ATTRIBUTABLE REWARD: A PROPOSED NEW MEASUREMENT OF ADVERTISING EFFECTIVENESS

DANE WU, Pacific Lutheran University

This exploratory paper proposes a new measurement of advertising effectiveness. The traditional "overinvolvement ratio" simply tests whether an advertisement strategy is effective or not. The new measurement, "attributable reward", can measure the degree of its effectiveness. Built on conditional probability, the proposed technique is comparatively simple and applicable.

INTRODUCTION

Decades ago merchant king John Wanamaker remarked that he knew half of his advertising was wasted but could not identify which half. Today, many marketing observers say that they are still playing this 50-50 guessing game. Over the decades, market researchers have developed various non-probabilistic methods to evaluate advertising effectiveness, e.g., (Hogan 2001; Chung et al. 1999). There also exists a probabilistic measure of advertising effectiveness called the "overinvolvement ratio" or OIR (Carson and Thorne 1996). OIR can be used to test whether an advertisement is effective but it fails to measure the degree of its effectiveness. In this paper, the author introduces a new concept named "attributable reward" or AR to measure the degree of the effectiveness. Unlike OIR, AR seeks to quantify the percentage of buyers within a population which would not have made a purchase had they not been exposed to a certain advertisement. It provides marketers with a more insightful quantitative tool for assessing the effectiveness of an advertisement.

TEST OF EFFECTIVENESS

To test the effectiveness of a new advertisement for a certain product, we can design an experiment in which the advertisement is shown to one customer group but not to another. Purchase behaviors of both groups are recorded for analysis. For convenience, we define B as the "buyers", N as the "nonbuyers", E as the "exposed group", and U as the "unexposed group". OIR is defined as the ratio of $P(E \mid B)$ and $P(E \mid N)$. Here, $P(E \mid B)$ is the conditional probability of the event E given that the event B has occurred. It represents the percentage of buyers exposed to the advertisement. $P(E \mid N)$ corresponds to the percentage of the nonbuyers exposed to the advertisement. OIR is nothing more than the ratio of the percentage of buyers who have seen the advertisement versus the percentage of the nonbuyers who have also seen the advertisement. An advertisement is said to be effective if OIR is greater than 1.

Now let us consider the following two experiments with different customer distributions.

Experiment I

	B (buyers)	N (nonbuyers)
E (exposed)	60	270
U (unexposed)	40	630

Experiment II

	B (buyers)	N (nonbuyers)
E (exposed)	60	30
U (unexposed)	40	70

In Experiment I, there are 100 buyers, of whom 60 have seen the advertisement. And among 900 nonbuyers, 270 have seen the advertisement. Since

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P $(E \mid B) = 60/100 = 0.6$ and $P(E \mid N) = 270/900 = 0.3$, OIR is equal to 2.0. OIR in Experiment II is also found to be 2.0.

In both experiments, we can conclude that the advertisement is effective since OIR is greater than 1. However, we are unable to compare the effectiveness between the two experiments through the use of OIR.

DEGREE OF EFFECTIVENESS

From the examples above, we see that OIR can only serve as a binary yardstick. In order to compare the advertising effectiveness, we hereby introduce the new measurement mentioned earlier. "Attributable reward" or AR to an advertisement is defined as:

$$AR = [P(B \mid E) - P(B \mid U)]/P(B \mid E).$$

Here $P(B \mid E)$ represents the probability of buying after being exposed to the advertisement and $P(B \mid U)$ represents the probability of buying without being exposed to the advertisement. AR can be interpreted as the difference of probabilities of buying between the exposed and non-exposed groups, on a relative scale. It measures the amount of reward that is attributed to the advertisement after all the other known causes of the sale have been taken into account.

Now suppose we observe the following customer distribution in a general experiment:

	B (buyers)	N (nonbuyers)
E (exposed)	a	b
U (unexposed)	c	d

Through some algebraic manipulation, a computational formula is obtained as follows:

$$AR = (ad - bc)/[a(c + d)].$$

In the first experiment, $a = 60$, $b = 270$, $c = 40$, and $d = 630$. Following the formula above, AR is computed as 67 percent. This means that 67 percent of the reward can be attributed to the advertisement. In other words, about 40 of the 60 buyers would not have made the purchase had they not been exposed to the advertisement. Nevertheless, AR in the second experiment is only around 45 percent where 27 of the 60 buyers would not have made the purchase had they not been exposed to the advertisement. Through the attributable reward, it can now be found that the advertisement in the first experiment is more effective.

ADDITIONAL COMMENTARY

Five additional points should be made regarding the above discussion.

Point 1: An extreme case is when $c = 0$, i.e., no buyers come from the nonexposed group. Then $P(B \mid U) = 0$. No one would purchase the product unless they had seen the advertisement. In this case, AR is 100 percent, which follows the common sense. But we would not be able to conclude that the advertisement is 100 percent effective based on OIR. In fact, it can be shown that $OIR = 1 + d/b$ when $c = 0$.

Point 2: AR is positive if and only if $ad > bc$. This provides us a convenient way to check whether an advertisement is effective or not.

Point 3: If $ad < bc$, the advertisement would be counter effective since AR is negative. In this case, AR measures the degree of the damage due to the exposure of an advertisement that reduces the sale. We call a negative AR the "attributable risk" instead.

Point 4: It is a common error to judge that an advertisement is not effective solely based on the fact that $P(E \mid B) < P(U \mid B)$. This inequality only implies that there are more individuals who have not been exposed to the advertisement than those have among the buyers. For instance, if $a = 40$, $b = 270$, $c = 60$, and $d = 630$, then $P(E \mid B) < P(U \mid B)$. However, $AR = 32.61\% > 0$. It is also erroneous to jump to a conclusion that an advertisement is effective if one only observes that $P(E \mid B) > P(U \mid B)$. For instance, if $a = 80$, $b = 800$, $c = 20$, and $d = 100$, then AR is negative even though the inequality holds.

Point 5: A higher OIR may not imply a higher degree of advertising effectiveness. For instance, if a = 60, b = 40, c = 25, and d = 75, OIR will be 2.4, compared with 2.0 in Experiment I. However, the effectiveness measured by AR turns out to be 16 percent lower in this instance.

CONCLUSION

This brief paper proposes a method for measuring the effectiveness of an advertisement. While business organizations are notoriously unwilling to devote research effort to controlled experiments, the proposed method is relatively simple but practical. Incorporated with an experimental design, this method provides a quantitative tool for marketing management.

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