
drama/adv/mystery	0.99	0.99	1.00	1.04	0.97	0.96
game show	0.80	1.05	0.90	0.88	0.77	0.69
talk/interview	0.95	1.05	0.96	1.07	0.91	0.88
religion	0.56	0.90	0.29	0.58	0.43	0.00
music	0.79	0.93	0.80	0.80	0.73	0.82
variety	0.76	0.96	0.63	0.75	0.74	0.95
soap opera	----	----	----	----	----	----
spec/mini series	1.03	1.15	1.05	1.09	0.98	0.93
other	0.63	0.59	0.59	0.81	0.61	0.86
Household Size						
1	0.73	0.67	0.81	0.82	0.70	0.70
2 or more	0.96	1.03	0.97	1.00	0.91	0.94
VCR						
yes	1.11	1.19	1.01	1.41	1.14	1.00
no	0.82	0.89	0.90	0.82	0.74	0.83

Much of the differences across markets observed in Tables 1.1 - 1.4 can be explained by normal sampling variation. Such variation tends to be largest when the amount of household viewing is smallest. Thus for example, larger variation would be expected for daytime variety shows because such programs are relatively few in number. Similarly, much smaller variation would be expected for prime time movies. These expectations show up very clearly in Tables 1.1 - 1.4. The calibration model attempts to adjust for real as opposed to sampling variations.

A second important result is that no significant differences were found by measurement period. The rate of diary misreporting is not seasonal and neither increased nor decreased during the study year. This result simplifies the application of the model to future measurement periods since no seasonality or trend factors are included in the model.

In the remainder of this section we summarize the effects of station characteristics, program characteristics and household characteristics on the prediction of diary misreporting.

Station Characteristics

Viewing of independent stations is significantly underreported relative to affiliate stations. The difference in the rate of diary underreporting of independent relative to affiliate stations is constant across all dayparts, except for prime time weekend programs where the difference is more extreme.

The fact that many independent stations are UHF while most affiliates are VHF accounts for the fact that overall, viewing of UHF stations is underreported relative to VHF stations. We found there to be no significant difference between the amount of misreporting between UHF and VHF <u>independent</u> stations. Thus, the variable VHF vs. UHF was not included in the calibration model.

Program Characteristics.

DAYPART and TIME
Significant differences across dayparts are evident by comparing Tables 1.1 - 1.4. Overall, diary underreporting is slightly more prevalent in daytime than in early fringe. There is substantially less underreporting in prime time than the earlier dayparts, and this lower rate of underreporting continues through 10:15PM. Table 1.4 shows that the amount of underreporting increases rapidly in late fringe as the program start time goes from 10:15PM to 12:45AM. Within a daypart, time of day was found to be significantly related to diary misreporting only in late fringe.

PROGRAM TYPE
Overall, movies tended to be underreported more so than other program types while sports and news tended to be less underreported. The relationship between program type and diary

these results could be explained by substantial differences in the way diary household education data and meter household education data is obtained and recorded by Nielsen and because inclusion of education in the model produced unstable predictions, we decided not to use education in the model. (Note: education information is not collected at all from Arbitron's diary households.)

HOUSEHOLD SIZE
As shown in Tables 1.1 - 1.4, one-person households have significantly lower diary:meter viewing rates than larger households. Household size was included in the calibration model.

PRESENCE OF VCR
As shown in Tables 1.1 - 1.4, households with VCRs have significantly higher diary:meter viewing rates than households without VCRs. Presence of VCR was included in the calibration model.

PRESENCE OF NONADULTS
Except for a single interaction effect, households with children and those with teens do not significantly differ from each other nor do they differ from adult-only households in their diary keeping behavior. We did find an interaction effect that suggests that adult-only households are somewhat less likely to report viewing of children's programs.

OTHER VARIABLES
No significant differences in diary:meter rates were found to be related to race, presence of a working woman, presence of cable or county size.

3.2 INTERPRETATION OF RESULTS

Regarding the interpretation of results, some interpretations appear obvious. For example, the DAY effect is such that there is the least amount of underreporting on Thursday, the first day of the Nielsen diary. Apparently, diary keepers do the best job on the first day while the diary is fresh on their mind. The decline in reporting begins on Friday and continues on Monday and Tuesday and culminates on Wednesday. We might also hypothesize that diary keeping is worse on the weekends because of distractions associated with a different schedule.

Other interpretations are less clear. The reason that independent stations are less reported than affiliate stations is still unknown. We concluded here that the reason is not because most independent stations are UHF. Further research with additional station characteristics may shed additional light on this issue.

Unlike the interpretation of station and program characteristics, there is an additional interpretation possible for household characteristics that has nothing to do with diary

-5-

Table 2.1: Observed Adjustment Factors

day	affind	daypart	Program Type movie	sports	news	kid	sitcom	drama	game	talk/iv	reign	music	variety	soap	spec	otr
M	aff	daytime	----	----	1.02	----	1.50	1.65	1.19	1.08	1.73	----	1.59+	1.04	1.89+	1.46
		ef	1.80	0.97	1.10	----	1.16	1.11	1.11	1.28	----	----	----	2.31+	2.03+	1.21
		prime	1.08	0.99	----	----	1.02	1.01	2.64+	0.91+	1.50+	----	----	----	0.90	1.77+
	ind	daytime	2.11	1.04	1.39	1.55	1.71	1.56	1.53	1.48	1.44	----	1.16+	2.41+	7.37+	2.24
		ef	2.25	1.10	----	1.43	1.35	1.31	1.17	----	----	1.46	----	----	----	----
		prime	1.44	1.30	1.33	4.08+	1.79	1.62	1.23	1.42	1.80+	1.39	----	----	1.16	1.72+
T	aff	daytime	----	----	1.14	----	1.61	1.24	1.29	1.14	1.46+	----	2.90+	1.10	0.72+	1.32
		ef	1.71	0.90	1.17	----	1.32	1.17	1.04	1.18	----	----	----	1.65+	0.92	1.08+
		prime	1.09	1.05	2.58	1.13	1.11	1.03	----	1.11	----	1.00	1.12	----	0.97	1.34
	ind	daytime	2.30	1.08	1.32	1.73	2.06	1.77	1.51	1.49	1.37	1.00+	4.61+	3.41+	----	1.59+
		ef	2.05	1.19	----	1.44	1.42	1.39	1.35	----	----	1.42	----	----	----	----
		prime	1.38	1.13	1.53	----	1.60	1.43	1.20	1.36	2.10+	1.76	1.67+	----	1.37	1.22+
W	aff	daytime	----	----	1.11	----	1.68	1.65	1.25	1.17	1.63	----	1.51+	1.09	2.19	1.46
		ef	1.91	----	1.14	----	1.23	1.14	1.18	1.28	----	----	----	2.65+	1.17	----
		prime	1.14	1.16	1.27	----	1.20	0.98	1.16	0.97	----	1.44	1.76	----	0.95	----
	ind	daytime	1.91	2.00+	1.28	1.74	1.80	1.76	1.69	1.51	1.18	----	1.79+	1.00+	----	1.83
		ef	2.53	1.12	----	1.68	1.48	1.27	1.25	----	----	1.24	----	----	----	----
		prime	1.42	1.48	1.44	----	1.96	1.43	1.32	1.77	1.49+	1.39	1.70	----	1.28	1.43+
R	aff	daytime	----	----	0.92	----	1.00	1.06	1.07	0.93	1.10+	----	1.85+	0.97	0.93+	1.17
		ef	1.16	----	0.97	----	0.97	0.98	0.90	1.06	0.72+	----	----	1.37+	1.09	0.86+
		prime	1.31	0.81	1.27	----	0.86	0.94	1.15	0.95	----	----	----	----	0.93	----
	ind	daytime	1.85	1.70+	1.04	1.39	1.58	1.50	1.28	1.17	1.04	2.94+	1.00+	1.85+	----	1.29+
		ef	2.58	1.08	----	1.19	1.17	1.20	1.11	----	----	1.30	----	----	----	----
		prime	1.39	1.06	1.24	----	1.18	1.27	1.11	1.26	1.86+	3.90+	----	----	1.12	1.51+
F	aff	daytime	----	----	0.97	----	1.51	1.54	1.11	1.02	1.52	----	1.58+	1.00	----	1.65
		ef	1.77	0.89	1.03	----	1.09	1.04	1.08	1.21	----	----	----	2.35+	1.43+	----
		prime	1.23	1.02	0.80+	----	1.07	0.95	1.97	1.10	----	----	----	----	1.19	1.49+
	ind	daytime	1.98	0.86	1.23	1.48	1.76	1.47	1.69	1.39	1.23	----	1.13+	1.00+	1.00+	1.95
		ef	1.74	1.03	----	1.36	1.31	1.22	1.16	----	----	1.58	----	----	----	----
		prime	1.33	1.26	1.31	----	1.58	1.31	1.33	1.60	1.59+	0.91+	----	----	1.23	1.91
Sa	aff	daytime	1.58	1.22	----	1.42	1.25	1.43	0.80	1.53	2.63+	1.61	----	----	1.76	2.28
		ef	1.78	1.34	1.25	----	1.35	1.41	1.08	1.36	----	1.06	----	----	1.34	1.41
		prime	1.17	0.80+	----	----	1.02	1.10	----	1.16	----	1.00	----	----	0.97	----
	ind	daytime	1.99	1.49	0.56+	1.81	1.45	1.79	1.42	2.46	1.64	1.52	1.42+	----	0.98	2.91
		ef	1.87	1.29	1.42+	1.94	1.50	1.70	1.47	1.43	----	1.25	1.36	----	1.05	2.01
		prime	1.51	1.20	1.28	----	1.43	1.68	----	1.41	1.00+	1.61	1.43	----	1.32	2.49
Sn	aff	daytime	1.74	1.12	1.17	1.79	2.48	2.10	2.42	1.59	1.59	1.49	2.51+	----	2.38	1.79
		ef	1.66	1.21	1.31	1.76+	1.77+	1.57	1.21	1.51	----	----	1.31	----	1.63+	2.75+
		prime	1.03	1.17	1.65+	1.35	1.16	0.99	----	0.90	----	0.87+	----	----	0.88	1.34
	ind	daytime	1.77	1.16	----	1.98	1.60	1.58	----	1.70	1.30	1.94	4.49+	----	1.47	1.30
		ef	1.64	1.22	----	1.08+	1.52	1.46	1.81	2.31	----	1.59	----	----	1.88	1.67
		prime	1.73	1.96	----	2.37+	1.45	1.78	1.78+	1.30+	1.85	1.75	1.24	----	1.94	2.38

+ Gross number of estimated viewing households less than 800,000

There are many models that may be used to obtain <u>expected</u> meter:diary ratios, which will be referred to as <u>expected</u> adjustment factors. The word "expected," as opposed to "observed," refers to the statistical concept of "expected value" apart from sampling error. Table 2.2 provides the expected adjustment factors obtained from the main-effects-only calibration model based on the 4 variables DAY, AFFIND, DAYPART, and PTYPE each exert main effects on the rate of diary under/over reporting but do not interact with each other.

Comparing Tables 2.1 with 2.2 we see that these expected factors systematically underpredict the amount of underreporting of early fringe weekday movies, and systematically differ in some other respects as well. This is an indication that main effects alone are not sufficient. Table 2.3 presents the expected factors from our final model, which differs from the main-effects model in the following ways:

o a DAYPART * PTYPE interaction was included allowing for the apparent result that prime time movies are less underreported than movies earlier in the day, and other similar results for other program types.

o an AFFIND * DAYPART interaction was included for weekend programs allowing for the apparent result that prime time independent programs on the weekend are much more underreported than programs in earlier dayparts.

o the above interaction effects were not included for prediction for weekday music, variety, soap or religion programs because these weekday program types were not viewed by a sufficient number of households to allow stable estimates of these interactions.

3.4 <u>Detailed Model Results for Late Fringe</u>

Unlike the model for the other dayparts, the model for late fringe includes TIME, which turns out to be the most important predictor of misreporting in this daypart. The observed adjustment factors are given in Table 3.1, the expected in Table 3.2.   As in Table 2.1, some of the observed factors in Table 3.1 are very large. To assist in identifying large factors that are "real" from those due to sampling variation, Table 3.1 uses the symbol "+" to designate those factors that are based on a small number of households. Comparison of the observed factors of Table 3.1 with the expected factors of Table 3.2 suggest that most of the very large observed factors were large because of sampling variation.

In general, because of the strong effect of TIME and lower viewing rates, late fringe is more difficult to model than the other dayparts. A comparison of the adjustment factors in Table

-7-

Table 2.2: Expected Adjustment Factors Based On Main Effects Only Model

day	affind	daypart	movie	sports	news	kid	sitcom	drama	game	talk/iv	relgn	music	variety	soap	spec	otr
M	aff	daytime	----	----	1.14	----	1.21	1.18	1.15	1.19	1.20	----	1.31+	1.05	1.09+	1.52
		ef	1.24	1.05	1.06	----	1.13	1.10	1.07	1.11	----	----	----	0.98+	1.02+	1.42
		prime	1.12	0.95	----	----	1.02	1.00	0.97+	1.00+	1.01+	----	----	----	0.92	1.28+
	ind	daytime	1.68	1.42	1.43	1.60	1.53	1.50	1.45	1.50	1.51	----	1.65+	1.32+	1.38+	1.92
		ef	1.57	1.32	----	1.49	1.43	1.39	1.35	----	----	1.37	----	----	----	----
		prime	1.42	1.19	1.21	1.35+	1.29	1.26	1.22	1.26	1.28+	1.24	----	----	1.17	1.62+
T	aff	daytime	----	----	1.20	----	1.28	1.25	1.21	1.25	1.26+	----	1.38+	1.11	1.15+	1.60
		ef	1.31	1.10	1.12	----	1.19	1.16	1.13	1.17	----	----	----	----	1.08	1.49+
		prime	1.19	1.00	1.01	1.12	1.08	1.05	----	1.06	----	1.04	1.16	1.03+	0.97	1.35
	ind	daytime	1.78	1.49	1.51	1.68	1.61	1.58	1.53	1.58	1.60	1.55+	1.74+	1.40+	----	2.02+
		ef	1.65	1.39	----	1.57	1.50	1.47	1.42	----	----	1.45	----	----	----	1.89+
		prime	1.50	1.26	1.28	----	1.36	1.33	1.29	1.33	1.35+	1.31	1.47+	----	1.23	1.71+
W	aff	daytime	----	----	1.20	----	1.28	1.25	1.21	1.25	1.26	----	1.38+	1.10	1.15	1.60
		ef	1.31	----	1.12	----	1.19	1.16	1.13	1.17	----	----	----	----	1.07	----
		prime	1.18	1.00	1.01	----	1.08	1.05	1.02	1.06	----	1.04	1.16	1.03+	0.97	----
	ind	daytime	1.77	1.49+	1.51	1.68	1.61	1.58	1.53	1.58	1.59	----	1.74+	1.39+	1.46+	2.02
		ef	1.65	1.39	----	1.57	1.50	1.47	1.42	----	----	1.45	----	----	----	----
		prime	1.50	1.26	1.27	----	1.36	1.33	1.29	1.33	1.34+	1.31	1.47	----	1.23	1.71+
R	aff	daytime	----	----	1.02	----	1.09	1.06	1.03	1.07	1.08+	----	1.18+	0.94	0.98+	1.37
		ef	1.12	----	0.95	----	1.02	0.99	0.96	1.0	1.00+	----	----	0.88+	0.92	1.27+
		prime	1.01	0.85	0.86	----	0.92	0.90	0.87	0.90	----	----	----	----	0.83	----
	ind	daytime	1.51	1.27+	1.29	1.44	1.38	1.34	1.30	1.35	1.36	1.33+	1.49+	1.19+	----	1.73+
		ef	1.41	1.19	----	1.34	1.28	1.25	1.21	----	----	1.24	----	----	----	----
		prime	1.28	1.07	1.09	----	1.16	1.13	1.10	1.14	1.15+	1.12+	----	----	1.05	1.45+
F	aff	daytime	----	----	1.10	----	1.17	1.14	1.11	1.15	1.16	----	1.26+	1.01	----	1.47
		ef	1.20	1.01	1.02	----	1.09	1.07	1.03	1.07	----	----	----	0.94+	0.99+	----
		prime	1.09	0.91	0.93+	----	0.99	0.97	0.93	0.97	----	----	----	----	0.89	1.24+
	ind	daytime	1.63	1.37	1.39	1.54	1.48	1.45	1.40	1.45	1.46	----	1.60+	1.28+	1.34+	1.85
		ef	1.52	1.27	----	1.44	1.38	1.35	1.30	----	----	1.33	----	----	----	----
		prime	1.37	1.15	1.17	----	1.25	1.22	1.18	1.22	1.23+	1.20+	----	----	1.13	1.56
Sa	aff	daytime	1.48	1.24	----	1.40	1.34	1.31	1.27	1.31	1.33+	1.29	----	----	1.21	1.68
		ef	1.38	1.16	1.17	----	1.25	1.22	1.18	1.23	----	1.20	----	----	1.13	1.57
		prime	1.25	1.05+	----	----	1.13	1.11	----	1.11	----	1.09	----	----	1.02	----
	ind	daytime	1.86	1.57	1.59+	1.77	1.69	1.66	1.60	1.66	1.67	1.63	1.83+	----	1.53	2.12
		ef	1.74	1.46	1.48+	1.65	1.58	1.54	1.49	1.55	----	1.52	1.71	----	1.43	1.98
		prime	1.57	1.32	1.34	----	1.43	1.40	----	1.40	1.41+	1.38	1.54	----	1.29	1.79
Sn	aff	daytime	1.40	1.18	1.20	1.33	1.28	1.25	1.21	1.25	1.26	1.23	1.38+	----	1.15	1.60
		ef	1.31	1.10	1.11	1.24+	1.19+	1.16	1.12	1.16	----	----	1.28	----	1.07+	1.49+
		prime	1.18	1.00	1.01+	1.12	1.08	1.05	----	1.05	----	1.04+	----	----	0.97	1.35
	ind	daytime	1.77	1.49	----	1.68	1.61	1.57	----	1.58	1.59	1.55	1.74+	----	1.45	2.02
		ef	1.65	1.39	----	1.57+	1.50	1.47	1.42	1.47	----	1.45	----	----	1.36	1.88
		prime	1.49	1.26	----	1.42+	1.36	1.33	1.28+	1.33+	1.34	1.31	1.47	----	1.23	1.70

+ Gross number of estimated viewing households less than 800,000

Table 3.1 Observed Adjustment Factors

day	affind	reqhr	movie	sports	news	kid	sitcom	drama	game	talk/iv	relgn	music	variety	soap	spec	otr
M & T & W	aff	10:15	1.14	0.98	1.01	----	----	1.01	----	----	----	----	----	----	----	----
		10:30	1.48	----	1.43	----	1.17	1.35	----	1.59+	----	----	1.06	----	----	----
		11:15	1.61	1.31	1.18	----	----	1.53	----	1.33+	----	----	1.24	----	----	----
		11:45	2.46	----	1.49	----	----	1.78	1.87	1.95	----	----	1.34	----	----	1.57+
		12:15	2.47	2.19	2.67	----	----	2.20	1.97	3.20+	4.28+	----	1.69	----	----	2.94+
		12:45	3.87	----	7.73+	----	----	2.91	----	3.92+	----	----	1.66	17.65+	----	5.77+
	ind	10:15	1.78	1.41	2.11	----	1.58	1.86	3.47+	----	----	----	----	----	----	1.25+
		10:30	2.57+	1.23	2.38	----	1.79	1.54	----	----	----	----	----	----	1.10+	1.25+
		11:15	2.46	1.36	2.23	----	1.94	1.71	3.30+	0.31+	----	----	----	----	----	0.99+
		11:45	2.35	1.22	2.85	----	2.52	2.41	8.03+	0.39+	0.87+	----	----	3.08+	----	3.12+
		12:15	2.89+	1.71+	5.48+	----	3.61	2.32	2.36+	----	1.98+	----	7.55+	----	----	2.93+
		12:45	3.47+	2.52+	5.29+	----	5.71	3.07	5.26+	2.34+	3.79+	----	----	----	----	23.20+
R	aff	10:15	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		10:30	0.98	----	1.08	----	1.00	1.47	----	1.24	----	----	0.90	----	----	----
		11:15	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		11:45	1.68	0.89+	1.08	----	----	2.47	1.36	2.26	----	----	1.13	----	----	3.00+
		12:15	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		12:45	2.70	1.88+	25.47+	----	----	3.30	----	2.22+	----	----	1.59	1.91+	----	4.41+
	ind	10:15	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		10:30	2.61	1.12	3.17+	----	1.51	1.18	----	----	----	----	----	----	----	1.88+
		11:15	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		11:45	2.28	1.06	3.15+	----	1.71	1.69	3.07+	----	1.22+	4.63+	----	1.07+	----	0.61+
		12:15	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		12:45	1.69	1.77+	4.35+	----	3.09+	2.34	7.49+	3.45	2.35+	----	----	----	----	1.00+
F	aff	10:15	----	0.84	0.95	----	----	----	----	----	----	----	----	----	----	----
		10:30	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		11:15	1.56	1.08	1.21	----	----	2.13	1.93+	1.30	----	1.38	1.07	----	1.09	----
		11:45	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		12:15	2.45	1.49	4.22	----	----	2.46	----	----	----	2.03	1.51	----	3.53+	----
		12:45	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	ind	10:15	1.76	1.03	1.49+	----	1.60	1.38	1.79+	----	1.00+	0.57+	----	----	----	1.47+
		10:30	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		11:15	2.07	1.29	2.26+	----	1.66	1.68	2.72+	2.50+	----	2.04	----	2.16+	1.51+	2.01+
		11:45	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		12:15	1.18+	1.49	2.40+	----	2.55	1.96	2.07+	1.00+	2.72+	1.00+	----	----	4.29+	1.00+
		12:45	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S	aff	10:15	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		10:30	1.30	2.18	1.97+	----	1.10	----	----	----	----	----	----	----	1.36	0.92
		11:15	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		11:45	1.71	----	2.76	----	1.35	1.81+	----	1.98	----	1.22	----	----	1.83	1.35
		12:15	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		12:45	2.23	----	----	----	1.58	3.69+	----	2.21+	----	1.64	----	----	2.65	1.69
	ind	10:15	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		10:30	1.84	1.47	0.68+	----	----	1.61	----	1.19	----	1.65+	----	----	1.78+	2.65+
		11:15	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		11:45	1.81	1.51	----	----	1.95	2.14	1.84	2.83+	----	2.97+	2.52+	----	13.40+	1.91+
		12:15	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		12:45	2.21	2.15	----	----	2.50	1.82+	----	3.27+	----	2.48+	1.00+	----	3.64+	0.94+
N	aff	10:15	1.08	1.03	1.03	----	----	----	----	----	----	----	----	----	----	----
		10:30	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		11:15	2.04	1.37	1.24	----	----	1.26	----	2.02	1.49+	1.75+	2.15	----	1.93+	2.97
		11:45	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		12:15	2.88	4.55	2.23+	----	1.56+	4.51	----	3.30	----	4.46+	4.86+	----	----	3.60+
		12:45	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	ind	10:15	1.99	4.88+	----	----	2.15	1.68	4.29+	1.78+	3.13+	----	----	----	----	7.66+
		10:30	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		11:15	3.05	2.44+	1.00+	----	2.05	1.97	4.43	2.34	2.46	----	----	----	----	3.53+
		11:45	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		12:15	2.61	1.76+	----	----	----	----	13.03+	5.92	----	1.00+	----	----	2.43+	5.64+
		12:45	----	----	----	----	----	----	----	----	----	----	----	----	----	----

+ Gross number of estimated viewing households less than 700,000

3.2 with the observed rates in Table 3.1 show some substantial differences that may not be explainable by sampling variance. However, these differences do not appear to be systematic. Therefore, our final model is based on main-effect-only for TIME, DAY, AFFIND, DAYPART, and PTYPE.

3.5 Detailed Model Results Including Household Characteristics

As mentioned earlier, except for children's programs, the household effects of HSIZE and VCR are independent of the other effects. These effects were also found to be constant for all dayparts. The household effects serve to modify the adjustment factors in tables 2.3 and 3.2 at the level of the household by multiplying these effects by the appropriate adjustment factor and aggregating these factors over all households. These household factors are:

      0.97 for 1-person households with a VCR
      1.23 for 1-person households without a VCR
      0.83 for 2+ person households with a VCR
      1.06 for 2+person households without a VCR

The application of the adjustment factor including the household effects is equivalent to a 2-step procedure whereby the household diary weight is multiplied by the household effect in the first step yielding a modified diary weight. Use of this modified weight will yield a modified diary rating. In the second step the appropriate adjustment factor from Table 2.3 or 3.2 is applied to the modified diary weighting.

As mentioned earlier, we recommend that further research be conducted to investigate whether the current diary weights adequately equate the diary sample with the meter sample and if these weights should be replaced by a different set of weights.

The factors for 1-person households and for those 2+ person households comprised only of adults were found to be substantially higher for children's programs. However, even though the amount of viewing of children's programs turns out to be significantly higher among meter households than that reported by the diary sample, the absolute amount of such viewing is fairly low. Hence, there is a substantial amount of variability surrounding these factors. Therefore, we chose not to provide separate estimates of the factors for 2+ person households with and without children.

The household factors applicable to children's programs are the following:

      1.64 for 1-person households with a VCR
      2.08 for 1-person households without a VCR
      0.83 for 2+ person households with a VCR
      1.06 for 2+person households without a VCR

-8-

Table 4.3 summarizes the performance of the calibration model when applied to diary ratings in the other 8 markets. With the exception of Seattle and Philadelphia, which show little change, the improvements are again statistically significant.

Further examination of the Seattle and Philadelphia data showed that meter-diary differences in those markets tend to be less than in any of the other markets.

Appendix C shows the number of quarter hour ratings falling within each error range for diary vs predicted error, cross-classified by 11 diary rating ranges. Examination of the table shows that the model does not perform as well for highly rated programs as it does for lower rated ones. Appendix D shows the same data for independent station quarter hours only; Appendix E shows only affiliate quarter hours.

TABLE 4.1

Average Diary, Meter and Predicted Ratings by Market

MARKET	DIARY	METER	PRED.	# QTR HOUR RTGS
Los Angeles	3.79	4.78	4.72	831
Washington, DC	4.65	5.86	5.57	601
Chicago	4.61	5.11	5.46	687
Boston	3.13	3.71	3.70	837
Dallas	3.47	3.99	4.16	917
Atlanta	3.87	4.90	4.65	818
San Francisco	3.43	4.19	3.99	604
Detroit	5.51	6.31	6.57	582
Miami	4.09	4.70	4.90	716
Houston	4.92	5.85	5.90	688
New York	4.86	5.71	5.89	590
Philadelphia	4.61	4.93	5.52	724
Seattle	4.55	5.09	5.16	478
OVERALL	4.19	4.93	5.01	9,073

TABLE 4.3

Percent Station/Quarter Hours Within Each Error Range For
Diary Error vs Adjusted Diary Error

Non-Calibration Markets

(Sorted by largest Diary-Adusted Diary differences)

MARKET	ERROR RANGE[a] -1 TO 1			ERROR RANGE -2 TO 2			TOTAL # QUARTER HOUR RATINGS
	DIARY (%)	ADJ. DIARY (%)	IMPROVE-MENT	DIARY (%)	ADJ. DIARY (%)	IMPROVE-MENT	(Base)
Atlanta	46	58	+12	72	85	+13	818
San Francisco	59	70	+11	89	92	+ 3	694
Detroit	45	55	+10	74	82	+ 8	582
Miami	51	61	+10	84	85	+ 1	716
Houston	39	48	+ 9	69	82	+13	688
New York	48	54	+ 6	78	84	+ 6	590
Philadelphia	55	58	+ 3	85	82	-3	724
Seattle	57	57	0	79	82	+3	478
TOTAL	50	58	+ 8	79	84	+ 5	5,200

[a]Definition of Error

DIARY ERROR = Diary - Meter Ratings

ADJ. DIARY ERROR = Adjusted Diary - Meter Ratings

4.0 Conclusion

The discrepancies between meter and diary ratings are in part random and in part systematic. In this research, we refer to the random part as "sampling variation" and to the systematic portion as "diary misreporting". To the extent that meter/diary discrepancies represent diary misreporting and such misreporting 1) is constant across markets and 2) can be predicted from program, station, and household characteristics, it is possible to calibrate diary ratings to adjust for misreporting.

The results from this initial research project suggests that:

1. A significant amount of diary misreporting exists and is constant across markets.

2. A substantial portion of diary misreporting can be predicted from program and station characteristics.

3. The expected improvements due to applying the calibration model developed here were confirmed when applied to the validation markets.

4. The validation also confirmed that the current calibration model works better when applied to diary ratings under 10. In general, it does not improve diary ratings of 10 or higher.

5. Variations on the model developed here may well produce similar or better results.

6. Additional reductions in "diary misreporting" are likely by developing weights for diary households that more closely equalize diary and meter sample households with respect to household size, presence of a VCR, and other household characteristics.

APPENDICES

APPENDIX A: Description of Variables in Database

Household Identifier (ID) -- unique identifier for each household

Household sampling weight (WEIGHT)

Market (MARKET)
>Boston
>Chicago
>Dallas
>
>Los Angeles
>Washington, D.C.

Measurement Period (PERIOD)
>May 1985
>July 1985
>
>November 1985
>February 1986

Week (WEEK)

Day (DAY)

Quarter hour (TIME)

Day part (DAYPART)

Meter/Diary Household (METER)

County Size (CNTYSZ) -- Nielsen county size

Age of the head of household in years (AGE)
>18-24
>25-34
>35-44
>
>45-54
>55-64
>65+

Race of the head of household (RACE)

Education of the head of household (ED)

>post grad or grad study
>college grad
>some college or technical training
>high school or less

Presence of a working woman in the household (WW)

Presence of a child less than two years old in the household (CHILD2)

Quarter Hours Included in Research

	TIME[*]	DAYS OF WEEK[**]	NUMBER OF QUARTER HOURS REQUESTED
7 am	0700	A	4
	0745	B	3
	0800	A	4
	0830	B	3
	0915	A	4
	0945	B	3
	1000	A	4
	1030	B	3
	1115	A	4
	1130	B	3
12:15 pm	1215	A	4
	1245	B	3
	1300	A	4
	1345	B	3
	1400	A	4
	1445	B	3
	1515	A	4
	1530	B	3
	1600	A	4
	1630	B	3
	1715	A	4
	1730	B	3
	1815	A	4
	1830	B	3
	1900	A	4
	1930	B	3
	2015	A	4
	2030	B	3
	2100	A	4
	2130	B	3
	2215	A	4
	2230	B	3
	2315	A	4
	2345	B	3
12:15 am	2415	A	4
	2445	B	3
			126

[*]Quarter hours begin at the indicated time. For example, the first quarter hour lasts from 7 am to 7:15 am. The quarter hour beginning at 12:15 am on Tuesday is considered to be part of the same day as the quarter hour beginning at 11:45 pm on Monday night. Thus, times range from 0700 to 2445.

[**]Series A is MWFSun, series B is TuThSat. Nielsen's week commences on Thursday. Thus, series A consists of days 2, 4, 5, and 7, while series B consists of days 1, 3, and 6.

-15-

Appendix B: <u>Technical Notes</u>

1. Log-linear modeling techniques were used to model the rate of misreporting as a function of characteristics of the household, program and station, and market. The methodology was similar to that which I developed to compare various meter:diary integration techniques in research I performed for the A.C. Nielsen Co. as reported in the April 1985 A.C. Nielsen Co. report "Adjusting Diary Demographic Viewing to Meter Household Tuning" and mentioned in <u>Television/Radio Age</u>, July 9, 1984, p. 106. Further details on the technical approach can be found in Leo A. Goodman with Jay Magidson (ed.), <u>Analyzing Qualitative/Categorical Data</u> (Cambridge, Massachusetts: Abt Books, 1978) and in my manuscript "Weighted Log-linear Modeling," 1987 Proceedings of the Social Statistics Section of the American Statistical Association.

Since the amount of misreporting did not vary by measurement period or week, individual quarter hours were aggregated over periods and weeks. Because data from the same household was counted for each quarter hour, observations were not independent and hence the usual statistical tests and confidence intervals were not applicable. The two criteria I used for deciding whether a difference was significant or not were 1) the use of appropriate statistical tests on selected individual quarter hours and 2) consistency across markets. An otherwise significant effect that differed substantially across markets was not used in the model because such a model would not likely be generalizable to other markets.

2. While we proposed to build and validate the calibration model using both Nielsen and Arbitron data, we were unable to use Arbitron data satisfactorily. The Arbitron data SI received was formatted differently from the requested specifications. SI successfully developed software to read and recode Arbitron's AID tapes. However, there appeared to be fewer meter households than in the public reports (average daily in-tab for each of the four weeks). Further investigation determined that the tape contained only those households that were in-tab for the entire four weeks. Basic descriptive summaries led us to conclude that such households are demographically different from those households that were not in-tab for one or more days during the measurement period. Since exclusion of the latter households would therefore confound the analysis, a calibration model was constructed only for Nielsen data.

3. The model has been constructed, but not tested or validated. The model will be validated using data from 12 metered markets from the May 1987 measurement period.

4. The reason that the diary:meter ratios associated with Tuesday and Thursday are spuriously low in Table 1.4 is that data for Tuesday and Thursday were obtained for quarter hours 10:30,

Appendix C

Percent of Programs in Each Error Range for
Diary vs Predicted Error
Cross-classified by Diary Rating Range

Affiliate and Independent Stations

DIARY RATING*		ERROR RANGES FOR LOWER DIARY RATINGS**												
		<-2	(-2,-1.5)	[-1.5,-1)	[-1,-.5)	(-.5,.5)	[.5,1)	[1,1.5)	[1.5,2)	[2,2.5)	[2.5,3)	[3,3.5)	[3.5,4)	[4+
		%	%	%	%	%	%	%	%	%	%	%	%	%
[0,1)	Diary	5	8	16	29	41	0	0	0	0	0	0	0	0
(1985)	Pred.	2	5	10	23	56	4	0	0	0	0	0	0	0
[1,2)	Diary	17	14	20	23	24	2	0	0	0	0	0	0	0
(1587)	Pred.	5	6	12	18	43	10	5	1	0	0	0	0	0
[2,3)	Diary	24	15	17	19	22	3	1	0	0	0	0	0	0
(1186)	Pred.	7	6	11	16	32	14	8	4	1	0	0	0	0
[3,4)	Diary	20	12	15	17	25	7	4	1	0	0	0	0	0
(861)	Pred.	5	6	9	11	31	15	11	7	3	2	0	0	0
[4,5)	Diary	23	12	14	15	22	8	4	1	1	0	0	0	0
(704)	Pred.	7	6	8	11	29	14	11	7	5	2	0	0	0
[5,6)	Diary	21	9	14	16	23	8	6	3	1	0	0	0	0
(579)	Pred.	6	4	6	12	27	11	12	8	7	3	2	0	1
[6,7)	Diary	18	9	12	12	22	9	8	6	1	1	1	0	0
(466)	Pred.	7	6	6	10	22	12	11	9	7	5	3	2	1

DIARY RATING		ERROR RANGES FOR HIGHER DIARY RATINGS										
		<-5]	(-5,-4)	[-4,-3)	[-3,-2)	[-2,-1)	(-1,1)	[1,2)	[2,3)	[3,4)	[4,5)	[5+
		%	%	%	%	%	%	%	%	%	%	%
[7,8)	Diary	1	2	2	10	24	43	13	4	1	0	0
(357)	Pred.	0	0	2	3	13	41	21	12	6	1	1
[8,9)	Diary	1	1	4	8	17	50	14	4	2	0	0
(263)	Pred.	0	1	2	3	10	38	23	14	7	3	1
[9,10)	Diary	1	2	5	6	16	49	13	6	2	1	0
(185)	Pred.	0	1	3	2	11	40	16	18	5	5	1
10+	Diary	1	1	2	5	11	37	15	12	8	4	4
(900)	Pred.	0	1	1	3	8	28	17	16	11	5	9

*DIARY RATING KEY

'[' includes the endpoint of the diary rating range, ')' does not
')' does not

Example:
[0,1) = Diary Rating >= 0 but < 1
(1985) = Number of quarter hours with diary rating in above range

**ERROR RANGES KEY

'[' includes the endpoint of the diary rating range,
')' does not
Example:
[-1.5, -1) = Error range >= -1.5 but < -1
Diary = Diary error (Diary - Meter Ratings)
Pred. = Predicted error (Predicted - Meter Ratings)

-18-

Appendix D

Percent of Programs in Each Error Range for
Diary vs Predicted Error
Cross-classified by Diary Rating Range

Independent Stations

ERROR RANGES FOR LOWER DIARY RATINGS

DIARY RATING*		<-2	(-2,-1.5)	[-1.5,-1)	[-1,-.5)	(-.5,.5)	[.5,1)	[1,1.5)	[1.5,2)	(2,2.5)	(2.5,3)	[3,3.5)	[3.5,4)	[4+
		%	%	%	%	%	%	%	%	%	%	%	%	%
(0,1)	Diary	4	7	16	29	44	0	0	0	0	0	0	0	0
(1830)	Pred.	1	4	9	23	59	4	0	0	0	0	0	0	0
[1,2)	Diary	15	12	22	25	25	2	0	0	0	0	0	0	0
(1155)	Pred.	4	5	9	17	46	12	6	1	0	0	0	0	0
[2,3)	Diary	25	14	16	21	22	2	1	0	0	0	0	0	0
(672)	Pred.	6	4	8	15	33	16	10	5	2	0	0	0	0
[3,4)	Diary	23	14	17	23	18	4	2	0	0	0	0	0	0
(313)	Pred.	3	3	6	10	30	17	12	10	5	3	1	0	0
[4,5)	Diary	32	17	17	12	17	3	1	0	0	0	0	0 -	0
(182)	Pred.	2	3	6	9	33	16	12	6	5	4	2	1	0
[5,6)	Diary	31	15	10	13	25	5	2	0	0	0	0	0	.
(132)	Pred.	4	1	2	8	24	15	19	8	14	4	1	1	1
[6,7)	Diary	30	13	12	16	13	7	4	4	0	0	0	0	0
(91)	Pred.	1	4	5	8	18	9	14	12	7	10	7	3	2

ERROR RANGES FOR HIGHER DIARY RATINGS

DIARY RATING		<-5]	(-5,-4)	[-4,-3)	[-3,-2)	[-2,-1)	(-1,1)	(1,2)	(2,3)	[3,4)	[4,5)	[5+
		%	%	%	%	%	%	%	%	%	%	%
[7,8)	Diary	2	2	9	17	32	34	4	0	0	0	0
(47)	Pred.	0	0	2	2	9	30	32	15	0	2	4
[8,9)	Diary	4	0	4	0	13	65	13	0	0	0	0
(23)	Pred.	0	4	0	0	0	9	4	39	26	9	9
[9,10)	Diary	0	0	9	18	9	55	9	0	0	0	0
(11)	Pred.	0	0	0	0	9	18	9	36	9	18	0
10+	Diary	0	8	8	0	17	17	33	17	0	0	0
(12)	Pred.	0	0	0	0	0	17	17	8	0	17	42

*DIARY RATING KEY
....

'[' includes the endpoint of the diary rating range, ')' does not
')' does not

Example:
(0,1) = Diary Rating >= 0 but < 1
(1830) = Number of quarter hours with diary rating in above range

**ERROR RANGES KEY
....

'[' includes the endpoint of the diary rating range, ')' does not
Example:
[-1.5, -1) = Error range >= -1.5 but < -1
Diary = Diary error (Diary - Meter Ratings)
Pred. = Predicted error (Predicted - Meter Ratings)

Appendix E

Percent of Programs in Each Error Range for
Diary vs Predicted Error
Cross-classified by Diary Rating Range

Affiliate Stations

DIARY RATING*		ERROR RANGES FOR LOWER DIARY RATINGS**											
		<-2	(-2,-1.5)	[-1.5,-1)	[-1,-.5)	(-.5,.5)	[.5,1)	[1,1.5)	[1.5,2)	(2,2.5)	(2.5,3)	[3,3.5)	[3.5,4)	[4+
		%	%	%	%	%	%	%	%	%	%	%	%	%
[0,1)	Diary	18	19	23	27	14	0	0	0	0	0	0	0	0
(155)	Pred.	11	10	23	30	26	1	0	0	0	0	0	0	0
[1,2)	Diary	24	17	17	19	21	2	0	0	0	0	0	0	0
(432)	Pred.	9	9	20	19	35	5	2	0	0	0	0	0	0
[2,3)	Diary	23	15	18	17	21	4	2	1	0	0	0	0	0
(514)	Pred.	9	8	16	18	31	10	6	2	0	0	0	0	0
[3,4)	Diary	18	10	14	14	29	9	5	1	0	0	0	0	0
(548)	Pred.	6	8	10	12	31	14	10	6	2	1	0	0	0
[4,5)	Diary	19	10	13	16	24	9	5	2	1	0	0	0	0
(522)	Pred.	9	7	8	11	28	14	11	7	4	1	0	0	0
[5,6)	Diary	18	7	15	17	22	9	8	4	2	0	0	0	0
(447)	Pred.	7	5	7	13	28	10	10	8	6	3	3	0	0
[6,7)	Diary	15	8	12	11	24	10	8	7	1	1	2	0	0
(375)	Pred.	8	6	6	10	23	13	10	8	7	4	2	1	1

DIARY RATING		ERROR RANGES FOR HIGHER DIARY RATINGS									
		<-5]	(-5,-4)	[-4,-3)	[-3,-2)	[-2,-1)	(-1,1)	[1,2)	[2,3)	[3,4)	[4,5)	[5+
		%	%	%	%	%	%	%	%	%	%	%
(7,8)	Diary	0	2	1	9	22	44	15	5	1	0	0
(310)	Pred.	0	0	2	3	13	43	20	12	6	1	0
[8,9)	Diary	0	1	4	8	18	48	14	5	3	0	0
(240)	Pred.	0	0	2	3	11	40	25	11	5	2	0
[9,10)	Diary	1	2	5	5	17	49	13	6	2	1	0
(174)	Pred.	0	1	3	2	11	41	16	17	5	4	1
10+	Diary	1	1	2	5	10	36	15	12	8	5	4
(888)	Pred.	0	1	1	3	8	28	17	16	11	5	9

*DIARY RATING KEY

'[' includes the endpoint of the diary rating range, ')' does not
')' does not

Example:
[0,1) = Diary Rating >= 0 but < 1
(155) = Number of quarter hours with diary rating in above range

**ERROR RANGES KEY

'[' includes the endpoint of the diary rating range, ')' does not
Example:
[-1.5, -1) = Error range >= -1.5 but < -1
Diary = Diary error (Diary - Meter Ratings)
Pred. = Predicted error (Predicted - Meter Ratings)