Measurement of Advertising Effectiveness Using Alternative Measures of Advertising Exposure†

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ABSTRACT

The objective of this study is to examine the impacts of alternative measures of advertising exposure on the evaluation of advertising effectiveness. This study used quarterly data of post-buy actual GRPs and corresponding advertising expenditures for the New York City fluid milk market. First, the correlation was tested between GRP and expenditure series. Then, advertising effectiveness was evaluated using these two series. Correlation tests suggested no correlation between GRP and expenditure variables was highly unlikely. The econometric analysis, however, found that the two alternatives produced quite different advertising elasticities and rates of return. The results indicate that the choice of advertising exposure measure may provide researchers with different evaluation results. [Econ-Lit citations: Q130, M300, M370] © 1999 John Wiley & Sons, Inc.

1. INTRODUCTION

In evaluating generic advertising programs, researchers have typically used advertising expenditures as a measure of advertising exposure. This approach mostly assumes there is a constant relationship between each dollar spent on advertising and its impact on sales. Another measure of advertising exposure is gross rating point (GRP), which has been frequently used in the marketing literature. GRP is a product of the reach of the advertisement and the average of its distribution of exposures delivered to a target audience. GRP is a direct measure of physical advertising exposure, while expenditure is an indirect way of measuring consumer’s exposure to advertising programs. Using expenditure and GRP, this study examines the impacts of alternative measures of advertising exposure on the evaluation of advertising effectiveness.

The assumption of a constant impact on sales per dollar expended on advertising can be divided into two assumptions: a) the cost per exposure is constant, and b) the relationship between an exposure unit and its impact on sales is constant. If there is a constant cost per exposure (e.g., GRP), given constant advertising effectiveness per exposure, both expenditure and GRP measures should be equivalent and produce the same evaluation results. However, casual observations suggest the assumption of constant cost per GRP may not hold in any practical applications. First, the per unit cost of GRPs, in general, decreases as GRPs

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increase due to volume discounting. It is a well-known fact in any negotiated business, such as media buying, that large buyers can extract price concessions in the form of discounts. For sellers, it is also true that it is easier to conduct a few transactions with one buyer than several transactions with several buyers. Therefore, the more a buyer is willing to buy, the less per unit cost becomes. Second, the per unit cost of GRPs differs across air-times, target audiences, and regions. For example, costs-per-point for daytime vs. prime time, teens vs. adults, and large vs. small cities are all different. In this case, the assumption of constant cost per exposure does not hold. Furthermore, the assumption of constant advertising effects on sales per exposure is also likely to fail because researchers are dealing with different media products. To maintain the basic assumptions, researchers need to develop some ways to make GRPs from different times, audiences, and markets comparable. Unfortunately few studies have been completed in this area.

One exception to this is a study by Chang and Kinnucan (1992). The study examined the correlation between GRPs and expenditures by applying two statistical tests to butter advertising in six Canadian regions. The two correlation tests include the simple correlation test and Spearman’s rank test. Results from both correlation tests suggest that the two series are correlated. However, graphical illustration of GRP and expenditure series indicates that the two series do not mimic one another in terms of the relative magnitude and direction of changes. Interestingly, the highest correlation was found between GRPs and expenditures when the expenditure data were not deflated while the lowest correlation was found when expenditure data were deflated by media cost index (MCI). If we were to assume that GRP measure is the appropriate norm, Chang and Kinnucan’s findings contradict a common belief that a deflated expenditure is better than an undeflated one and that the MCI is a more appropriate deflator for advertising expenditures than the CPI. Based on their findings, Chang and Kinnucan reached the conclusion that expenditures and GRPs, in practice, may not be equivalent measures for advertising exposure.

There are several limitations of Chang and Kinnucan’s (1992) study in terms of data quality. The GRPs used in their study were not continuous but sporadic with irregular intervals. Also, the GRPs were not actual data but estimates. These limitations may cause serious problems in terms of comparability between GRPs and corresponding expenditures. Due to the poor quality of GRP data and relatively small sample size (n = 20), the study was not able to examine whether the two series led to different evaluation results.

In this study, we use post-buy actual GRPs and corresponding re-cap advertising expenditures as alternative measures of advertising exposure. The two data series are also continuous from the first quarter of 1989 to the third quarter of 1998.

In the next section, we evaluate relative merits of expenditure versus GRP measures. Then, we test for correlation between the two variables. Finally, we report evaluation results and our conclusions.

**2. ADVERTISING EXPOSURE: EXPENDITURE VERSUS GRP**

Expenditure has been a standard measure of advertising in evaluating generic advertising programs for two reasons: a) access to expenditure data is relatively easy and b) results with expenditure data are easily translated into money terms. Since most studies use constant parameter models, they typically assume advertising effectiveness is constant over different time periods or cross-sectional observations. In this case, expenditure has been used as a gross measure of advertising exposure with an assumption of the constant cost-per-exposure. If the assumption of the constant cost-per-exposure is invalid, the assumption of the con-
stant advertising effectiveness is most likely invalid as well. Maintaining the assumption of
the constant cost-per-exposure requires appropriate deflators. Researchers typically use me-
dia cost index (MCI) or consumer price index (CPI) for this purpose.

However, deflators such as the MCI or CPI, may not be a correct solution to the potential
problem. These deflators do not take into account volume discounts for large media buy-
ers, possible business negotiations among checkoff program managers, advertising agen-
cies, and media companies, and differences in media cost across alternative air times and
target audiences. Further, although media prices (MCI) and most other prices (CPI) are of-
ten affected by similar forces, there is no precedent for expecting them to move exactly par-
allel. For some period of time, media prices may rise at a faster pace. Figure 1 shows the
historical trend of MCI for spot TV and CPI for the period 1989 through 1998. Between
1989 and 1990, TV advertising cost and other consumer good prices had a similar increas-
ing trend. But, in 1991, the advertising cost decreased by 6% while prices of other consumer
goods increased by 6%. Between 1992 and 1993, both price series had similar trends. Then,
in recent years the advertising price increased sharply compared to other consumer good
prices. Therefore, MCI and CPI not only fail to satisfy the assumption of the constant cost
per exposure, but also may lead to different evaluation results.

Using GRPs, researchers can eliminate some of the limitations that the expenditure mea-
sures have. Since GRP is a direct measure of quantity of advertising good that consumers
actually receive, deflators are not required in the evaluation process. This can avoid some
potential problems that may arise by using incorrect deflators. GRP measure also takes into
account volume discount and other possible business deals between business units relating
to media purchase.

However, GRP measure is also not a perfect measure of the true advertising exposure.
Recall that when expenditure measure was used in advertising evaluation models, the con-
stant advertising effectiveness assumption was decomposed into two parts: constant cost
per exposure and constant impact on sales per exposure. Because GRP is a direct measure
of exposure, the first part of the assumption is unnecessary when GRP data are used in the
evaluation model, but the model still requires the second part of the assumption. GRP mea-
sure falls short of ensuring this assumption. It is unlikely that the effectiveness of a given

![Figure 1](https://example.com/figure1.png)

Figure 1  Historical price trend: MCI vs. CPI. Source: McCann-Erickson.
level of GRPs is the same across air times (e.g., prime vs. daytime), target audiences (e.g., teens vs. adults), and regions (e.g., Los Angeles, CA vs. Ithaca, NY), and media (e.g., magazine vs. TV).\(^1\) The effectiveness of GRPs may also differ by quality variation in advertising programs.

Another limitation of GRP measure is caused by its own definition. Note that the definition of GRP was the product of reach and average frequency. This definition ignores some fundamental questions relating to how advertising works. What are the effects of repeated exposure? Do the first, second, or third in a series of exposures have the same effects? With no explicit answers for these questions, GRPs implicitly give each exposure of the advertising message equal value. To account for this definition problem, Shimp (1990) and Turk (1988) suggested using “Effective Rating Points (ERPs).” The ERP concept is based on the idea that an advertising campaign reaches some consumers too few times and other consumers too many times. But what constitutes too few or too many exposures? In general, fewer than three exposures is considered ineffective, while more than ten exposures is considered excessive (Shimp). However, what is effective (or ineffective) for one advertising program may not necessarily be so for another. Similarly, the level of effectiveness may differ by individual or by creative advertising strategy. McDonald (1996) criticized the concept of ERPs as saying, “Attractive though the concept of effective rating point is, it remains largely ill-defined, and difficult to make real and actionable in a specific media-planning context.”

If all conditions are met for assumptions of constant cost per exposure and constant impact on sales per exposure, the two measures should be equivalent and thus produce the same evaluation results. However, as indicated earlier, these assumptions are most likely violated in practice. Therefore, researchers may report different results depending upon the advertising exposure they use. In the next section, we illustrate this problem empirically using advertising data collected from the New York City fluid milk market.

3. EVALUATION OF THE NEW YORK CITY GENERIC MILK ADVERTISING PROGRAM

This study uses quarterly data from 1989 through 1998. Advertising data are actual TV advertising expenditures and corresponding post-buy GRPs, provided by Leo Burnett and Dairy Management Inc. Fluid milk sales data were obtained from the New York State Department of Agriculture and Markets, and other required data in the evaluation were compiled from various publications.

During the study period, annual per capita fluid milk sales in the New York City market decreased from 218 pounds in 1989 to 205 pounds in 1998 while each year dairy farmers spent approximately $0.30 in advertising on a per capita basis. Figure 2 plots advertising expenditures deflated by MCI and CPI. A comparison of two series suggests that the level of real advertising expenditures differs by use of deflators. During the sample period, MCI resulted in smaller real spending than CPI, particularly in recent years.

Figure 3 shows two series of GRPs: one as unadjusted and the other as adjusted. The adjusted series represent adjusted GRPs for different target audiences. The New York City

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\(^1\)For example, the advertising effectiveness of 100 GRPs at prime time is not likely to be the same as that of 100 GRPs at day time. Likewise, the effectiveness of 100 GRPs for teens may not be the same as that of 100 GRPs for adults. This is because members of the population of each target audience are different particularly in size, and economic and demographic characteristics.
fluid milk advertising programs have changed target audiences periodically. The advertising campaign focused on people between 18 and 49 years old from 1989 to 1990, between 25 and 49 years old from 1991 to 1992, between 25 and 54 years old from 1993 to 1994, between 18 and 34 years old in 1995, and between 12 and 34 years old from 1996 to 1998. In addition to English programs, there were also Spanish programs for the Hispanic population. To make these historical data comparable and to aggregate GRPs from the Spanish programs with GRPs from English programs, we need to adjust the GRP data using some weight variables. Two types of weights may be considered: one calculated based on cost-per-points and the other calculated based on proportion of target audiences. The weight
calculated with cost-per-points seems to be a good candidate for this purpose, assuming that equilibrium media price reflects potential differences in advertising effectiveness across alternative target audiences. However, this weight may be inappropriate if the cost-per-points is not free from the problems we discussed earlier (e.g., volume discount and business deal). We therefore use proportion of target audiences as a weight variable in this study, assuming the effectiveness of each GRP increases with the size of target audiences. In Figure 3, the adjusted GRPs were computed with GRPs from English programs targeting ages between 18 and 49 years in 1989 as a basis. Figure 3 shows the adjusted GRP series has less fluctuations than the unadjusted GRP series, while both series have similar trends.

With these data, we first conduct several correlation tests, and then estimate a simple advertising model to evaluate the effectiveness of the New York City fluid milk advertising programs using two alternative measures of advertising exposure: expenditures and GRPs. We finally compare results from the two measures. Although we expect that the historical series of GRPs and expenditures are highly correlated, the high correlation does not warrant the same evaluation results.

### 3.1. Correlation Test

Two types of correlation tests were performed to examine statistical relationships between GRPs and expenditures. First, the sample correlation coefficient is computed and tested for the linear dependence between expenditures and GRPs, assuming the two series have a bivariate normal distribution. The second is a more generalized test for the cases where the sample distribution is unknown. We follow Mendenhall, Wackerly, and Scheaffer (1990) for these two correlation tests.

For the random variables, \((a_1, b_1), (a_2, b_2), \ldots, (a_n, b_n)\), the sample correlation coefficient \((r)\) is computed as

\[
r = \frac{\sum_{i=1}^{n} (a_i - \bar{a})(b_i - \bar{b})}{\sqrt{\sum_{i=1}^{n} (a_i - \bar{a})^2 \sum_{i=1}^{n} (b_i - \bar{b})^2}}
\]

Then, the test statistic for testing that the correlation coefficient is equal to zero is

\[
Z = \frac{0.5 \ln \left( \frac{1 + r}{1 - r} \right)}{\sqrt{\frac{n - 3}{n - 1}}}
\]

where \(n\) is the sample size.

Table 1 presents correlation coefficients between GRPs and advertising expenditures. Two sets of estimates were computed: one for levels and the other for percentage changes. The percentage changes for the two advertising exposure measures were calculated from the immediately preceding period. The sample correlation coefficients, computed for the series of level, ranged from 0.378 between unadjusted GRPs and expenditures deflated by MCI to 0.615 between adjusted GRPs and nominal expenditures. The coefficients, com-
puted for the series of percentage change, ranged from 0.702 between adjusted GRPs and expenditures deflated by MCI to 0.740 between unadjusted GRPs and nominal expenditures. Z-test statistics indicate that no correlation hypothesis is rejected for all cases at the 5% level or lower.

However, note that the sample correlation coefficients were tested for the linear dependence with the normality assumption. More generalized methods, which do not require assumptions on the distribution of variables and types of correlation, have been developed as non-parametric correlation tests. One of the frequently used methods is Spearman’s rank test, which will be used in this study. To implement this test, the two variables of interest should be first ranked and then tested by rank correlation coefficients. The Spearman’s rank correlation coefficient \( r_s \) is calculated as

\[
\frac{1}{n(n^2 - 1)} \sum_{i=1}^{n} c_i^2
\]

where \( c_i \) denotes the difference in rank for the \( i \)th pair of observation. If the computed correlation coefficients are larger than the critical value, the null hypothesis of no correlation between two ranks is rejected.

Table 2 provides Spearman’s rank correlation coefficients between GRPs and advertising expenditures. For all cases, the null hypothesis of no correlation was rejected at the 1% level. This indicates that historical series of GRPs and expenditures are most likely to be correlated with each other during the sample period.

<table>
<thead>
<tr>
<th>TABLE 1. Sample Correlation Coefficients Between GRPs and Advertising Expenditures</th>
<th>Expenditure</th>
<th>Expenditure</th>
<th>Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nominal</td>
<td>MCI</td>
<td>CPI</td>
</tr>
<tr>
<td>Level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRP, unadjusted</td>
<td>0.4645*</td>
<td>0.3780**</td>
<td>0.3931**</td>
</tr>
<tr>
<td>GRP, adjusted</td>
<td>0.6147*</td>
<td>0.5244*</td>
<td>0.5492*</td>
</tr>
<tr>
<td>Percentage change</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRP, unadjusted</td>
<td>0.7401*</td>
<td>0.7342*</td>
<td>0.7356*</td>
</tr>
<tr>
<td>GRP, adjusted</td>
<td>0.7118*</td>
<td>0.7024*</td>
<td>0.7061*</td>
</tr>
</tbody>
</table>

\*No correlation hypothesis is rejected at the 1% level.  
\**No correlation hypothesis is rejected at the 5% level.

<table>
<thead>
<tr>
<th>TABLE 2. Spearman’s Rank Correlation Coefficients Between GRPs and Advertising Expenditures</th>
<th>Expenditure</th>
<th>Expenditure</th>
<th>Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nominal</td>
<td>MCI</td>
<td>CPI</td>
</tr>
<tr>
<td>Level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRP, unadjusted</td>
<td>0.6520</td>
<td>0.4879</td>
<td>0.5737</td>
</tr>
<tr>
<td>GRP, adjusted</td>
<td>0.6415</td>
<td>0.4745</td>
<td>0.5512</td>
</tr>
<tr>
<td>Percentage change</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRP, unadjusted</td>
<td>0.7307</td>
<td>0.7298</td>
<td>0.7318</td>
</tr>
<tr>
<td>GRP, adjusted</td>
<td>0.6762</td>
<td>0.6741</td>
<td>0.6767</td>
</tr>
</tbody>
</table>

No correlation hypothesis is rejected for all cases at the 1% level.  
Critical value: 0.432 at 1% level \( (n > 30) \).
Correlation coefficients in Tables 1 and 2 confirm Chang and Kinnucan’s finding that the correlation between expenditures and GRPs was the highest when the expenditure data were not deflated while the lowest correlation was found when expenditures were deflated by MCI. As Chang and Kinnucan suggested, the results indicate that inappropriate deflators may vitiate our attempt to remove the effects of inflation from the nominal expenditure series.

Both parametric and non-parametric tests, on levels and percentage changes, strongly suggest that no association between GRPs and expenditures is highly unlikely. However, this does not necessarily mean these two series are equivalent in terms of magnitude and direction. In particular, if these two series do not move in a parallel fashion, the equal evaluation results are not warranted. We illustrate this graphically in Figures 4 and 5. Figure 4 presents the historical trend of the two advertising intensities in terms of levels, while Figure 5 illustrates the trend in terms of percentage changes. In Figure 4, since the two measures
have different scales, we normalized the data with mean values of each measure. The graphical illustrations clearly show that expenditures (deflated by MCI) and GRPs (adjusted) do not move in the same direction. For example, observations 3, 4, 5, 6, 9, 13, 19, 20, and 29 in Figure 4 and observations 3, 4, 5, 13, 20, 31, and 34 in Figure 5 show that the two series move in different directions. Also, in many cases, the differences in percentage changes were quite large.

The graphical illustrations indicate that the two measures are likely to produce different results in advertising evaluation. To provide insight on this expectation, we next evaluate the New York City fluid milk advertising program using the two measures of advertising exposure. We will estimate advertising elasticities and rates of return for comparison.

3.2. Econometric Evaluation of Advertising Effectiveness

Ordinary least squares (OLS) is used to estimate a simple demand equation specified in a double-log form as

\[
\ln Q = \alpha_0 + \alpha_1 \ln P + \alpha_2 \ln M + \alpha_3 \ln AD + \alpha_4 \ln \text{AGE019} + \alpha_5 \ln \text{BLACK} \\
+ \alpha_6 \ln \text{EATAWH} + \alpha_7 Q_2 + \alpha_8 Q_3 + \alpha_9 \text{TREND} + \varepsilon
\]  

(4)

where Q, P, M, and AD represent per capita fluid milk sales, retail fluid milk price deflated by CPI, per capita income deflated by CPI, and per capita advertising exposure, respectively; AGE019, BLACK, and EATAWH are teens under 20 years old, proportion of African American population, and percent of food expenditure for eating away from home, respectively; and Q2, Q3, TREND, and G represent seasonal dummy variables for the second and third quarters, trend variable and error term, respectively.\(^2\)

Here, advertising variable is a goodwill variable specified as a function of current and lagged advertising expenditures or GRPs, which allows a carryover effect of advertising on sales. The advertising goodwill variable in this study has a quadratic form with an end-point restriction. The carryover effect was assumed to last a maximum of three quarters.

We estimated equation (4) with four alternative advertising variables: expenditures deflated by MCI; expenditures deflated by CPI; and unadjusted and adjusted GRPs. Because equation (4) was specified in a double-log form, estimates of parameters in Table 3 are interpreted as elasticities.\(^3\) Estimated results are reported in Table 3. In general, key economic and demographic variables had the correct signs, but some were not significantly different from zero.

The estimated own price elasticities of demand ranged from \(-0.381\), in the model using adjusted GRPs, to \(-0.514\), in one of the models using advertising expenditures. The estimated income elasticities were almost identical in all four models, but were not statistically different from zero.\(^4\) The relative small magnitude of price and income elasticities in all models is consistent with previous studies of fluid milk demand in New York City reflecting the nature of milk as a staple good (Kinnucan, 1986; Lenz, Kaiser, & Chung, 1998). The two demographic variables and the eating away from home variable had the large elasticity values, but none were statistically significant from zero.

\(^2\) Seasonal dummy variables were included for the spring and summer months. Our results indicate that in these months per capita consumption of milk is significantly lower than the rest of the year.

\(^3\) Due to the double-log specification, we substituted one for the zero advertising exposures in the data.

\(^4\) A reviewer indicated that the insignificance of price and income variables in the GRP model might be caused by the potential measurement error of GRP data and suggested a latent-variable model as a future research.
<table>
<thead>
<tr>
<th></th>
<th>Expenditure MCI</th>
<th>Expenditure CPI</th>
<th>Unadjusted GRP</th>
<th>Adjusted GRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.6170 (0.06)</td>
<td>0.6650 (0.07)</td>
<td>3.8722 (0.34)</td>
<td>1.0603 (0.09)</td>
</tr>
<tr>
<td>Price</td>
<td>−0.5141* (−1.77)</td>
<td>−0.5011* (−1.73)</td>
<td>−0.3906 (−1.16)</td>
<td>−0.3812 (−1.16)</td>
</tr>
<tr>
<td>Income</td>
<td>0.1483 (0.48)</td>
<td>0.1552 (0.50)</td>
<td>0.1540 (0.44)</td>
<td>0.1546 (0.45)</td>
</tr>
<tr>
<td>Advertising</td>
<td>0.0715* (1.79)</td>
<td>0.0750* (1.91)</td>
<td>0.0055 (0.09)</td>
<td>0.0444 (0.55)</td>
</tr>
<tr>
<td>AGE019</td>
<td>−3.5173 (−0.45)</td>
<td>−3.6296 (−0.49)</td>
<td>−1.0893 (−0.13)</td>
<td>−3.2506 (−0.36)</td>
</tr>
<tr>
<td>BLACK</td>
<td>3.3346 (0.75)</td>
<td>3.4379 (0.77)</td>
<td>2.9933 (0.60)</td>
<td>2.9068 (0.58)</td>
</tr>
<tr>
<td>EATAWH</td>
<td>−1.0415 (−0.69)</td>
<td>−1.0475 (−0.70)</td>
<td>−0.8602 (−0.52)</td>
<td>−1.1251 (−0.66)</td>
</tr>
<tr>
<td>Q₂</td>
<td>−0.0422* (−3.31)</td>
<td>−0.0425* (−3.29)</td>
<td>−0.0366* (−2.62)</td>
<td>0.0445* (−3.00)</td>
</tr>
<tr>
<td>Q₃</td>
<td>−0.0537* (−3.94)</td>
<td>−0.0536* (−3.92)</td>
<td>−0.0549* (−3.64)</td>
<td>−0.0579* (−3.75)</td>
</tr>
<tr>
<td>TREND</td>
<td>−0.0100 (−0.75)</td>
<td>−0.0106 (−0.79)</td>
<td>−0.0094 (−0.63)</td>
<td>−0.0095 (−0.63)</td>
</tr>
<tr>
<td>R²</td>
<td>0.5984</td>
<td>0.6040</td>
<td>0.5319</td>
<td>0.5547</td>
</tr>
<tr>
<td>D.W.</td>
<td>2.122</td>
<td>2.088</td>
<td>2.136</td>
<td>2.150</td>
</tr>
<tr>
<td>N</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Rate of Return</td>
<td>3.57</td>
<td>3.18</td>
<td>0.27</td>
<td>2.22</td>
</tr>
</tbody>
</table>

*Statistically significant at the 10% level.
Numbers in parentheses are t-ratios.
The estimated advertising elasticities were positive and statistically significant in the two models based on expenditures. The elasticities in these two models, 0.071 and 0.075, are similar to previous studies in this market. For example, Lenz, Kaiser, and Chung (1998) found an advertising elasticity of 0.060 for New York City using monthly data from 1986 to 1995, while Kinnucan estimated an advertising elasticity of 0.054 using data from 1971 to 1984. Our results indicate that choice of deflator, CPI or MCI, does not yield significantly different advertising elasticities. However, the estimated advertising elasticity for the model using GRPs was not statistically different from zero.

Average rates of return from advertising were also computed and compared. The rates of return were calculated by simulating fluid milk demand with and without milk advertising by New York dairy farmers. The rate of return for the two expenditure models was computed based on the following formula:

\[
ROR = \frac{(\Delta MILK \cdot DIFF)}{COST},
\]

where \(\Delta MILK\) is the change in milk demand (pounds) in New York City due to advertising, \(DIFF\) is the Class I differential farmers receive for fluid milk sales under the New York–New Jersey milk marketing order, and \(COST\) is the advertising costs in New York City. The rate of return for the model using GRPs was computed based on the following formula:

\[
ROR = \frac{(\Delta MILK \cdot DIFF)}{(GRP \cdot GRPCOST)},
\]

where \(GRP\) is gross rating points, and \(GRPCOST\) is the unit cost of GRP.

The estimated rate of return in three models was above 1.0 indicating positive net benefits of advertising. The largest return was found using the expenditure model with MCI as a deflator, which was 11% higher than the model using CPI as a deflator. Both expenditure models produced significantly higher estimated rates of return than GRP models. This suggests that while GRP and expenditure series pass both parametric and non-parametric correlation tests indicating a high positive correlation, the two measures still have substantial differences in terms of estimated advertising elasticities and rates of return. Thus, the choice of advertising exposure measure can produce different evaluation results.

4. CONCLUSIONS

The primary objective of this study was to examine if alternative measures of advertising exposure could lead to different evaluation results for generic advertising programs. To meet the objective, this study used quarterly data of post-buy actual GRPs and corresponding advertising expenditures for the New York City fluid milk market. First, the correlation was tested between GRP and expenditure series. Then, advertising effectiveness was evaluated using these two series. Correlation tests suggested no correlation between GRP and expenditure variables was highly unlikely. However, the econometric analysis with these two variables found quite different evaluation results in terms of advertising elasticities and rates of return.

Results indicate that the two measures are not equivalent. In other words, no constant cost per GRP was maintained during the sample period. Potential problems that might have caused these results include the following. First, widely used deflators, MCI and CPI, may not be a solution for keeping the constant cost per GRP. It is obvious that the deflators do not take into account problems such as volume discount and business deal. Annual
deflators estimated at the national level may not even remove regional inflation effects appropriately. In fact, inappropriate deflators may add more problems than they remove. Second, the adjustment procedure we used in this study for GRPs from different target audiences may not be complete. A weight variable, computed based on proportion of each target audience, was applied to the actual GRPs to account for potential differences in advertising effects from GRPs from different target audiences. This method is feasible only when the advertising effectiveness varies in proportion to the size of target audiences. However, this may not be always true in practice. Finally, measurement error may have caused biased results, at least in part. Although this study used actual GRPs and corresponding advertising expenditures, it is always possible to have some type of measurement error in any data sources.

Additional research on this issue may enlighten our understanding on the use of alternative measures of advertising exposure in evaluations of advertising effectiveness. Certainly, we need better deflators when researchers decide to use the expenditure measure. Ideally, one would want to have deflators that remove all the differences between GRP and expenditure measures so that advertising evaluation results do not depend on the choice of advertising exposure measure. If this is not practical in the near future, it would be helpful to construct deflators that can account for regional differences in inflation especially in the media market. To maintain consistent and comparable GRP series across historical time periods and different regions and target audiences, we also need better adjustment procedures. A complete procedure should ensure constant cost-per-point as well as constant advertising effect-per-point, particularly when a constant parameter model is used for the advertising evaluation.

Without having answers for these fundamental questions, we are not in a position to recommend one measure over the other. Nevertheless, our results confirm Chang and Kinnucan’s earlier finding that GRP and expenditure data may not be equivalent, and show that the choice of advertising exposure measure may provide researchers with different evaluation results.

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