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Some Observations on Benefit-Cost Ratios

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Most commodity promotion evaluations have as their main objective some type of Benefit-Cost Ratio (hereafter BCR). For example, of the 19 studies submitted to the USDA in 2002 in fulfillment of the evaluation requirement mandated by Congress, all but six reported BCRs and these were for small-budget programs. The evaluations for all of the major commodities (e.g., dairy, beef, pork, and cotton) had a BCR as a key outcome. Because BCRs are used to justify program continuation, and in some cases increased assessment levels, it is important that they be properly measured and interpreted. To that end, we discuss two issues: distinguishing *marginal* BCRs from *average* BCRs, and the importance of measuring the price effect of promotion.

Distinguishing Marginal from Average BCRs

Most studies report a marginal BCR (*MBCR*) and thus it is important to know how this measure differs from the average BCR (*ABCR*). A *MBCR* indicates the return to the *last* dollar spent on promotion; an *ABCR* indicates the return to *every* dollar spent on promotion. The latter tells whether the program is profitable; the former tells whether spending levels are too high or too low. The *MBCR* declines as promotion spending approaches the economic optimum and equals one (neglecting opportunity cost) when producer profits are maximized. The *ABCR* also falls as spending approaches the economic optimum, but must stay above one for the program to be profitable.

It is sometimes asserted that the *MBCR* is below the *ABCR* and thus can be taken as a lower-bound estimate of profitability. This assertion rests on the assumption that sufficient funds are being spent for promotion to exhibit diminishing marginal returns. Although this assumption is assured at the firm level by the profit-maximizing assumption, it is less certain at the industry level where assessment levels must be kept low enough to garner majority support. Maintaining majority support may require that activities such as nutrition education, new product research, or export market development be supported, which further dilutes the ability to fund domestic market promotion at the economic optimum. When this is the case, the relationship between the *MCBR* and *ABCR* is unclear.

Insight into the problem can be gained by reference to Figure 1. In the upper panel the "lazy *S*" curve labeled *TR* shows the relationship between promotion expenditure and *net* industry returns, i.e., returns after subtracting the producer cost of the promotion effort. This curve is drawn to conform with a sales response function that exhibits at first increasing and then decreasing returns to promotion. In the lower panel the *MR* and *AR* curves indicate, respectively, the marginal and average net returns that correspond to each point along the total net returns function.

There are three points of interest along these curves. The first point of interest is the minimum expenditure required for promotion to yield a profit, which is labeled A^o in diagram. For expenditure levels less than A^o average returns are negative. Marginal returns in this range, however, can be negative or positive depending on how close actual expenditure is to the breakeven level A^o.

The second point of interest is the expenditure level that maximizes *average* returns, which is labeled *A'* in the diagram. This point is found by drawing a straight line from the origin of the upper panel of Figure 1 (line L) and finding its tangency point along the TR function. Between A^o and *A'* marginal and average returns are both positive, but marginal returns are always above average returns. In this region the marginal return sets the *upper* limit on the average return.

The third point of interest is the expenditure level that maximizes *total* returns, which is labeled $\overline{A}$ in the diagram. This point is found by finding the tangent line along the TR function that is horizontal (line NN'). At this point the slope of the TR function is zero and hence marginal net return is zero. Between points A' and $\overline{A}$ marginal return is positive, but *below* average return. Hence, in this region the marginal return can be taken as a *lower bound* estimate of the average return. Beyond marginal returns are negative, but average returns can be positive or negative depending on the extent to which the industry "overshoots" the optimum.

From the foregoing discussion it is clear that considerable care must be taken in interpreting *MBCR*s. For example, a *MBCR* of say 5:1 is consistent with both a profitable program at point A' and an unprofitable program to the left of point A^o. Because marginal net returns decline to zero as promotion expenditures approach the economic optimum, a large *MBCR* does not imply that profits are large, and in fact may imply the opposite. *MBCR*s may differ across industries not because one program is more profitable than another, but simply because spending levels differ. Because of these ambiguities, the preferred measure of program profitability is the *ABCR*.

Importance of Measuring the Price Effect of Promotion

Several of the studies submitted to the USDA in fulfillment of the mandatory evaluation requirement measured the BCR by simulating a demand model with price held constant. The problem with this approach is that it violates the basic principle that for promotion to benefit producers it must raise the farm price by more than the per-unit assessment. Indeed, the general formula for the average benefit cost ratio is given as follows (Kinnucan and Zheng, p. 268):

(1) $ABCR = P^*/\theta$

where $P^* = dP/P$ is the relative increase in farm price due to promotion and $\theta = A/PQ$ is the promotion-sales ratio, or "intensity." From equation (1) for promotion to be profitable ($ABCR > 1$) the relative increase in farm price associated with the demand shift must exceed promotion intensity. Thus, if $P^* = 0$, as is implicitly assumed when a demand model is simulated with price held constant, $ABCR = 0$ and promotion is unprofitable. And this is true no matter how large the demand shift associated with the promotion effort. (Holding price constant is tantamount to assuming that the supply curve is horizontal. It is well known that shifting a demand curve along a horizontal supply curve yields no benefits to producers, as the revenue gain is matched by an increase in production costs.) The upshot is that to measure properly the BCR either the demand equation needs to be specified in price dependent form, or a supply equation needs to be specified along with the demand equation so that two equations can be solved simultaneously to get the price effect.

BCRs are sometimes derided for being implausible large. That this can be mistaken is shown in table 1 where we have used equation (1) to compute *ABCR*s implied by a five percent increase in farm price and associated break-even price increases for eleven national checkoff programs. These eleven programs account for over 80% of total promotion spending and include all the major programs except citrus (which are state-based). A five percent price increase is used because it is in line with estimates reported in the literature (when such estimates are available!) and thus serves as a useful benchmark. The break-even price increase is defined as the price increase necessary to yield $ABCR = 1$ for a given level of intensity. Intensity is computed by dividing check-off revenue by farm value using the data provided in the first two columns of table 1. (Since not all check-off revenue is spent on promotion, the break-even price increases as BCRs in table 1 are *understated*, an issue addressed later.)

Results show the implied *ABCR* ranging from 2.0:1 for honey to 15.5:1 for potatoes with an average value of 8.2:1. Thus, to the extent that promotion can raise farm price five percent, all the programs listed in table 1 are highly profitable, yielding benefits that are at least as twice as large as costs. Moreover, in instances where promotion increases the farm price by five percent, the *expected ABCR* based on the observed intensities for these eleven commodities would be 8.2:1. Hence, not only are large *ABCR*s plausible, they are expected. The reason is not that benefits are large in an absolute sense, but that benefits are large *in relation to* costs. This is highlighted in the last column of table 1, which gives the minimum price increase necessary for the programs to breakeven. These minimum price increases, which are equivalent to corresponding intensity levels, range from 0.32 percent for potatoes to 2.48 percent for honey with an average value of 0.94 percent.

Because price increases of this magnitude are difficult to detect, let alone ascribe to promotion, skepticism about large BCRs is understandable. But the fact remains that promotion costs tend to be tiny in relation to commodity value, which means it does not take much of a demand shift to yield a large BCR. Moreover, the results in table 1 are based on the implicit assumption that all of check-off monies are spent on promotion. In reality, for most programs only about half of the funds are spent on promotion. In these instances, and focusing strictly on the promotion component of the check-off program, the breakeven price increases would be about half those presented in table 1 and the implied *ABCR*s about double. Taking beef as an example, only about $25 million of the $88 million collected under the check-off is actually spent on promotion. Dividing $25 million by a farm gate value of $25 billion yields an intensity of 0.10 percent, which means that to break even the promotion component of the beef check off needs to raise beef price at the farm level by a mere 0.10 percent. In this instance, if promotion increased the farm price by five percent, the implied BCR would be 50:1. The point is that small price effects are compatible with large BCRs, a fact that program managers (and researchers!) need to bear in mind when interpreting such numbers.

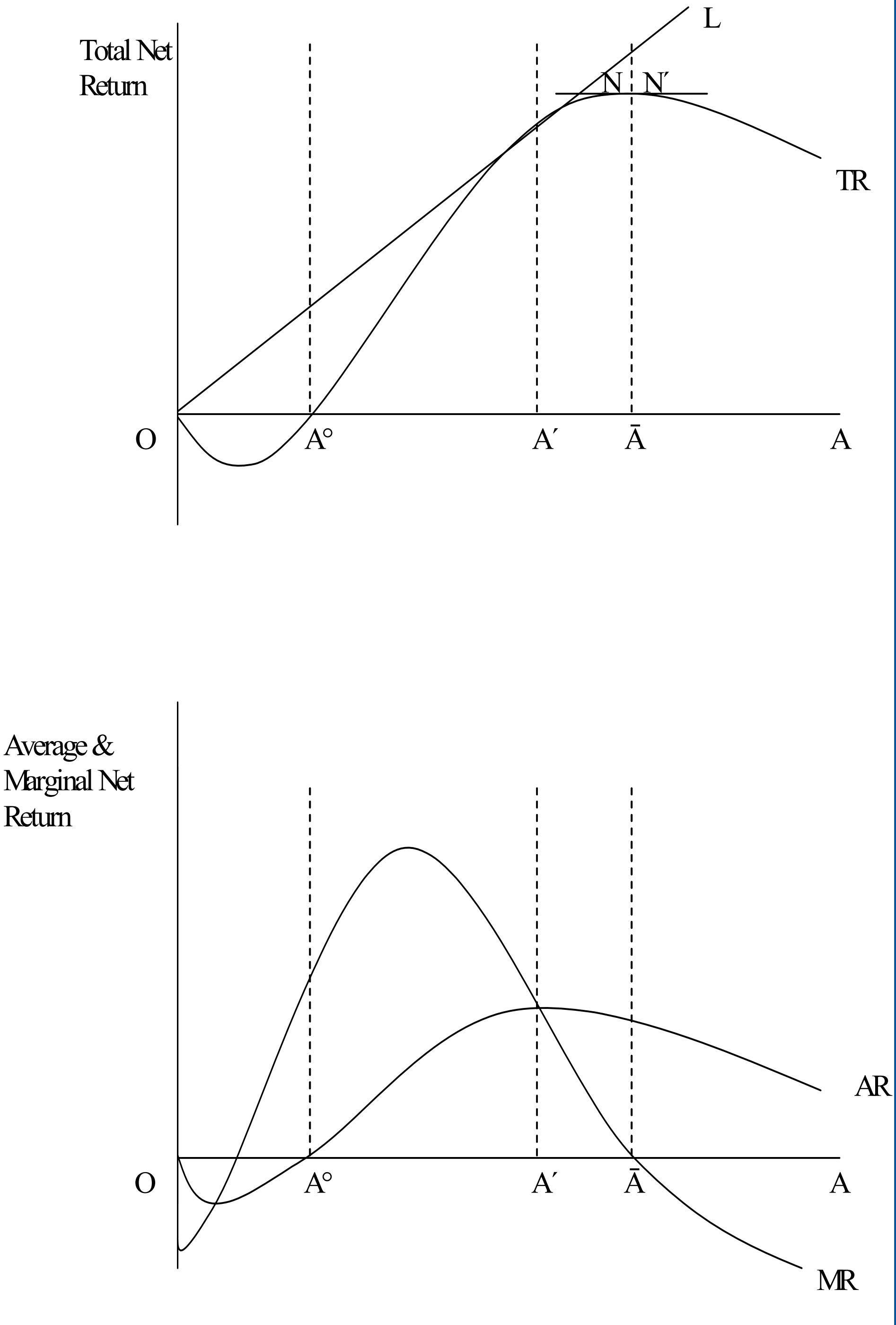
In summary, price effects are the key to whether promotion pays, and should serve as the focus of analysis if benefit-cost ratios are to be legitimate. In addition to reporting the price effect of promotion, studies should report promotion intensity (promotion expenditure divided by farm revenue) so that the break-even price increase is readily apparent.

Table 1. Average Benefit-Cost Ratios for Selected Commodity Promotion Programs Implied by a Five Percent Increase in Farm Price and the Break-Even Price Increase

Program	Budget (Million $)	Farm Value (Million $)	Intensity	Implied BCR	Break-Even Price Increase (%)
Dairy	244.0	21,950	0.0111	4.5	1.11
Fluid Milk	109.5	10,500	0.0104	4.8	1.04
Beef	87.9	25,050	0.0035	14.2	0.35
Soybeans	61.4	14,700	0.0042	12.0	0.42
Cotton	60.2	5,278	0.0114	4.4	1.14
Pork	54.6	10,267	0.0053	9.4	0.53
Eggs	18.8	4,380	0.0043	11.6	0.43
Peanuts	18.7	985	0.0190	2.6	1.90
Potatoes	8.6	2,660	0.0032	15.5	0.32
Honey	3.6	145	0.0248	2.0	2.48
Watermelons	1.6	286	0.0056	8.9	0.56
Average	60.8	8,746	0.0094	8.2	0.94

Source: Budget data are from Armbruster and Nichols; farm value is from government sources through the website *www.census.gov/prod/2004pubs/03statab/agricult.pdf*.

Figure 1. Relationship Between Total, Average and Marginal Returns to Promotion



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