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INCENTIVES TO ADVERTISE: TOO STRONG,
TOO WEAK, OR JUST RIGHT?

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INCENTIVES TO ADVERTISE: TOO STRONG, TOO WEAK, OR JUST RIGHT?

Lynn Hunnicutt and L. Dwight Israelsen

ABSTRACT

There is some debate about whether firms advertise too much or too little. We present a simple model to examine the incentives of a firm to advertise, and distinguish between the market expansion effects and business stealing effects of advertising. When products are homogeneous, firms advertise too little relative to the amount that would maximize total industry profits. In differentiated products markets, the possibility of stealing customers from competitors causes firms to advertise too much. Finally, we derive conditions that determine when an expansion in one firm’s advertising level increases rival advertising.
INTRODUCTION

There is some debate about whether consumers face too much or too little advertising. Bagwell and Ramey (1994) find that there may be too little advertising in equilibrium, if ads serve to coordinate buyers and sellers. Nelson (1974) and Milgrom and Roberts (1986) claim that since advertising itself signals product quality (irrespective of content), there may be too little advertising in equilibrium. Benham (1972) finds that advertising that is informative increases competition and reduces prices paid by consumers. On the other hand, Tremblay and Tremblay (1995) point out that there may be more advertising than is optimal, especially if advertising is costly, uninformative, or used to sell consumers things they do not need. Dixit and Norman (1978), and comments by Fisher and McGowan (1979) and Shapiro (1980), show that if advertising does not enlarge the size of the market, it reduces social welfare.

In this paper, we modify a model first applied to worker decisions in collectives and communes to examine the incentives to advertise. In the model, advertising may increase demand for all products in the industry (the market size effect), and/or it may reallocate demand from one firm to another (the business stealing effect). The market size effect represents an externality created by the advertising firm for all competitors in the industry. When business stealing is not possible, the competitive equilibrium level of advertising is smaller than that which would maximize industry profits. If firms can reallocate sales toward themselves by increasing their advertising, incentives to advertise are too strong, and the competitive equilibrium number of ads is larger than that which would maximize industry profits. Next we look at the effect of firm $i$'s advertising on firm $j$'s incentive to advertise, and find that if the business stealing effect is not present, advertisements are strategic substitutes. Increased advertisements by firm $j$ reduce the marginal profits from an additional ad by firm $i$ reducing the equilibrium level of advertising for firm $i$. In industries where the business stealing effect is present, the effect is more complicated. In fact, the results may be reversed. That is, ads may be strategic complements, so that increased advertising by firm $j$ may increase firm $i$'s incentive to advertise.

THE MODEL

This model is related to that presented in Israelsen (1980), which was applied to work incentives in collectives and communes. Each firm's profit is given $\pi_i = s_i F(A, X) - c(a_i)$, where $s_i$ is the firm's...
share of industry revenue \( F(\cdot) \), which depends on total industry advertising \((A)\) and other industry inputs \((X)\). Profits are reduced by the cost of the firm’s advertising. The firm’s share of industry revenue \( (s_i) \) depends on the structure of the industry, as we will see below.

When products are homogeneous, each firm takes its share of the market as given, so that its profits depend only on the number of firms in the industry. In particular, when products cannot be differentiated, advertising done by any one firm does not affect its share of market revenue. These are the “competitive” industries of economics textbooks, where products are not differentiated, and advertising for product \( i \) does not differentiate it from others in consumers’ minds. In this case, the firm’s profit function is

\[
\pi_i = \frac{1}{n} F(A,X) - c(a_i).
\]

For simplicity, assume that the \( n \) firms in the industry are identical, so that each of them gets an equal share of industry revenue. To ensure a finite level of advertising, we assume \( F_1 > 0 \), \( F_{11} \leq 0 \), and \( c'(\cdot) > 0 \), so that advertising raises revenue but at a decreasing rate. In this market, firm \( i \)’s revenue depends on total industry advertising and the number of competitors in the industry.

A second type of industry is one where products are differentiated, so that advertising for product \( i \) causes consumers to believe that the good is distinct. In this case, the firm’s revenue function is given by

\[
\pi_i^d = \frac{a_i}{A} F(A,X) - c(c_i).
\]

In this industry, advertising has two effects. First, when firm \( i \) increases its share of industry advertising, it is able to attract customers that formerly went to competitors. This business stealing exists when \( \frac{d}{da_i} \left( \frac{a_i}{A} \right) - \frac{1}{A} \left( 1 - \frac{a_i}{A} \right) \frac{dA}{da_i} > 0 \). The second effect of advertising is the market expansion effect. This occurs when firm \( i \)’s advertising increases total industry advertising and thus attracts new consumers to the industry. All firms in the industry benefit from a positive market expansion effect, which occurs when \( \frac{dA}{da_i} > 0 \). Notice that when market expansion fails \( \left( \frac{dA}{da_i} \leq 0 \right) \), the business stealing condition is guaranteed.

If ads by firm \( i \) are offset by fewer industry ads, then firm \( i \)’s revenues rise only because it is stealing some of the industry’s existing customers from its rivals (without increasing the number of customers purchasing in the industry). Also note that the larger firm \( i \)’s share of industry advertising \( \left( \frac{a_i}{A} \right) \), the smaller the response of industry ads to increases in \( i \)’s advertisements must be in order for \( i \) to steal business from its competitors. Firms that already do most of an industry’s advertising have a hard time stealing business from their rivals through additional advertisements.

In a differentiated goods industry, firm \( i \)’s revenue depends both on total industry advertising, and on its share of that total. Many consumer goods companies face revenue functions like this one. For example, internet booksellers may benefit when amazon.com increases its television advertising (i.e., \( A \) increases). They are also likely to benefit if their own television advertisements \( (a_i) \) attract customers to their website.

Notice that in homogeneous and differential industries, total revenue earned by firms is given by

\[
\Pi = (A,X) - \sum_i c(a_i).
\]

At the industry optimum, \( \frac{d\Pi}{dA} = 0 \), which implies \( \frac{\partial F}{\partial A} = \sum_i \frac{dc_i}{da_i} \frac{dA}{dA} \). That is, the increase in industry revenue caused by an additional industry advertisement must equal the total marginal cost of ads. In the private solution, \( \frac{d\pi_i}{da_i} = 0 \), which might lead to over- or underinvestment in advertising.

**INCENTIVES TO ADVERTISE**

To determine the effect of an increase in \( i \)’s advertising on its own profit, we use the following first-order condition

\[
\frac{\partial \pi_i}{\partial a_i} = \frac{1}{n} F(A,X) - c'(a_i),
\]
Firm $i$ maximizes its profits by setting $\frac{d\pi^h_i}{da_i} = 0$, which implies that it advertises until the marginal cost of its own advertising $\frac{dc}{da_i}$ is equal to its share of incremental industry profit from advertising $\frac{1}{n} \frac{\partial F}{\partial A} \frac{dA}{da_i} \frac{dc}{da_i}$.

From the industry's point of view, assuming that advertisements are independently chosen, so that $\frac{da_j}{da_i} = 0, j \neq i \Rightarrow \frac{dA}{da_i} = 1$, firm $i$'s ads should be set to satisfy $\frac{d\Pi}{da_i} = \frac{\partial F}{\partial A} \frac{dc}{da_i} = 0$. Evaluating the industry's first-order condition at the privately optimal level of advertising, we have

$$\frac{d\Pi}{da_i} = \frac{\partial F}{\partial A} - 1 \frac{\partial F}{\partial A} \frac{\partial F}{\partial A} \frac{1}{n} \geq 0.$$ 

Thus, in the homogeneous goods industry, firm $i$ advertises too little. That is, private incentives to advertise are too low in homogeneous goods industries.

In the differentiated product industry, the competitive equilibrium solves each firm's first-order condition as follows:

$$\frac{d\pi^d_i}{da_i} = F(A, X) \left[ \frac{a_i}{A} \frac{dA}{da_i} + \frac{a_i dA}{A da_i} \frac{\partial F}{\partial A} \frac{dc}{da_i} \right].$$

Here, we have both the market expansion and the business stealing effects of advertising. Recall that the market expansion effect is given by $\frac{dA}{da_i} \geq 0$, which is positive as long as firm $i$'s ads increase industry advertising. In the homogeneous goods equilibrium, the industry benefit of the last advertisement $\frac{\partial F}{\partial A}$ was $n$ times larger than its cost. Here, the industry benefit to firm $i$'s last advertisement may not be $n$ times larger than its cost, since firm $i$'s advertisements may steal customers from its rivals, which neither benefits nor harms the industry as a whole.

The second effect present in the differentiated products model is the business stealing effect, given by $\frac{d}{da_i} \frac{a_i}{A}$. As long as $1 - \frac{a_i}{A} \frac{dA}{da_i} > 0$, or $\frac{a_i}{A} \frac{dA}{da_i} < 1$, firm $i$ steals business from its rivals when it increases its own advertising.

In the differentiated goods industry, each firm sets the marginal cost of an additional advertisement equal to its marginal gain. Thus, evaluating the industry first-order condition at the competitive equilibrium level of advertisements, and recalling that our independence assumption guarantees that $\frac{dA}{da_i} = 1$, we see that

$$\frac{d\Pi}{da_i} = \left( 1 - \frac{a_i}{A} \right) \left( \frac{\partial F}{\partial A} - \frac{F}{A} \right) \leq 0.$$ 

In differential products industries, $\frac{d\Pi}{da_i} \leq 0$ since our assumptions about the shape of $F(A, X)$ guarantee that $\left( \frac{\partial F}{\partial A} - \frac{F}{A} \right) < 0$. In contrast to the homogeneous goods industry, the ability of firms to steal business from competitors gives firms a larger incentive to advertise than is optimal for the industry as a whole. When firms can steal customers from one another, each of them advertises too much.
EFFECTS OF COMPETITOR'S ADS

Next, we examine the effect of an increase in firm $i$'s advertising on firm $j$'s profits, and thus on firm $j$'s incentive to advertise. To examine this issue, we calculate $\frac{d^2 \pi_i}{da_i da_j}$. By using our assumption that $\frac{dA}{da_i} = 1$, and the first-order condition, we see that in the homogeneous goods industry

$$\frac{d^2 \pi_i}{da_i da_j} = \frac{1}{n} \left[ \frac{\partial^2 F}{\partial A^2} + \frac{\partial F}{\partial A} \frac{d^2 A}{da_i da_j} \right] = \frac{1}{n} \frac{\partial^2 F}{\partial A^2} \leq 0.$$

Thus, an increase in firm $j$'s advertising reduces the marginal profitability of firm $i$'s advertisements. This discourages firm $i$ from advertising, which reinforces our conclusion that there is too little advertising in a homogeneous goods industry. In homogeneous goods industries, since the only effect of advertising is to expand the market (benefiting all firms in the industry), advertisements are guaranteed to be strategic substitutes. Increased advertising by a rival reduces the marginal benefit of advertising, without changing its cost.

In differentiated products industries, the effects are more complex, because advertising not only increases the size of the market, it also allows firms to steal business from one another. Here, assuming that $\frac{dA}{da_i} = 1$, we see that

$$\frac{d^2 \pi_i}{da_i da_j} = \frac{d}{da_j} \left[ \frac{F(A, X)}{A} \left( 1 - \frac{a_i}{A} \right) \frac{\partial F(A, X)}{\partial A} a_j \right] = \frac{1}{A} \frac{\partial F}{\partial A} \frac{F}{A} \left( 1 - \frac{2a_j}{A} \right) a_j \frac{\partial^2 F}{\partial A^2}.$$

This term is more difficult to sign and may in fact be positive. The first part $\frac{1}{A} \frac{\partial F}{\partial A} \frac{F}{A}$ is negative. The third part $\frac{d}{da_j} \frac{\partial^2 F}{\partial A^2}$ is also negative. Since we cannot sign $1 - \frac{2a_j}{A}$, we are left with no clear conclusions regarding how an increase in advertising by firm $j$ will affect firm $i$'s marginal profitability of advertising.

CONCLUSION

This paper has examined the incentives of a firm to advertise in both homogeneous and differentiated products industries. Advertising has two effects—it may expand the market, thus increasing the welfare of all firms in the industry, and it may induce customers of one firm to purchase from a competing firm instead. This business stealing effect is present only when products are differentiated. We show that when business stealing is not possible, individual firm incentives to advertise are too low, and fewer ads than would maximize industry profit are produced. This suggests why many agricultural industries include cooperatives and checkoff programs designed to expand the market. In differentiated products industries, the possibility of stealing customers from a rival increases the incentive of the firm to advertise, making the privately optimal level of advertising too large.

Next, we look at the effect an increase in firm $j$'s advertising levels have on firm $i$'s optimal choice of advertising. In homogeneous goods industries, we find that an increase in firm $j$'s advertising level reduces the marginal benefits to firm $i$ of advertising, so that firm $i$ advertises less. That is, in homogeneous goods industries, ads are strategic substitutes. In differentiated goods industries, the effect is more complicated, and clear results are more difficult to obtain. It is possible that an increase in firm $j$'s advertising level might increase firm $i$'s desired advertising, making advertisements strategic complements.

This paper does not make claims regarding socially optimal levels of advertising, because we have not considered consumer welfare. In both types of industries, the privately optimal level of advertising is not likely to maximize social welfare, as it does not even maximize industry-wide profits. Further results are difficult to obtain without examining the effects of advertisements on consumer utility.
Extensions of this work include looking at the effect of increased industry advertisements on individual firm incentives to advertise. Especially in homogeneous goods industries, where private advertisements need to be supplemented by industry group advertising levels, it would be useful to characterize the effects of a rise in $A$ on the optimal level of $a_i$. It would also be useful to examine the effect of mergers on incentives to advertise. When two firms merge, their share of industry advertising will (at least initially) rise. Depending on what one assumes about how final shares adjust, one may see larger or smaller incentives to advertise, which may increase or reduce social welfare.

REFERENCES


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