THE ECONOMIC EFFECTS OF PROPOSED REGULATION OF TV ADVERTISING DIRECTED AT CHILDREN: A THEORETICAL AND EMPIRICAL ANALYSIS

by

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ABSTRACT

This thesis theoretically and empirically examines the economic effects of past and proposed reductions in children directed TV advertising on the consumers and producers of children's products. The history and nature of the proposals to ban children directed advertising is presented, and then theoretical models of advertising for the profit maximizing firm are developed for both the independent firm and the firm that operates in the duopoly setting. The comparative static properties of the models produce interesting results that show the conditions in which advertising restrictions lead to increases or decreases in product prices and product availability. The concept of interdependence in advertising is presented in a unique mathematical and graphical form. Finally, empirical attention focuses on the market for breakfast cereals. It examines the effectiveness of TV advertising in altering aggregate cereal sales and the effect that past reductions in cereal advertising had on cereal industry sales and profits.

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INTRODUCTION

There has been considerable pressure to reduce or possibly eliminate TV advertising directed toward children, and two government agencies are currently considering imposing such measures. The purpose of this paper is to analyze some of the economic effects of mandatory reductions in children directed advertising.

The reason for the pressure is that children have long been a special group of citizens--prohibited from purchasing alcoholic beverages, denied voting rights, and even protected from serving in prison for violating the law. Action for Children's Television (ACT) has been fighting to "further protect" children by proposing a ban on children directed advertising. In the words of ACT, "[children directed advertising] takes unfair advantage of children's lack of sophistication and maturity..." [4,394].

Obviously the people in ACT feel television advertising directed at children poses a cost to "society" in the form of the "subjugation" of children. Numerous studies funded by ACT, the federal government, and private business have reached varying conclusions regarding the psychological effects of advertising on children. It should be emphasized, however, that this thesis makes no attempt to analyze the cognitive and moral aspects of children directed advertising--that is not the job of the economist. This thesis will analyze the purely economic consequences of any regulatory moves regarding advertising.

This thesis follows the form of The Journal of Industrial Economics.

The primary focus of the paper will be on the microeconomic effects of forced reductions in advertising on the firms and industries that currently utilize large advertising campaigns directed toward children. Emphasis will center on this aspect of the topic for two major reasons. First, the effects on the industries and firms will ultimately effect consumers through product quality, product availability, and product prices. Second, the regulatory agencies of the government seem to ignore these potential effects, thus making research in this area critically important.

Secondary emphasis in this paper will be on the effect any reduction in advertising would have on the major networks. This aspect of the topic is secondary because research has already been, and is presently being done, on this effect.

The material in this thesis is presented in five chapters. Chapter One introduces the history of children's television. It traces the growth of children's programming, the growth of advertising directed toward children, and the subsequent growth of concern by ACT. Chapter One concludes with a summary of the current status of the regulatory proceedings.

The first part of Chapter Two presents a summary of the current literature on the theory of advertising. The following sections of the chapter set forth some new models of advertising for the profit maximizing firm in both the independent firm and duopoly setting. The models focus on three major areas: (1) market power and advertising, (2) comparative static properties of the models, and (3) the concept

of oligolply interdependence in advertising. Theories are first presented in mathematical form and, when practical, are also illustrated graphically. In all cases the theories are presented in their most general form in the sense that they may be used in analyzing any type of promotion.

Chapter Three synthesizes Chapters One and Two, providing a theoretical analysis of the economics of ACT's proposals. Chapter Three draws not only from the general theories developed in Chapter Two but also from research done by other scholars of advertising. Emphasis is on the effects of current and past advertising restrictions on product prices and quantities, as well as some welfare implications of product variety.

In Chapter Four the theories of Chapter Two and the theoretical results of Chapter Three are tested empirically. Several econometric models are used to estimate the effectiveness of advertising in altering cereal sales. The cereal industry is used because cereal sales tend to be non-seasonal in nature and because the majority of cereal firm advertising is directed toward children. Moreover, most of the pressure by ACT to ban advertising has been directed toward cereal firms. Thus, Chapter Four empirically analyzes the effects of the proposed regulations in the cereal market.

Finally, Chapter Five amalgamates the results of the entire research project, giving the policy implications indicated by the research. Potential effects of the regulation on the networks, consumers, and child-related industries will be summarized.

CHAPTER ONE: THE HISTORY OF CHILDREN'S TELEVISION AND ADVERTISING

Section One: Children's Television: Its Early Years.

Children's programs have not always been funded solely by advertising. In 1949, 42% of children's programs were shown without sponsorship. This was a "mixed blessing," for due to a lack of sponsorship, few funds were available for the development of children's programs [30, 36-38].

Due to the success of certain programs, such as "Walt Disney" in the 1950's, more children's shows were developed. Disney's success in gaining larger viewing audiences made networks and sponsors alike realize that children's programs had "dollar potential" [30, 40]. Sponsors could buy network time and reach a large, specialized audience of children; networks could increase advertising revenues by selling time during children's programs.

The emphasis on "children's television" was short-lived; the emphasis in 1956 turned to adult "prime time" television. The result was that local stations began programming older, cheaper "re-run" programs coupled with locally run commercials during children viewing hours. These commercials generally consisted of a local "host" that would introduce cartoons and sell products [30, 43-45].

A rebirth in children's programming occurred during the 1960's [30, 50]. The sixties also revealed the true potential of children's advertising to reach children at minimal cost. For example, according to Nielsen figures in 1965, "1000 children could be reached on weekend shows for one dollar, 286 kids per dollar on weekdays, and 133 kids per

dollar during prime time" [30, 51].[1] Due to the efficiency of reaching children on weekends, many cereal and toy firms began to specialize in sponsoring weekend shows. This had the effect of increasing the quantity of children's programs [30, 52]. The search for profits led to strong competition not only between sponsors but also between networks. The profit motive led networks to try to increase the appeal of children's shows to ensure good ratings. Good rating meant sponsors, and sponsors meant money.

The history of children's television shows that advertising and profits were key factors in the development and propagation of children's programs. Yet, as children's advertising grew, a group of concerned citizens formed a non-profit organization known as Action For Children's Television (ACT). ACT was concerned about the harmful effects of advertising on children, especially children under eight years of age.

Section Two: The ACT and Early Proposals.

The legal steps taken toward regulating children directed advertising has involved a lengthy, costly process for all parties concerned. The initial move against children directed advertising began in 1970 when ACT submitted a petition to the FCC that called for:

(1) no commercials on or sponsors of children's programs;

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[1] Despite the connection Melody tries to make between "reaching children" and "increasing sales," there is a subtle difference. Reaching children only implies (in the Nielsen sense) that children are exposed to commercials. Thus, "reaching children" is a necessary but not sufficient condition for increasing sales.

(2) no "host" selling; and

(3) greater than three hours per week to be devoted to children's programs [3, 461-462].

ACT's rationale for calling for the changes in programming and advertising practices include "[ensuring] that children are not singled out on the basis of advertising market criteria for pinpoint advertiser exploitation" and to "[ensure] that children are singled out for special programming on the basis of their own needs and interests" [47, 431]. In this sense, ACT's proposal would remove the financial base of children's television and at the same time increase the number of children's shows.

The FCC, in its "Notice of Inquiry into Children's Television" (1971) agreed with ACT that advertising directed at children is harmful to them. However, the FCC feared that a ban on children directed advertising would reduce network revenues and hamper programming efforts. In the words of FCC commissioner Abbot Washington, "... a ban would destroy the commercial support necessary to fund programs directed not only to pre-school aged children but to younger children in general" [13, 696]. Thus, the FCC chose to respond to ACT's initial petition with a policy of voluntarism, essentially asking networks to reduce the quantity of children directed advertising [14, 27136].

Meanwhile, ACT presented a petition to the FTC asking for a ban on food advertising directed at children [4, 382]. The basis for the petition is summarized by the following statement by ACT:

> "ACT has argued that advertising of foods directed to children takes unfair advantage of children's lack of sophistication and maturity; that it produces nutritional mis-education which is difficult to unlearn; that the

> food habits promoted by TV ads aimed at children teach that one eats because it is fun, it is sweet or it is the way to get a toy, rather than food is vital to health and well being...ACT urges the FTC to establish a Trade Regulation Rule prohibiting all television advertising of edible products directed to children." [4, 394].[2]

Later, in a Senate hearing on nutrition, ACT recommended "absolute prohibition against any kind of television advertising on children's shows" [47, 378].

In response to ACT's allegations against cereal advertising, General Mills pointed out to the Senate Committee on Nutrition that 17% of the U.S. population skipped breakfast half of the time. General Mills thus claimed that they must make cereal "sweet and fun" to eat in order to entice children to eat breakfast [46, 319]. In the words of General Mills, "A breakfast that children do not eat will not make any nutritional contribution" [46, 321].

Although initial efforts by ACT to ban children directed advertising did not find immediate approval within the ranks of the FCC and FTC, it did have an indirect effect. Until December 31, 1972 the National Association of Broadcasters (NAB) had put a ceiling of 16 minutes per hour of non-program type material on children's daytime shows. On January 1, 1973 the NAB reduced this ceiling to 12 minutes per hour of non-program material [34, 3]. It is important to note that before and after 1973 actual non-program time was approximately two minutes less than the "voluntary" ceiling placed by the NAB.

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[2]This plea was submitted just a few days after a January 25, 1972 New York Times article revealed that the FTC was charging breakfast cereal producers of monopolization through barriers to entry created by large advertising expenditures.

A more direct effect of petitions by ACT was the conception of an inquiry by the FCC to analyze the impact of reductions in non-program time ceilings [3, 462]. In the interim, however, 1974 FCC guidelines were essentially the same as those the television industry (e.g., NAB) had already imposed [16, 10]. Thus, in 1974 the FCC embarked on a study to analyze the feasibility of further reducing children directed advertising.

Since the ACT had failed to secure an immediate ban on children directed advertising, it filed a lawsuit to force the FCC to reverse its decision not to adopt the rules proposed by ACT. Much to the dismay of ACT, the appeals court ruled that the FCC was acting in its discretion and that the FCC could refuse to adopt the rules proposed by ACT [3, 458].

Section Three: The Current Status of FCC and FTC Rulemaking.

In 1978 both the FTC and FCC publicized their intent again to delve into the feasibility of restricting children directed advertising. Action by the FTC was reborn in 1978 when a FTC staff report recommended the conception of a rulemaking process "to eliminate harms arising out of TV advertising to children" [20, 345]. The major area of concern cited in the report was the advertising of sugared products. In August of the same year a study by the FCC was initiated in order to determine if stations had complied with the 1974 guidelines, to analyze the economic impact of reducing the quantity of advertising on children's shows, and to determine how to define children's programming [16, 10].

Presently, the FCC is being extremely cautious in imposing regulations, even though preliminary results of their study indicate that the voluntary guidelines imposed in 1974 increased children's programs by less than one percent [15, 16]. The FTC seems equally as cautious in banning advertising of sugared products, because Congress is considering reducing the power of the organization [21, 40].

As for the current quantity of advertising messages, ABC announced in 1979 that it plans to reduce advertising minutes sold during children hours by 10% per year for the next two years. This would mean that by January 1981 less than 7.5 minutes per hour would be devoted to commercials during children hours. This amount would be less than the current levels of advertising sold during prime time television [2, 23]. As a side effect, advertising minutes may increase in the future during prime time. NBC and CBS seem reluctant to follow the reductions made by ABC [1, 10].

The primary concern of the FCC in analyzing the economic impact of further reductions in TV advertising during children's shows is the effect on network revenues. Very little research has been called for by the FCC to ascertain the economic effects of further reductions in advertising time on advertisers. Even the FTC, whose responsibility lies in the domain of commerce, neglects the affect on advertisers and spends dollars researching the effects of advertising on children. The view by the FTC is summarized by chairman Michael Pertschuk thusly: "... advertising exploits children and may be unfair and misleading... commerical exploitation is repugnant to a civilized society" [35, 3].

While advertising may or may not "exploit" youth, the concern of this thesis is the fact that the FCC, FTC, and ACT take a very narrow view of the economic effects of reductions in advertising. They neglect the effects regulation would have on industries and firms that currently use advertising to promote children's products.

It may well be that reductions in advertising would lead to price competition in child-related industries. On the other hand, reductions in advertising time available could reduce entry, increase product prices and alter industry profits. These are the microeconomic questions that must be answered before a definitive policy by the FTC or FCC can be achieved. The remainder of this thesis concentrates on this effect of the proposed regulations that seems to concern ACT, the FTC and the FCC the least. Possibly, the contents of this paper will add to the research done in the other areas and provide the information necessary for a policy decision to be reached based on the whole picture, not just a narrow part of it.

CHAPTER TWO: THE THEORY OF ADVERTISING

The ultimate purpose of this chapter is to develop a general theory of advertising that can be used in the remaining chapters to analyze the economic consequences of proposed regulation of TV advertising directed toward children. The economic ramifications of advertising and the profit maximizing firm's utilization of advertising has historically been the center of much analysis. Dorfman and Steiner [12] have done pioneer work relating the profit maximizing utilization of advertising to the elasticity of demand. They point out that the profit maximizing firm should advertise so long as the increase in revenue resulting from a one dollar increase in advertising expenditure exceeds the elasticity of demand for the firm's product.

With a similar model, Frank [17] presents an oligopoly version of some of the results derived by Dorfman and Steiner. He analyzes potential collusive agreements in advertising, and shows that collusion in advertising leads to reductions in firm advertising.

Needham [32] presents an analysis of advertising as a barrier to entry, again employing assumptions of profit maximization similiar to those made by Dorfman and Steiner. Needham shows that established firms can choose advertising levels such that potential entrant's entry potential in nil. As a result, established firms can earn profits (due to the entry barriers) while simultaneously preventing entrants from earning profits.

One additional work in advertising theory stands out as worthy of explication. Tauber [44], in an early exposition on the theory of

interdependence, describes what he terms "the oligopolistic lock-in" in which firms are forced to an inferior profit state due to interdependence. He carefully lists the necessary conditions for the existence of the "lock-in" in advertising:

(1) an oligopolistic market structure;

(2) the product of each firm is viewed as differentiated;

(3) total industry demand for the product is relatively promotion inelastic; and

(4) a sizeable market segment which has little brand loyalty, exists. Thus, promotion is valuable only to the extent that brand switching occurs.

Tauber points out that the incentive structure leading to the inferior profit state is magnified by the fact that the length of time necessary to begin a new advertising campaign, if advertising is reduced through collusive agreements, is often relatively long. Hence, firms are reluctant to form the collusive agreements that could remove the "lock-in" that is forcing the inferior state.

The above cited works of course only scratch the surface of the theoretical analyses of advertising. However, each of the articles are representative of what I will term the "core" topics of advertising theory with one omission.[3] Other articles in advertising theory are either direct or indirect spin-offs of the above works.

All of the previously mentioned works are similar in the sense that advertising expenditures are treated as the relevant decision

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[3]The ommission is a December, 1979 article by Scherer on the Welfare implications of advertising. "Ommission" is somewhat of a misnomer, however, as the article is reviewed in Chapter Three.

variable in the models. This assumption has its merits, but as will be pointed out below, the "trick" of using advertising quantity as the decision variable yields the same results plus additional results unobtainable via the traditional models.

The purpose of the remainder of this chapter is three-fold. First, I will synthesize much of the previously mentioned work and relate advertising to a frequently used index of monopoly power for both the independent firm and duopoly case. Equilibrium levels of advertising for the profit maximizing firm will be the crux of this chapter. Then, I will analyze the comparative static properties of the models. Finally, I will view advertising interdependence both mathematically and graphically. It is the last two sections of this chapter that deviate the most from previous work.

Section One: Independent Firm Model.

A. Introduction.

Before much is said about the profit maximizing independent firm's advertising strategy, several points should be made. In analyzing a given firm's advertising strategy the market structure of the industry is a crucial consideration. In a monopolistic market, one firm's advertising decisions do not vary with the strategies of other firms because there is only one firm in the industry.[4] However, in a market

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[4]A case could be made that even the pure monopolist's advertising strategy is dependent on the advertising of other firms to the extent that all industries compete for the limited income of consumers. Still, a monopolist's advertising is at least relatively less dependent on the advertising strategies of other firms in that the oligopolist must compete not only against the advertising of other industries, but against the advertising of firms in its industry as well.

characterized by interdependence, the advertising strategy of one firm critically depends on the actions of other firms. This interdependence alters the advertising practices of individual firms. More about this will be said in the section on the duopoly case.

B. Model.

Assume that the demand for a firm's product is given by

(2-1) $$P = F(Q, A),$$

where P is the price of the firm's output, Q is the quantity of output, and A is the quantity of advertising (in, say, television minutes, square inches of print, etc.) employed by the firm.

At a given quantity, we would expect advertising to have a positive effect on price if the firm decides to advertise (i.e., $\frac{\partial P}{\partial A} > 0$). However, this is merely a necessary condition for the firm to advertise; indeed, cost considerations must also be viewed. Let us assume that the firm competes in a competitive market for advertising and can purchase any quantity of advertising at a price of a^0.[5]

Since the firm can produce an output independent of his advertising outlay, the firm's advertising cost is not considered a cost of production (advertising is a marketing input, not a production input; advertising per se does not produce an output). Given the firm's production costs

$$C = C(Q),$$

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[5]This deviation from traditional advertising analysis and its usefulness will be fully appreciated in the section on the model's comparative static properties.

we can express the firm's profit function as

(2-2) $\pi = P \cdot Q - C(Q) - Aa^0$, or equivalently

(2-3) $\pi(Q, A; a^0) = F(Q, A) \cdot Q - C(Q) - Aa^0$,

where we assume π is twice continuously differentiable. We now assume that the firm attempts to maximize profits with respect to its decision variables Q and A. The first order conditions (FOC) for profit maximization are:

(2-4) $\pi_1 \equiv \frac{\partial \pi}{\partial Q} = F(Q, A) + QF_1 - C'(Q) = 0$

(2-5) $\pi_2 \equiv \frac{\partial \pi}{\partial A} = QF_2 - a^0 = 0$, where $F_1 \equiv \frac{\partial P}{\partial Q}$; $F_2 \equiv \frac{\partial P}{\partial A}$.

Equation (2-4) states that the profit maximizing firm will continue to increase output so long as the marginal revenue from a unit of output (MR_0) exceeds the marginal cost of production (MC_p). Indeed, in equilibrium the firm will equate MR_0 and MC_p. However, equation (2-5) further states that the firm will increase its advertising outlay so long as the revenue brought about by an additional unit of advertising exceeds the additional cost of one unit of advertising. Again, the firm will equate $MR_A = MC_A \equiv a^0$. The firm must satisfy both conditions simultaneously.

The second order sufficiency conditions (SOSC) for profit maximization are:

(2-6) $$|H| = \begin{vmatrix} \pi_{11} & \pi_{12} \\ \pi_{21} & \pi_{22} \end{vmatrix} = \begin{vmatrix} 2F_1 + QF_{11} - C''(Q) & F_2 + QF_{12} \\ F_2 + QF_{12} & QF_{22} \end{vmatrix} > 0,$$

(2-7) $\pi_{11} \equiv 2F_1 + QF_{11} - C''(Q) < 0.$

At this point it is not clear that using product price as an endogenous variable and the price of advertising as a shift parameter will yield an elasticized form of (FOC) equivalent to that obtained by traditionalists such as Dorfman, et al. However, the mathematics works out so that this altered form of the traditional model, with its accessibility to comparative statics, can indeed be so elasticized. To see this, return to the (FOC). Taking ratios and manipulating (2-4) and (2-5) produces

$$(2\text{-}8) \qquad -\frac{F_2}{F_1} = \frac{a^0}{F(Q, A) - C'(Q)} \equiv \frac{a^0}{P - C'(Q)} .$$

Now recall from (2-1), by virtue of the implicit function theorem, that $\frac{dQ}{dA} = -\frac{F_2}{F_1}$ since $F_1 \neq 0$. Utilizing this fact and multiplying (2-8) through by $\frac{A}{Q}$ allows the expression to be expressed as an elasticity:

$$(2\text{-}9) \qquad \varepsilon_{QA} = \frac{a^0}{P - MC} \left(\frac{A}{Q}\right)$$

$$\text{where } \varepsilon_{QA} = \frac{dQ}{dA} \cdot \frac{A}{Q}$$

$$MC = C'(Q).$$

Finally, multiplying (2-9) through by $\frac{P}{P}$ we obtain the Dorfman-Steiner form:

$$(2\text{-}10) \qquad \varepsilon_{QA} = \frac{P}{P - MC} \quad \frac{A^{\$}}{R}$$

$$\text{where } A^{\$} = \text{advertising expenditures}$$

$$R = \text{total revenue.}$$

Thus, we have shown that the equilibrium advertising elasticity in terms of advertising dollars and output (Dorfman and Steiner's

advertising elasticity) is identical to the equilibrium advertising elasticity in terms of advertising quantity and product quantity as determined by the model of equation (2-3).

Equation (2-10) has some interesting implications. First of all, note that $\frac{P}{P - MC}$ is the inverse of Lerner's index of monopoly power (See Lerner, 1934). The smaller the deviation (P - MC), ceterus paribus, the smaller is Lerner's index of monopoly power. Thus, a perfectly competitive firm (where P = MC) would approach a Lerner index of 0; a firm having considerable market power (P > MC) would have a Lerner index greater than zero. It should now be obvious that the profit maximizing advertising elasticity varies inversely with the degree of market power; the more market power a firm possesses, ceterus paribus, the smaller its profit maximizing advertising elasticity. The easier it is to enter an industry, the greater the advertising elasticity. Thus, advertising elasticity could be used as a theoretical index of monopoly power.

Secondly, note that we can rewrite (2-10) as

$$(2\text{-}11) \qquad \left(\frac{P - MC}{P}\right) = \frac{1}{\varepsilon d} = \frac{1}{\frac{dQ}{dA} \cdot P} = \frac{1}{\mu} ,$$

where εd = ordinary elasticity of demand;

μ = the Dorfman-Steiner variable $\frac{dQ}{dA} \cdot P$.

Hence, the degree of monopoly power, as measured by the Lerner index, is the inverse of the price weighted responsiveness of demand to advertising. This implies that in order to estimate the Lerner index,

one merely needs to obtain Dorfman and Steiner's μ, a measure of the responsiveness of demand to advertising.[6]

C. Comparative Statics.

By eschewing the Dorfman-Steiner approach of employing advertising expenditures, we have added versitility to our model. The primary purpose of this section is the analysis of changes in the advertising price parameter, a^0. For this analysis, we return to the (FOC) of equations (2-4) and (2-5). Taking the total differential, we obtain

$$(2\text{-}13) \qquad [2F_1 + QF_{11} - C''(Q)]dQ + [F_2 + QF_{12}]dA = 0$$

$$(2\text{-}14) \qquad [F_2 + QF_{21}]dQ + [QF_{22}]dA = da^0.$$

The determinant of this system of linear equations is $|H|$ in (2-6). We can thus solve this system by Cramer's Rule to obtain:

$$(2\text{-}15) \qquad dQ = - \frac{(F_2 + QF_{12})}{|H|} da^0,$$

$$(2\text{-}16) \qquad dA = \frac{(2F_1 + QF_{11} - C''(Q))}{|H|} da^0.$$

Recalling the definition of a differential, and reading the coefficients in (2-15) - (2-16), we obtain

$$(2\text{-}17) \qquad \frac{d\bar{Q}}{da^0} = - (F_2 + QF_{12})/|H| \begin{cases} < 0 \text{ if } F_{12} \geq 0 \\ > 0 \text{ if } F_{12} \leq 0 \text{ and } |F_{12}| > F_2. \end{cases}$$

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[6] For a brief criticism of the Lerner index and the assumption of maximizing profits see Scherer (1970), p. 50.

$$(2\text{-}18) \qquad \frac{d\bar{A}}{da^0} = (2F_1 + QF_{11} - C''(Q))/|H| < 0.$$

Here, $\bar{A}$ and $\bar{Q}$ denote the profit maximizing level of advertising and output, respectively. $\frac{d\bar{A}}{da^0} < 0$ is guaranteed by the second order conditions: The numerator of (2-16) is π_{11} of (2-7); the denominator is positive by (2-6). Thus, the profit maximizing advertising outlay, denoted $\bar{A}$, varies inversely with a^0, the price of advertising.

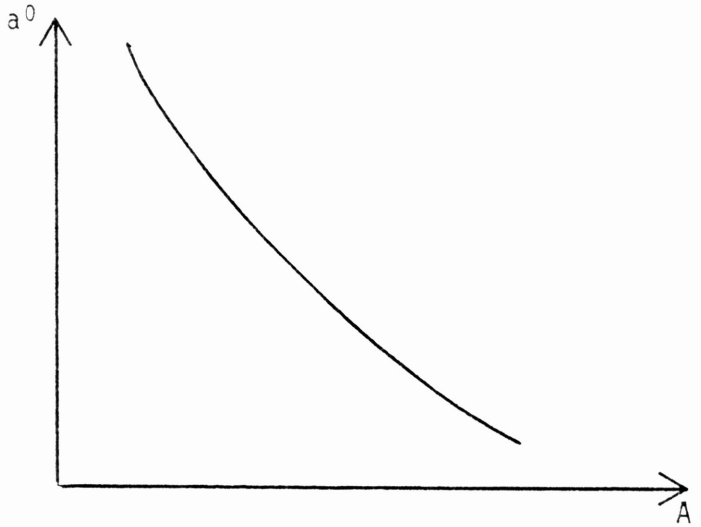

Figure 2-1. Demand For Advertising

The relation is shown in Figure 2-1, and can be interpreted as the firm's demand for advertising, as well as the optimal utilization of advertising as an outlay. Also, note that sgn $\left(\frac{d\bar{Q}}{da^0} \right)$ = - sgn $(F_2 + QF_{12})$. Equation (2-5) requires $F_2 > 0$, but no restriction is placed on the sign of F_{12}. However recall that $F_{12} \equiv \frac{\partial}{\partial A} \left(\frac{\partial P}{\partial Q} \right)$ is simply the the rate of change in the slope of demand relative to changes in advertising. Thus if $F_{12} > 0$, advertising influences demand by making it more elastic; if $F_{12} < 0$, advertising makes demand more inelastic; if $F_{12} = 0$, advertising does not affect the slope of the demand curve. Figure 2-2 shows the three possible relations.

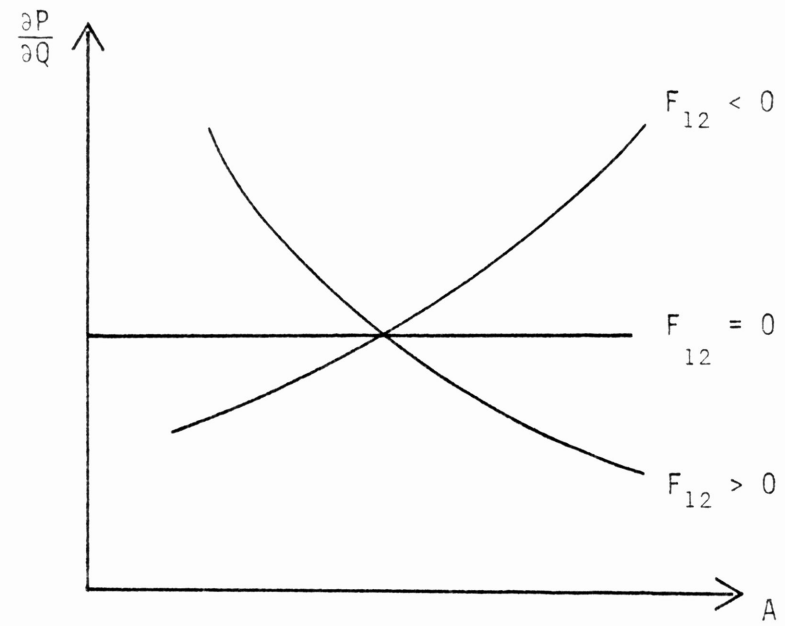

Figure 2-2. Advertising and the Slope of Demand

It seems reasonable to assume that firms advertise to alter consumer preferences by making consumers believe that fewer substitutes exist, thus making demand more inelastic for their product (i.e., $F_{12} < 0$). Under this assumption, $\frac{d\bar{Q}}{da^0} \lesseqgtr 0$, and the optimal output varies directly, inversely, or is uneffected by changes in a^0, the price of advertising.

Next turn to the effect on price. Taking the total differential of (2-1) we obtain:

$$(2\text{-}19) \qquad dP = F_1 dQ + F_2 dA.$$

Substituting our values from (2-15) - (2-16) into (2-19):

$$(2\text{-}20) \qquad dP = \frac{F_2[2F_1 + QF_{11} - C''(Q)] - F_1(F_2 + QF_{12})}{|H|} da^0$$

and

$$(2\text{-}21) \qquad \frac{d\bar{P}}{da^0} = \frac{F_2[2F_1 + QF_{11} - C''(Q)] - F_1(F_2 + QF_{12})}{|H|} \gtreqless 0.$$

Here, $\bar{P}$ denotes the profit maximizing price charged by the firm.

The ambiguity of the sign of (2-21) can best be seen by expressing (2-21) in its more general form:

$$(2\text{-}22) \qquad \frac{d\bar{P}}{da^0} = \underbrace{\left(\frac{\partial P}{\partial A}\right)_{\bar{Q}} \frac{d\bar{A}}{da^0}}_{\text{substitution effect}} + \underbrace{\left(\frac{\partial P}{\partial Q}\right)_{\bar{A}} \frac{d\bar{Q}}{da^0}}_{\text{output effect}}.$$

Under the assumption that $F_{12} \geq 0$, $\frac{d\bar{A}}{da^0}$ and $\frac{d\bar{Q}}{da^0}$ are less than zero. But $\left(\frac{\partial P}{\partial A}\right)\bar{Q} \equiv F_2 > 0$ and $\left(\frac{\partial P}{\partial Q}\right)\bar{A} \equiv F_1 < 0$, so that the terms in (2-22) differ in sign, and their sum is ambiguous. Hence, the sign of (2-21) is ambiguous, independent of whether we assume that advertising makes demand elastic or inelastic.

The decomposition of (2-21) into substitution and output effects is worthy of explication. First of all, note that the substitution effect is always negative; it always tends to make optimal price, $\bar{P}$, vary inversely with the price of advertising, a^0. This means that the firm uses price decreases as a substitute for advertising when increases in a^0 occur. The output effect may either reinforce or offset to some extent the subsitution effect. If $[F_2 + F_{12}] > 0$, the firm responds to increases in the price of advertising by decreasing output. This decrease in output has a positive effect on price, making the total effect ambiguous. If $[F_2 + F_{12}] < 0$, the firm responds to increases in a^0 by increasing output. This increase in output

tends to decrease price, thus supporting the substitution effect. Thus, the net effect depends on the sign and relative magnitude of the two effects. If the output effect dominates the substitution effect, $\frac{d\bar{P}}{da^0} > 0$ and the firm's optimal price varies directly with the price of advertising. Conversely, if the substitution effect dominates the output effect, $\frac{d\bar{P}}{da^0} < 0$, and the firms optimal price varies inversely with the price of advertising. The nature of this ambiguity ultimately stems from the fact that the firm can determine either P or Q, but not both. Maximizing π with respect to Q implies a unique $\bar{P}$.

Section Two: Duopoly Model.

A. The Model.

The model developed in Section One assumed that producers act independently. This section seeks to expand the theory developed in Section One to the duopoly case. Assume that two firms exist in a market, and that market demand for the two firm's products is

$$(2\text{-}23) \qquad P = F(Q, A) \qquad \text{where } Q = Q_1 + Q_2, \quad A = A_1 + A_2.$$

Here, Q_i represents the quantity of the i^{th} firm's product; A_i represents the i^{th} firm's quantity of advertising. Final market price, then, is dependent upon the output and advertising of both firms. Suppose that firm one expects firm two to produce and advertise according to the reaction equations

$$(2\text{-}24) \qquad Q_2 = \Delta(Q_1); \; A_2 = \delta(A_1).$$

These reaction functions, along with the cost function of firm one, $C_1 = C_1(Q_1)$ and the exogenously determined price of advertising, a^0, enable us to write the first firm's profit function as:

$$(2\text{-}25) \qquad \pi^1(Q_1, A_1; a^0) = Q_1F(Q, A) - C_1(Q_1) - a^0A_1.$$

Assuming $\pi^1(Q_1, A_1; a^0)$ is twice continuously differentiable, the first order conditions of firm one for profit maximization are:

$$(2\text{-}26) \qquad \frac{\partial \pi^1}{\partial Q_1} = Q_1F_1(Q, A)\left(1 + \frac{dQ_2}{dQ_1}\right) + F(Q, A) - C_1'(Q_1) = 0$$

$$(2\text{-}27) \qquad \frac{\partial \pi^1}{\partial A_1} = Q_1F_2(Q, A)\left(1 + \frac{dA_2}{dA_1}\right) - a^0 = 0.^7$$

Note that for $\frac{dQ_2}{dQ_1} = \frac{dA_2}{dA_1} = 0$, we get the same solution developed in section one. That is, if firm one does not expect firm two to follow some predictable reaction scheme to firm one's strategy, the market solution for profit maximization will be the same as the monopoly solution. In this case (no interdependence), the first order conditions for both firms can be expressed as:

$$(2\text{-}28) \qquad \varepsilon_1 = \frac{a^0}{P - MC_1}\left(\frac{A_1}{Q_1}\right); \quad \varepsilon_2 = \left(\frac{a^0}{P - MC_2}\right)\frac{A_2}{Q_2}, \text{ or}$$

$$(2\text{-}29) \qquad \varepsilon_1 = \frac{P - MC_2}{P - MC_1}\left(\frac{A_1}{A_2} \cdot \frac{Q_2}{Q_1}\right)\varepsilon_2$$

$$\text{where } \varepsilon_i = \frac{dQ_i}{dA_i} \cdot \frac{A_i}{Q_i}, \quad i = 1, 2.$$

Returning to (2-26) and (2-27), and assuming $\frac{dQ_2}{dQ_1}, \frac{dA_2}{dA_1} \neq 0$, we can

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[7] It is assumed that the second order conditions hold; i.e., $|H| > 0, \pi_{11} < 0$.

obtain an expression similar to equation (2-9):

$$(2\text{-}30) \qquad \frac{F_2(Q, A)\left[1 + \frac{dA_2}{dA_1}\right]}{F_1(Q, A)\left[1 + \frac{dQ_2}{dQ_1}\right]} = \frac{a^0}{C_1'(Q_1) - F(Q, A)}$$

Noting that $\frac{dQ}{dA} = -\frac{F_2}{F_1}$ if $\frac{\partial P}{\partial Q} \neq 0$,

$$(2\text{-}31) \qquad \varepsilon_{QA} = \frac{a^0}{P - MC_1}\left(\frac{A}{Q}\right)\left(\frac{1 + \frac{dQ_2}{dQ_1}}{1 + \frac{dA_2}{dA_1}}\right)$$

where $\varepsilon_{QA} = \frac{dQ}{dA} \cdot \frac{A}{Q}$

$A = A_1 + A_2$

$Q = Q_1 + Q_2$.

Hence, the market advertising elasticity is expressed (2-31) as "expected" by firm one. In practice, firm two would come up with a similar "estimate" of (2-31) based on its expectations of firm one's reactions. This process would be replicated until a stable solution was reached. Stability will not be addressed in this section.

Returning to (2-31), note that if firm one expects its rival to have identical output and advertising reactions (i.e., $\frac{dQ_2}{dQ_1} = \frac{dA_2}{dA_1}$), the right hand side of (2-31) becomes 1, and the expected market ε_{QA} is written as:

$$(2\text{-}32) \qquad \varepsilon_{QA} = \frac{a^0}{P - MC}\left(\frac{A_1 + A_2}{Q_1 + Q_2}\right),$$

which is the aggregate form of (2-9).

Equation (2-31) and the introduction of interdependence to the market elasticity brings up an interesting point. If firm one expects that firm two would follow increases in Q_1 by proportionately

greater increases in Q_2 (i.e., $\frac{dQ_2}{dQ_1} > 1$), ceterus paribus, the market advertising elasticity would be greater. Also, if firm one expects that firm two would follow increases in A_1 by increasing A_2 in a greater proportion (i.e., $\frac{dA_2}{dA_1} > 1$), ceterus paribus, the market advertising elasticity would be less. These relations are graphed in Figure 2-3 and 2-4.

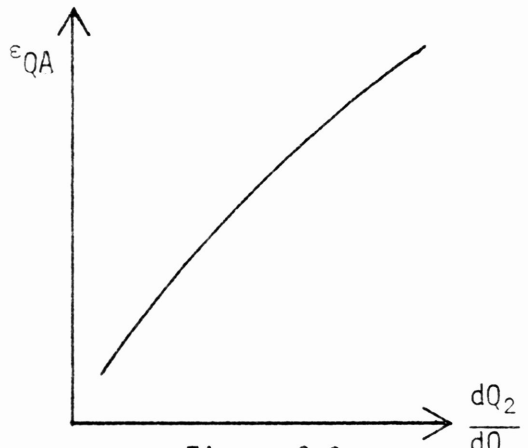

Figure 2-3.
ε_{QA} and Quantity Reactions

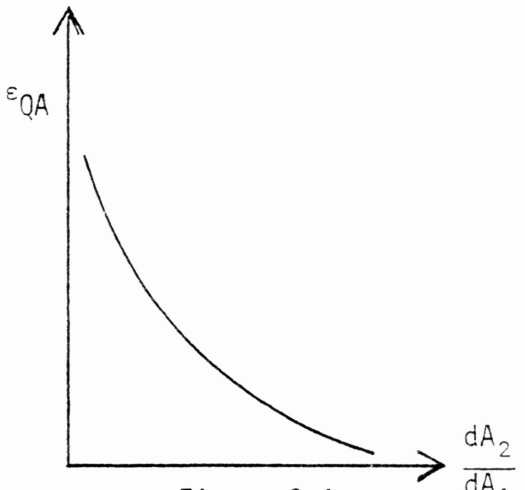

Figure 2-4.
ε_{QA} and Advertising Reactions

Interdependence thus alters the optimal advertising outlay of profit maximizing firms and subsequently, the market advertising elasticity.

As a final note, unlike the independent firm model of Section One the sign of F_2 in the duopoly case is ambiguous. This ultimately means that a duopolist (it generalizes easily to an oligopolist) may be rational to advertise even if advertising at a given quantity reduces price, (i.e., $F_2 < 0$). This would be the case, as (2-27) shows, if $\frac{dA_2}{dA_1} < -1$. This epitomizes the existence of interdependence and uncertainty in the case of oligopolies.

B. Comparative Statics.

Keeping in mind the functional dependence defined by (2-24), and taking the total differential of (2-26) and (2-27), we can obtain by Cramers Rule:

$$(2\text{-}33)\qquad \frac{d\bar{A}_1}{da^0} = \frac{Q_1F_1\frac{d^2Q_2}{dQ_1^2} + (1 + \frac{dQ_2}{dQ_1})^2Q_1F_{11} + 2F_1(1 + \frac{dQ_2}{dQ_1}) - C_1'(Q_1)}{|H|} < 0$$

$$(2\text{-}34)\qquad \frac{d\bar{Q}_1}{da^0} = -\frac{(1 + \frac{dA_2}{dA_1})[Q_1(1 + \frac{dQ_2}{dQ_1})F_{12} + F_2]}{|H|} \gtreqless 0$$

where $|H|$ denotes the Hessian determinant of (2-26) and (2-27). Again, we have a decomposition of the price effect into the following:

$$(2\text{-}35)\qquad \frac{\partial\bar{P}}{\partial a^0} = \underbrace{(\frac{\partial\bar{P}}{\partial A_1})_{\bar{Q}}\frac{d\bar{A}_1}{da^0}}_{\text{substitution effect}} + \underbrace{(\frac{\partial P}{\partial Q_1})_{\bar{A}}\frac{d\bar{Q}_1}{da^0}}_{\text{output effect}}.$$

Since $\frac{d\bar{A}_1}{da^0}$ is still unambiguously negative by (SOSC), profit maximizing duopolists will substitute away from advertising as its price increases. However, the sign of $\frac{d\bar{Q}_1}{da^0}$ depends not only on the sign of F_{12}, but on the reaction term as well. If both reaction terms are positive (i.e., $\frac{dA_2}{dA_1}, \frac{dQ_2}{dQ_1} > 0$), the only assumption necessary to conclude $\frac{dQ_1}{da^0} < 0$ is that $Q_1(1 + \frac{dQ_2}{dQ_1})F_{12} + F_2 > 0$. Now, $\frac{dQ_2}{dQ_1}$ and $\frac{dA_2}{dA_1}$ are obtained from firm one's expectations of firm two's advertising and output strategy. These expectations are based either on past experience or some other criteria. The fact that both F_2 and F_{12} are unrestricted by (FOC) and (SOSC), makes the comparative static

properties of the duopoly case extremely nebulous. This would tend to explain why, in a mathematical sense, duopolists are often "locked in" to a set of strategies.[8]

Section Three: A Reexamination of the Concept of Interdependence.

A. Introduction.

The mathematical model of the last section showed that the advertising strategy of one firm may depend upon the strategy of a rival firm. The implications of such interdependence were viewed in the context of the market advertising elasticity and the comparative static properties of the duopoly model. The purpose of this section is to explain how, given an assumed pattern of interdependence, the levels of profits and sales of each of the duopolists would vary with the different levels of advertising. In order to do this, I will first present the standard approach to game theory. Then, a novel and more precise graphical exposition of interdependence will be presented.

B. The Profit-Payoff Matrix for Advertising Decisions.

For simplicity, let us begin by assuming a two-firm cereal industry comprised of Kellogg and General Mills. This will, without a loss of generality, enable us to present the concept of interdependence in a two-dimensional matrix. The results may easily be generalized to the case of an n-firm cereal industry. Further assume that both firms advertise to promote their products, and decisions are made so as to maximize the profits of the firm subject to the unknown actions of the rival firm. Finally, assume that the advertising of one firm

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[8] See Tauber, 1970.

increases its own sales and, ceterus paribus, decreases the sales of the rival firm.

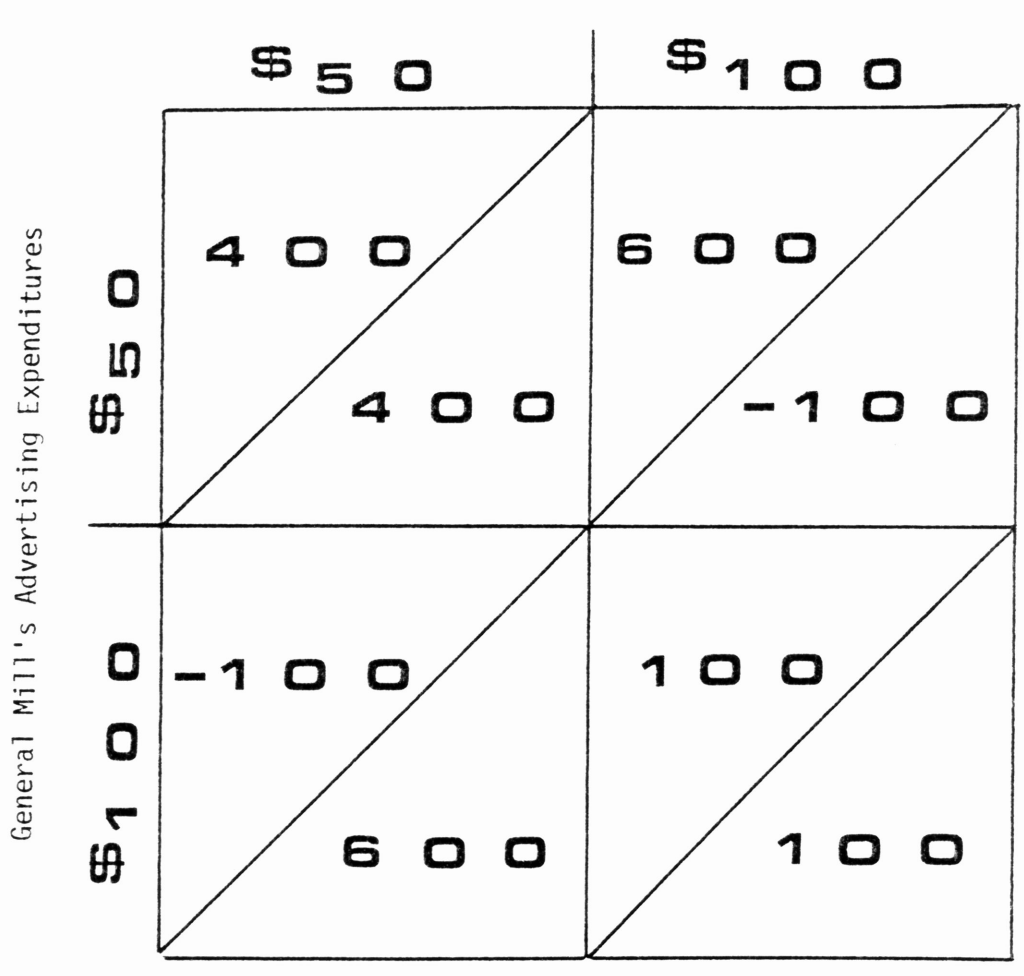
The above assumptions are summarized in the Profit-Payoff Matrix of Figure (2-5). This matrix reveals all potential distributions of profits to Kellogg (the upper triangle of each square) and General Mills (the lower triangle of each square). This information is available to each firm; neither firm knows the strategy that the other will choose, and all profit distributions depend upon the action of the rival firm. It is in this sense that interdependence exists in the market--neither firm can pre-determine precise expectations of profits. All expectations are contingent upon the action of the rival firm.

Given the set of profit distributions in Figure 2-5, at what level will the prudent profit maximizing firm decide to advertise? Kellogg observes that if it employs the small quantity of advertising, it will make profits of either $400 or losses of $100. The actual value depends on the advertising of General Mills. If Kellogg utilizes the larger amount of advertising it will receive profits of either $600 or $100. Clearly the "maximin" (the maximum of the minimum profits) for Kellogg is $100 under the $100 advertising strategy. In order independently to maximize its own profits Kellogg must advertise at the $100 level. This strategy guarantees profits of at least $100.

Now let us examine this game from the perspective of General Mills. Remember that like Kellogg, General Mills has no foreknowledge of the rival's decision and can at best independently seek to maximize its profits. If General Mills chooses the lower level of

Figure 2-5

A Hypothetical Profit-Payoff Matrix



advertising and Kellogg chooses the higher level, then General Mills will experience losses of $100. On the other hand, if Kellogg also chooses the lower level of advertising, then General Mills will make $400 in profits. In the case where General Mills advertises at the higher level, the worst it can do is make $100 in profits, and could possibly enjoy $600 in profits. Again, profits of $100 comprise a "maximin" and we thus have a completely determined game. It will be in both Kellogg's and General Mill's independent self interest to choose the higher level of advertising. This level of advertising is indeed an equilibrium.

The preceding analysis using game theory has shown that, given independent profit maximizing decisions on the part of two rival firms, both duopolists choose to advertise at a "high level." The profits enjoyed by the duopolists at the equilibrium ($100 each) are clearly inferior to the solution in the northwest corner of the matrix in figure 2-5 ($400 each). At this point one might wonder what "forbids" the duopolists from seeking to jointly maximize profits by agreeing to utilize the lower levels of advertising. Two ideas immediately come to mind to answer such a question: the promise of profits and the fear of losses.[9] So long as both firms agree to and in fact use low levels of advertising, both firms achieve a higher level of profits than they could have individually achieved. This increase in profits would be attributable to the increased market power that the

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[9]Indeed, considerations such as policing costs, contracting costs, and legal restrictions also discourage the formation of such a collusive agreement. Tauber's discussion on adjustment time is also a relevant explanation of oligopolists' distaste for collusion.

cartel would have. However, at the lower level of advertising it would be in the best interest of each individual firm to cheat and "sneak" in advertising. This profit potential encourages a movement to the southeast corner of Figure 2-5, thus serving to "break up" any existing cartel. A second factor works to prevent a cartel from forming. By making an agreement with a rival not to advertise a firm exposes himself to risk--the risk that the rival will cheat, and losses will occur to the "trusting" firm. This risk tends to prevent the cartel from ever developing; hence, we can indeed claim that the independent profit maximization process achieves a stable equilibrium of high advertising and lower profits. Joint profit maximization may create lower levels of advertising and higher profits in the short run, but it does not provide the stable equilibrium necessary to ensure long run benefits.

In section two it was shown that under the assumption that firms increase their advertising when rivals increase their advertising (i.e., $\partial A_i/\partial A_j > 0$, $i,j = 1, 2$), a lower market advertising elasticity results. Clearly, the market advertising elasticity implied from the hypothetical data presented in Figure 2-5 is lower at the stable equilibrium than at any other solution. This result stems from the assumptions regarding the effects of rival advertising that were presented in the beginning of this section. A low advertising elasticity would thus be expected in a market characterized by Tauber's "oligopoly lock-in."

C. Interdependence: A Graphical Analysis.

The concept of interdependence is most often introduced and analyzed via the game theory matrix presented above. The framework of

game theory matrices provides a useful way of showing how firms reach what appears to be an "inferior" level of profits. However, several items are lost in the process. The assumptions necessary to reach the illustrative conclusions are often difficult to formalize and the data are seemingly "cooked up" for the purposes of expository convenience. A more crucial problem, however, is the possibility that inconsistencies may be buried in the awkward framework of the model. An alternative model that encompasses greater flexibility circumvents the above problems. The assumptions of the theory are as follows:

(1) The demand for each duopolist's product is given by $Q_i = f^i(P_i, A_1, A_2)$ where A_i, $i = 1, 2$ denotes the advertising expenditure of firm i in dollars. The corresponding profit function is given by

$$\pi_i = P_i \cdot f^i(P_i, A_1, A_2) - C_i(Q_i) - A_i,$$

where π_i denotes the profits of the i^{th} duopolist, $C_i(Q_i)$ denotes the production costs of the i^{th} firm, and the function is assumed to be twice continuously differentiable;

(2) Each firm seeks to maximize its profits; firms cannot treat a rival's advertising expenditure as a decision variable, and no known reaction function exists. Thus, firms advertise so long as $P_i \cdot f^i_{Ai}(P_i, A_1, A_2) > 1$, that is, so long as the marginal revenue from an advertising dollar exceeds unity;

(3) Each firm has limited capital to spend on advertising in the short run. The maximum expenditure on advertising for the i^{th} firm is A_i^{max}, $i = 1, 2$;

(4) For a given level of advertising by firm i, an increase in firm j's advertising will decrease the influence of firm i's advertising on firm i's sales, $i \neq j$, i.e., $\partial R_i/\partial A_j < 0$, $i \neq j$ where $R_i = P_i \cdot f^i(P_i, A_1, A_2)$;

(5) For each firm, advertising influences sales at a positive but diminishing rate, i.e., $\partial R_i/\partial A_i > 0$; $\partial^2 R_i/\partial A_i^2 < 0$, where $R_i = P_i \cdot f^i(P_i, A_1, A_2)$.

Now that our formal assumptions have been exhausted, let us proceed to show graphically the case of interdependence in advertising. The graphs in Figure 2-6 and 2-7 show the sales of each firm as a function of that firm's advertising expenditures. We know that the profit maximizing firms will equate the marginal revenue of advertising to the marginal cost of advertising, as well as equate the marginal revenue of output with its marginal cost. The curves are drawn in order that the revenue from advertising is isolated, indirectly providing the advertising side of the first order conditions. The slope of each of the curves (1 through 6 in Figure 2-6 and Q through W in Figure 2-7) measures the marginal revenue from advertising. Recall that the profit maximizing quantity of advertising occurs where $\partial R_i/\partial A_i = 1$.

Figure 2-6

"Firm One Sales"

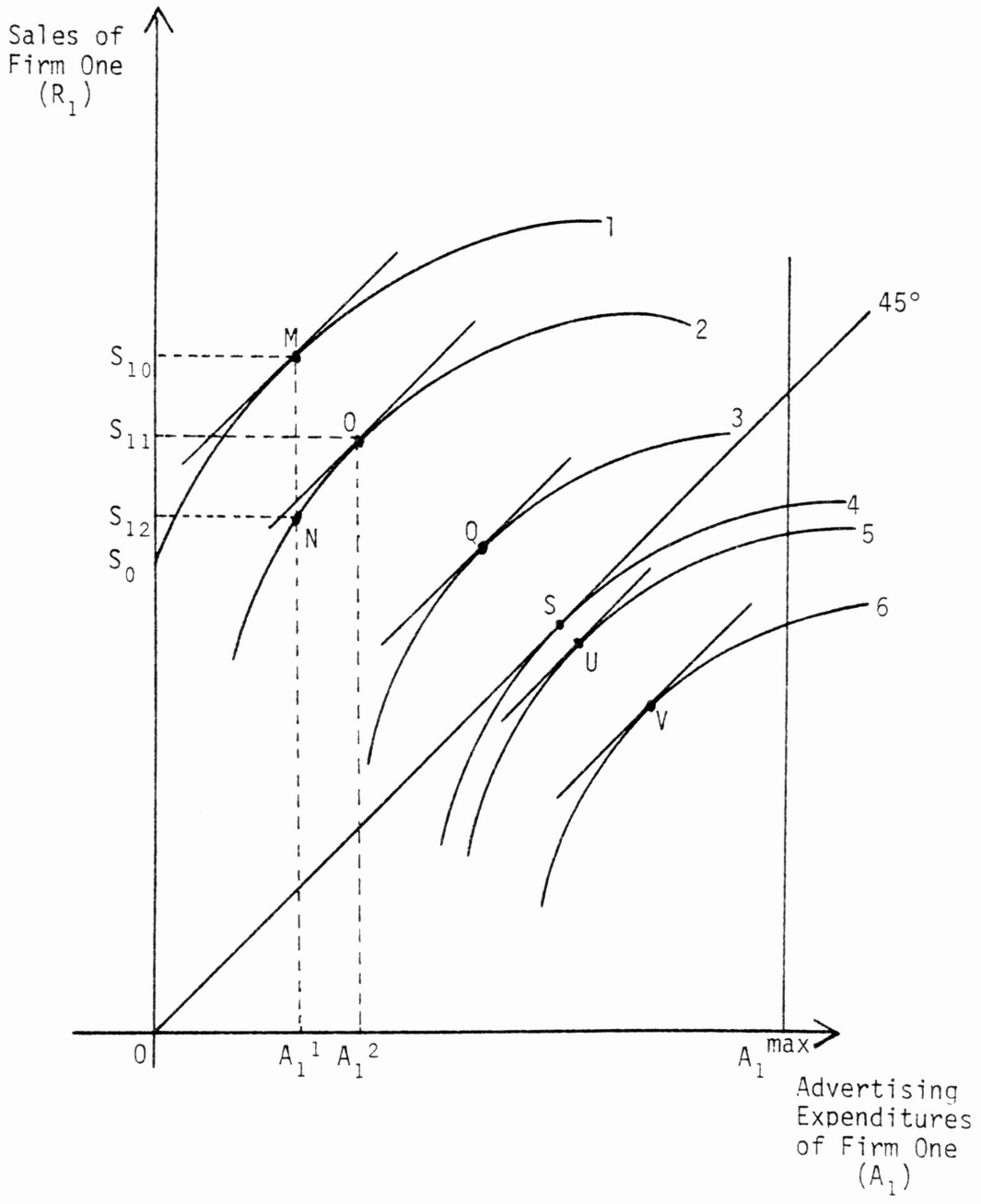
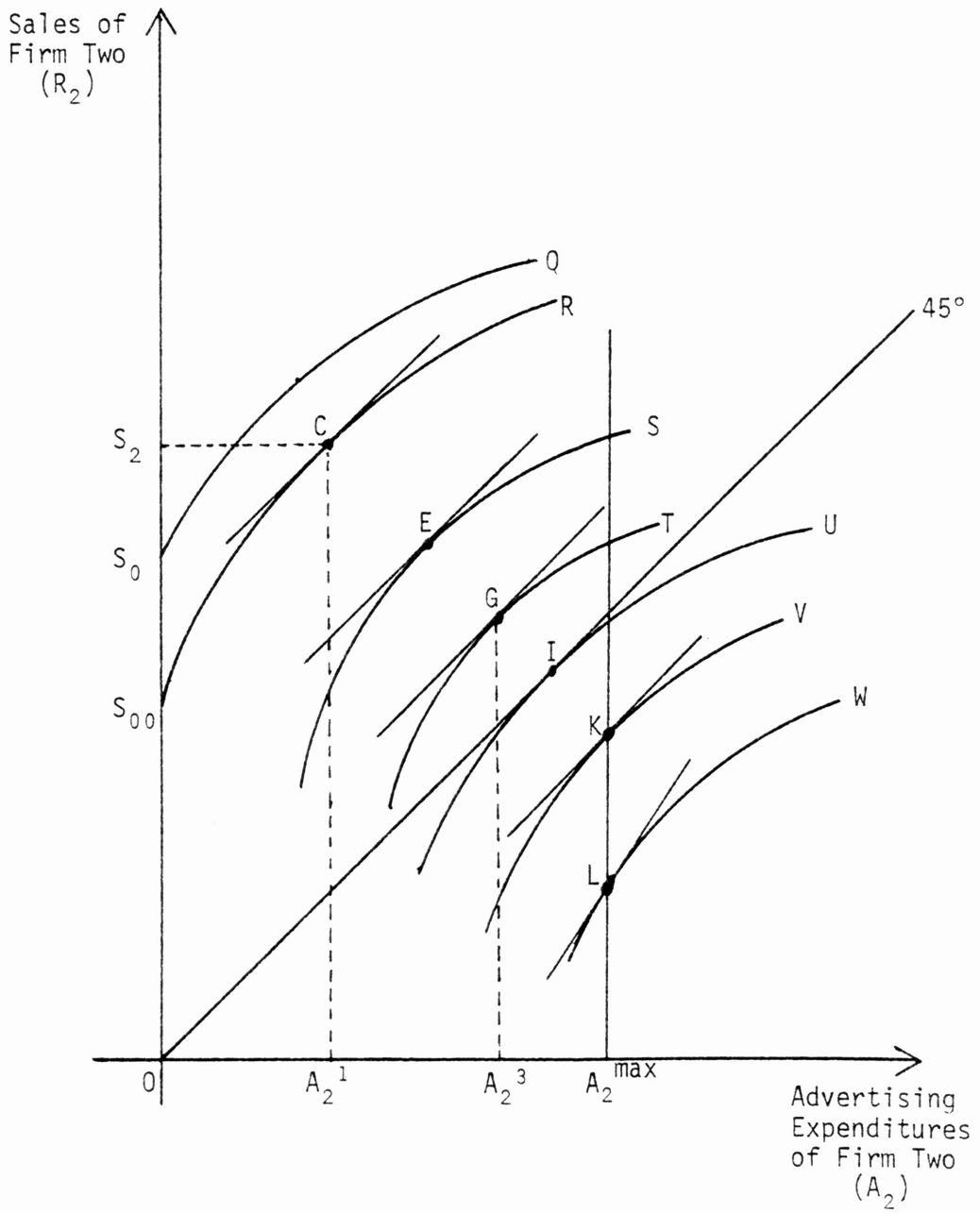


Figure 2-7

"Firm Two Sales"



Begin by assuming that neither firm is currently advertising (they are both at S_0 on their respective graphs). Now suppose that firm one's management decides to consider advertising and deduces that it could operate anywhere on curve 1 in Figure 2-6. Since the slope of curve 1 is equal to 1 at point M, the firm advertises at point M. This increases sales to S_{10}. By assumption (4) the increase in firm one's advertising shifts firm two's advertising sales curve down from Q to R. Firm two, after reviewing the success of firm one's advertising and having lost sales of $(S_0 - S_{00})$, decides it too will enter the advertising game choosing to advertise at point C where the tangency occurs. It enjoys "extra sales" of $(S_2 - S_0)$ over its pre-advertising strategy.

The story does not stop here, however. The result of the increase in firm two's advertising is to shift down firm one's advertising-sales curve to curve 2 in Figure 2-6, again by assumption (4). At its current level of advertising, corresponding to point N on curve 2, it finds that the marginal revenue from advertising exceeds its marginal cost and quickly increases advertising to A_1^2. Sales also increase to S_{11} from S_{12}.

Again, this increase in firm one's advertising shifts down firm two's advertising-sales curve, making the marginal revenue at the old level of advertising exceed the marginal cost. Thus, firm two increases its advertising, and the chain begins again. The process finally ends when firm one reaches point V in Figure 2-6. Firm two is forced to point L, where it can no longer increase advertising. At point L, firm two would like to move up the curve by increasing

advertising, but cannot do so due to the limited capital assumption. A key point here is that, given the assumption above, the advertising elasticity of a single firm is greater than that of the aggregate market.

Notice that (in this example) both firm one and two, at their equilibrium points V and L, are spending more for advertising than they are bringing in in revenue. Yet, they can do nothing to prevent the loss. If either firm decreased its own advertising, it would simply slide down its advertising-sales curve towards inefficiency. Clearly, they would be better off had they never started advertising.

It is important to note that the equilibrium level of advertising need not, and in the long run cannot, occur at a point below the 45° line (where unambiguous losses occur). The position of the short run equilibrium depends on the level of capital available for advertising, and could occur at points such as G and Q if we assume that firm two's capital available for advertising cannot exceed A_2^3. At these points, advertising may produce profits. However, points above G and Q would represent superior profit positions--positions unobtainable for the same reasons given in subsection B above.

It should now be obvious that advertising may foster monopoly power. Firms with limited capital (or relatively less capital, e.g., firm two in our example) will be the first firms to leave the industry. This would ultimately allow the rival firm (firms) to move up advertising-sales curves to higher profit levels. In this sense, there are "theoretical economies of scale in advertising."

CHAPTER THREE: AN APPLICATION

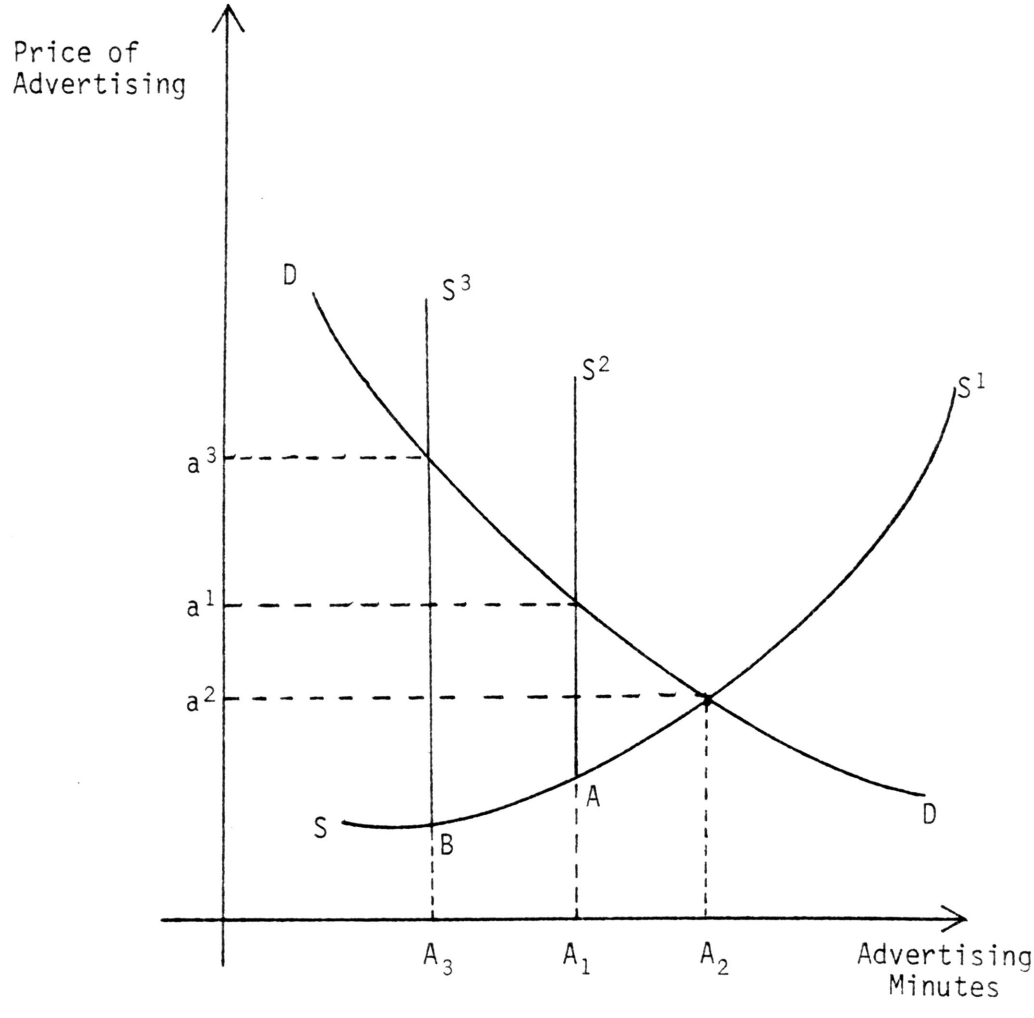
Having developed a theoretical model for advertising, market power, and interdependence in the previous chapter, the work in this chapter is very straight forward. It will apply the models to the case of the cereal industry, tracing the microeconomic ramifications of the past and proposed regulation of advertising on the cereal industry and consumers of cereal.

The market for advertising time during children's shows is competitive on the demand side. Indeed, children directed advertisers implicitly compete for advertising minutes against traditional non-children directed advertisers. Moreover, a large degree of explicit competition between the producers of children's products exists. Thus, it seems reasonable to assume that for any one cereal firm the price of a minute of advertising is exogenously determined; one firm's demand for advertising time does not significantly alter the market determined price of advertising.

Figure 3-1 graphically depicts the market for advertising minutes during children shows. The supply curve ss^1 is the summation of the three network's marginal cost curves. It is drawn under the assumption that no advertising restrictions (quotas) are imposed by the NAB or FCC. Given market demand DD by producers of children's products, the pre-quota equilibrium occurs at (A_2, a^2). Currently, however, supply is fixed by NAB regulations: after A_1 no additional advertising may be sold. Consequently, the current supply curve is SAS^2, and the current equilibrium state is (A_1, a^1). Thus, we see that current

Figure 3-1

The Market for Advertising Time



regulation has probably has raised the price cereal firms would pay for advertising above the free market price, a^2.

Proposals by ACT call for further reductions in the number of advertising minutes sold during children's shows, say to A_3. The result of such regulation would be to restrict further the supply to SBS^3, ultimately leading to a higher price of advertising, a^3.

It should now be obvious that comparative static properties of the models in Chapter Two are relevant. Despite common parlance (see for example [36, 12] and [16, 10]), an increase in the price of advertising need not lead to cereal price increases nor will a reduction in advertising necessarily lead to a price reduction. As was shown in Chapter Two, the price effect depends on the magnitude of the substitution and output effects. No a priori statement can be made regarding the effect of an increase in the price of advertising on cereal prices or cereal consumption.

It may be noted, however, that if a move from A_1 to A_3 increases (decreases) cereal prices, the complete freeing of the market would, on the margin, lead to lower (higher) cereal prices than currently prevail. The same holds true for the quantity side: if moving from A_1 to A_3 reduces (increases) product availability, the complete freeing of the market, on the margin, would increase (decrease) product availability. A key result here is that further reductions in children directed advertising may actually increase the consumption of sweetened cereal products, depending on the sign of (2-17) or (2-34). Thus there is a paradox in ACT's stated objections to pre-sweetened cereals.

The effect of further reductions in advertising on cereal firms depends on the effect of past reductions. Theoretically, in a free market state (A_2, a^2) in Figure 3-1, cereal firms would over-advertise (see Chapter Three, Section Three). However, because mandatory reductions in advertising have already occured during the 1970's, it is unclear whether further reductions would increase or decrease the profits of existing cereal firms. An increase in industry profits would theoretically encourage entry into the industry; profit decreases would deter entry and perhaps foster exist. More on these effects will be presented in Chapter Four.

In concluding this chapter, let me emphasize one point made by Scherer [39]. Product variety is not a free good; cereal firms must constantly "remind" consumers of brand differences lest "...run the risk of being forgotten..." [39, 129]. Of course, this is a two way street; consumers benefit from the increased opportunity set generated by product variety; firms must pay for the advertising used to remind consumers of the variety. Independent of Scherer's analysis of consumer and producer surpluses generated in the process, the extent to which changes in advertising prices would effect cereal prices and quantities depends on the analysis of Chapter Three. These effects are no more straight forward than the welfare effects that are generated by them.

CHAPTER FOUR: EMPIRICAL RESULTS

Section One: Advertising and the Sales Function.

In estimating the revenue function for ready-to-eat breakfast cereal (RTE) I used a two-stage least squares process. A log-linear revenue function was used because it conveniently estimated coefficients that can be interpreted as elasticities. Additionally, the log-linear form alleviated the problem of specifying a model that satisfied the second order conditions set forth in Chapter Two. The precise form and data sources are given in Appendix A.

The data set available was limited to the years 1966-1977. Since degrees of freedom were at a premium, I was unable effectively to formulate a model employing lagged variables. Thus, the sales model assumes that advertising and pricing has no lasting effects. Given the short memory span of children (see [4, 361]), this assumption may be valid and useful in testing the effects of reductions in children directed advertising on cereal sales.

A summary of the regression results are presented in Table 4-1. The coefficients may be interpreted as sales elasticities, and the 14% advertising elasticity indicates that spot TV advertising is sales inelastic for the industry as a whole. The low t-value of the advertising coefficient indicates that advertising is an insignificant determinant of sales; the coefficient of advertising is not significantly different from zero at any reasonable level of significance. Moreover, note that the price variable is a more significant determinant of sales than is advertising. Disposable income tends toward a unitary effect on sales.

Table 4-1

PER CAPITA LOG-LINEAR REVENUE FUNCTION

Dependent Variable: LNSAL

Variable	Coefficient	Standard Error	t-value
Intercept	-7.256	2.540	-2.856
LNA	0.146	0.146	0.999
B[LNPC]	1.647	0.182	9.057
LNY	1.071	0.332	3.225

Durbin-Watson D = 1.97

Summary of Variable Symbols:

LNSAL = Logarithm of real per capita cold cereal sales;

LNA = Logarithm of real per capita spot television advertising by Kellogg, General Mill's, Quaker Oats, and General Foods;

B[LNPC] = First stage block result of LNPC, the logarithm of the price index of cereal divided by the consumer price index (1967 = 100);

LNY = Logarithm of real per capita disposable income.

Table 4-2 shows the values of the marginal revenue of advertising (MR_A) for selected years in my study. During the years before proposals were introduced to reduce children directed advertising (i.e., before 1970), marginal revenue figures averaged close to unity. Two years (1966 and 1967) exhibited marginal revenues below unity. This, recalling Chapter Three's results, indicates that cereal firms were indeed over advertising, perhaps due to interdependence. These empirical results are in line with a 1969 statement by a Kellogg spokesman, "...for the past several years, our individual company growth has come out of the other fellows hide" [39, 123].

In the years following regulatory proceedings (i.e., 1970 and following) the empirical results show an increasing MR_A. Most likely, this is due to the reduction in advertising time mandated by NAB (see Chapter One). In fact, in each of the years following 1970 the marginal revenue of advertising exceeded unity, averaging 1.41. I constructed a t-test to determine whether or not pre-1970 MR_A calculations were significantly less than those after 1970. With a t-value of 14.7, we can reject the null hypothesis of no difference, with a significance of less than 1%.[10]

Figure 4-1 (a) and (b) show graphically the relationship between the marginal revenue of advertising, sales, and profits. Before 1970 cereal firms tended to lie to the right of A*, over-advertising. As regulation reduced the quantity of advertising minutes available,

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[10]This admittedly treats the 1966-1969 and 1970-1977 estimates of MR_A as independent random variables. The reader is forewarned of potential biases in the standard error used in forming this t-statistic.

Table 4-2

SELECTED MARGINAL REVENUE
OF SPOT TELEVISION ADVERTISING

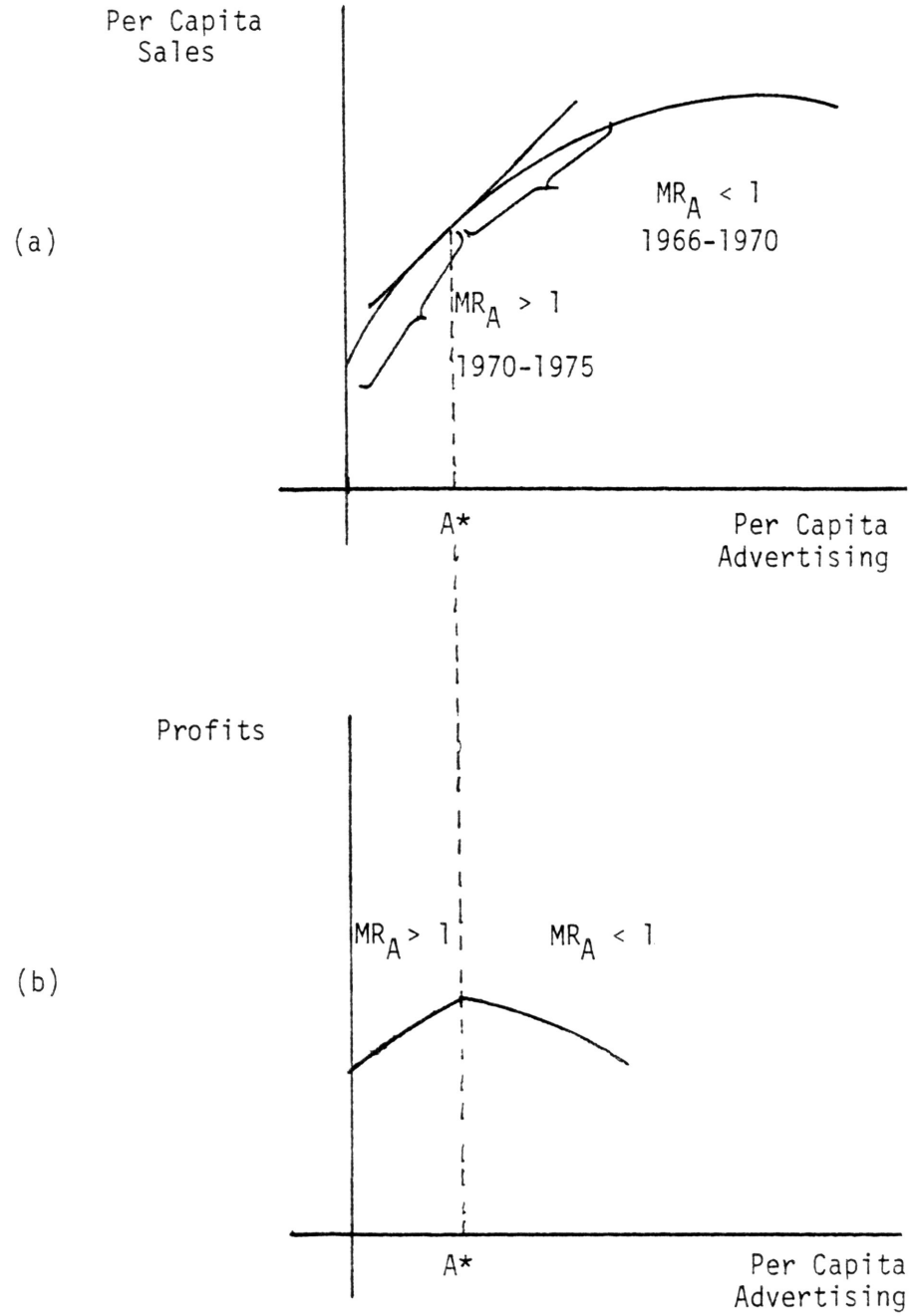
Marginal Revenue

Year	Marginal Revenue of Spot Television Advertising	Standard Error
1966	.97	.93
1967	.95	.91
1970	1.13	1.09
1971	1.16	1.11
1974	1.72	1.65
1975	1.56	1.49

1966-1969 Average: 1.04
1970-1976 Average: 1.41
t-value for significant difference: 14.7

Figure 4-1.

Advertising and Profits



firms gradually moved to the left until $MR_A > 1$, meaning that the reductions in advertising time available have gone beyond the stage of "helping" cereal firms. The regulations are currently reducing cereal firm profits.

If per capita advertising continues to decline over time (as it will, assuming constant or reduced advertising due to regulation and positive population growth), the marginal revenue of advertising will continue to rise over time. Further reductions in advertising mandated by the NAB, FCC, or FTC would further reduce cereal industry profits. If reduced profits deter entry into the cereal industry, it is not obvious why the FTC would advocate such a move.

Section Two: Advertising, Profit Rates, and Market Power.

In Chapter One we stated that the FTC is concerned with the high profit rate, high concentration ratio, and high advertising intensity in the RTE cereal industry. The closing lines of the last section show that empirical evidence suggests that as a result of further mandatory advertising reductions, cereal industry profits are likely to decline. Entry has not occured even with high profit rates in the industry. With the lower profit rates induced by advertising restrictions, entry potential is reduced. Profits, after all, are the entry incentive.

An excellent discussion of advertising and profits is offered by Needham [32] and Leitzinger [26]. They argue that existing firms can make excess economic profits due to the fact that advertising levels are such that the marginal entrant just breaks even. This, in conjunction with the theoretical argument of "scale economies in

advertising" due to the limited capital assumption, may explain why cereal industry profits have historically been high (see Block, 1974).

Schmalensee, on the other hand, presents empirical evidence that discounts the relevance of pure economies of scale in advertising as a barrier to entry [40,243]. Rather than present a further summary of contemporary theories on this topic, let me point to two excellent sources that amalgamate the current research into concise summaries: Wells [49] and Ornstein [33]. Both Wells and Ornstein conclude that the evidence pointing toward a causal relation between advertising intensity and market power is weak.

Chapter Two formulated an alternative approach to the advertising-market power question. The rationale was that through the Lerner index the advertising elasticity would point out industries that were pricing above marginal cost. In order to test the hypothesis that low advertising elasticities occur in industries where market power exists, I ran a simple correlation between advertising elasticities and four firm concentration indexes. Data were obtained from Comanor, et al. [10,88 and 199]. The results showed no significant correlation.

Several possible explanations exist as to why my theoretical results were not born out. I used concentration ratios as a proxy of market power. Theoretical results by Saving [37] and empirical results by Leitzinger [27] indicate that the hypothesis of a correlation between market power and industrial concentration is invalid at the theoretical level and weak empirically. Thus, the results I obtained may indicate that industrial concentration does not imply market power, and not that market power does not imply a low advertising elasticity.

Future research correlating advertising elasticities to price-marginal cost relationships would more accurately test the empirical validity of my theory.

A second explanation stems from possible violations of the ceterus paribus assumption necessary to employ the theory. Yet, before this explanation is accepted, future attempts will be made to estimate price-marginal cost relationships and correlate the results against advertising elasticities.

One final comment seems appropriate before concluding this section on advertising and market power. Arrora [5] presented empirical evidence that the promotion elasticity for ethical drugs decreased over the product life cycle. If this result holds in general, and in particular in the cereal industry, economists that have been analyzing the advertising-market power question may be incorrect; present market power may be attributable to declining promotion elasticities. For example, if four cereal firms begin the cereal industry and make excess economic profits, entry will occur. However, if promotion elasticities decline over time and promotion has lasting effects for the initial firms, then entry potential will be reduced over time. Thus, time may be the real barrier to entry in the cereal industry--not advertising intensity or concentration. This hypothesis would certainly complement Needham's and Leitzinger's theory of the marginal entrant.

Section Three: The Effect on Networks: A Comment.

Rather than expound on the effects on the networks of a reduction in TV advertising directed at children, I wish to comment on a study

done by FCC staff economist, Alan Pearce [34]. His work served as the basis for early rulemaking by the FCC.

Pearce presents a table of network weekend children's television revenues for the 1970-1973 period:

1970	1971	1972	1973
66.8m	61.9m	69.5m	67.4m

Source: [34,6]

Pearce concludes:

> "The table above shows that while the amount of network advertising in weekend children's television was reduced by 22%, effective January 1, 1973, gross revenues fell by only 2.1 million--a drop of only 3.0%, but were still significantly higher than the total gross revenues in both 1970 and 1971" [34, 6-7].

Pearce's figures are misleading because he neglected the effect of inflation during this period. Using the consumer price index for the period (1967 = 100) to determine "real revenues," I produce the following table:

1970	1971	1972	1973
57.43m	51.03m	55.4m	50.6m

Thus, a 12% decrease in real revenues occured over the period during which Pearce claimed that revenues were not significantly effected. Given that fewer commericals do not decrease but actually increase network programming costs, the decrease in "profits resulting from children's television" between 1970 and 1973 was much greater than 12%.

The above comment on Pearce's study does not fully analyze the effect of reductions in advertising on networks. It does, however, point out an error in Pearce's analysis--an error of over 12%. Pearce's claim that networks were uneffected by the NAB reductions is unfounded given his own data. Moreover, Pearce neglects the welfare effects on different networks (not all networks were harmed to the same degree). Additional research in these areas should be done in order to determine if Pearce's statement on networks being revenue neutral to the ban is valid.

CHAPTER FIVE: CONCLUSIONS

Section One: The Effects on Consumers.

Although formal restrictions were not placed on TV advertising directed toward children during the 1970's, the NAB did effectively cut in half the amount of commerical time during "children's programs." The effect of this decrease in the supply of advertising was to raise the price of advertising. It was shown in Chapter Two that such increases in the price of advertising lead profit maximizing firms to reduce their utilization of advertising. Corresponding to the new level of advertising is a new output and a new product price.

In the past, consumer groups and some economists have claimed that the result of a decrease in advertising is a decrease in product price. In particular, ACT and the FCC have argued that the result of further reductions in children directed advertising would be lower prices of cereals, toys, and other "children's products." However, this thesis has shown that, *a priori*, such statements are not legitimate. Depending on the relative magnitudes of the substitution and output effects, prices may actually rise as a result of advertising reductions.

One of the stated aims of ACT is to reduce the quantity of sugared products (including pre-sweetened cereals) consumed by children. ACT reasons that an advertising ban on sweetened products would produce such an effect. Again, the economic theory developed within this thesis points out that mandatory restrictions on advertising may increase the total consumption of "children's products," including

candies and pre-sweetened cereals. The proposed ban, then, may be a case where not only do "the ends not justify the means," but where "the means to not produce the ends."

It is almost certain that further reductions in advertising would lead to decreased product variety in the market. As Scherer [39] points out, firms advertise to remind consumers of product differences. Restrictions on children directed advertising, then, may reduce consumer welfare through lost consumer choice.

Section Two: The Effects on the Cereal Industry.

Theoretical results show that firms operating within an industry in which sales are relatively insensitive to advertising will, in a free market, over-advertise. The empirical evidence presented in this thesis indicates that total cereal sales are in fact insensitive to TV advertising. This means that before the mandatory reductions in advertising during the 1970's, cereal firms over-advertised. The instant reductions were mandated by the NAB, cereal firms benefited through increased profits. Although weak, the data indicates that the advertising restrictions of the 1970's ultimately led the cereal industry to the point where it under-advertised, thus reducing the profits of individual cereal firms.

The economic ramifications of profit decreases in the cereal industry lead to the conclusion that the industry will become more concentrated over time, due to either reduced entry or increased exit. Ultimately, if Leitzinger's [26] and Needham's [32] theory of the marginal entrant is correct, higher profits will be earned in the future by the surviving cereal firms. Thus, further reductions in

children directed advertising will benefit some existing firms through long run gains in market power.

Section Three: The Effects on Networks.

Although this thesis did not set out to perform a rigorous analysis of the effects of NAB mandated reductions in children directed advertising on the networks, it was shown in Chapter Four that the FCC may have underestimated the real effects of the reduction in advertising on networks. Real network revenues derived from children directed advertising declined by 12% during the first few years after the NAB restrictions, while programming costs probably rose. Additional research on these potential effects of further reductions should be undertaken before Pearce's [34] results are accepted.

Section Four: Some Policy Notes.

This thesis has analyzed some of the microeconomic effects of mandatory reductions in TV advertising directed toward children. The positive economist cannot determine whether further reductions in children directed advertising would produce "good" or "bad" economic effects. Clearly some parties would gain from an advertising ban, others would lose.

Two important policy notes can be made, however. First, many of the economic effects on consumers are ambiguous in that prices may either rise or fall and product variety may decline. Given these ambiguities, caution should be taken in implementing a ban. Second, this research has shown one case where the stated means (e.g., an advertising ban) may not produce some of the desired ends (e.g., reduced

consumption of sugared products). Given these two caveats and the restructuring of the industries that produce "children's products," it is not obvious that the expected net economic benefits of reducing the amount of TV advertising directed toward children are positive.

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APPENDIX A

Section One: The Econometric Model.

The "best fit" sales function for cereal was of a log-linear form, and was obtained by a two stage least squares procedure. Stage one regressed the endogenous variables on all the exogenous variables in the system. The precise specification is defined below:

Stage One: The Block.

$$(A\text{-}1) \qquad \ln PC^*(t),\ \ln SAL^*(t) = b_0 + b_1 \ln OPMH(t) + b_2 \ln PMAC(t) + b_3 \ln PM(t) + b_4 \ln A(t) + b_5 \ln Y(t),$$

where ln denotes natural logarithm;

PC(t) = relative retail price index of cereal in terms of consumer price index in year t;

SAL(t) = per capita cold cereal sales in year t divided by consumer price index in year t;

OMPH(t) = index of output per man hour in the breakfast cereal industry for year t;

PMAC(t) = wholesale price index of machinery and equipment discounted by the wholesale price index for all commodities for year t;

PM(t) = relative retail price index of dairy products (excluding eggs) in terms of retail price index of cereal and bakery products in year t;

A(t) = total per capita spot television advertising expenditures by Kellogg, General Mills, General Foods, and

Quaker Oats in year t divided by consumer price index in year t;

$Y(t)$ = per capita disposable income in year t discounted by consumer price index for year t.

Stage Two: The Sales Function.

$$\text{(A-2)} \qquad \ln SAL^*(t) = a_0 + a_1 \ln A(t) + a_2 \ln PC^*(t) + a_3 \ln Y(t),$$

where * denotes first stage estimate.

Given the specification in (A-2), it can easily be shown that the marginal revenue of advertising is equal to

$$\text{(A-3)} \qquad \frac{a_1 \cdot SAL(t)}{A(t)} .$$

Treating $\frac{SAL(t)}{A(t)}$ as a given quantity in any year, the standard error of the marginal revenue of advertising is simply

$$\text{(A-4)} \qquad \frac{SAL(t)}{A(t)} \cdot SE(a_1),$$

where SE $(\cdot)$ denotes standard error.

This is the methodology used in forming Table 4-2 in Chapter Four.

Section Two: Data

Data giving price indexes for cereal and bakery products and dairy products were obtained from Historical Statistics of the U.S., 1970 (HSUS) for the 1958-1959 time period, and from Food Consumption, Prices, and Expenditures (a76 supplement) (FCPE) for the 1960-1976 period. Consumer price indexes and population figures were also obtained from these sources. Wholesale price indexes for

machinery and equipment and all commodities were obtained from HSUS and Statistical Abstracts.

Disposable income figures were obtained from HSUS for the 1958-1970 period, and from Statistical Abstracts (SA) for the 1971-1976 period.

Figures for the cereal industry's expenditures on advertising were by far the most difficult to obtain. The data was obtained by summing the spot television advertising expenditures reported for Kellogg, General Foods, General Mills, and Quaker Oats in individual issues of Advertising Age, 1958-1976. Cold cereal sales data were obtained from September issues of Supermarketing. Inaccessibility to issues before 1965 reduced my data on cereal sales to the 1965-1978 period.

Output per man hour indexes were obtained for the cereal breakfast food industry (SIC 2043) from Productivity Indexes for Selected Industries, Bureau of Labor and Statistics, 1978.

A more detailed listing of sources and actual data is available upon request.