SALES, ADVERTISING AND DISTANCE --
A REGRESSION ANALYSIS

by

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We accept this thesis as conforming to the
required standard

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Department of Commerce and Business Administration.

The University of British Columbia
Vancouver 8, Canada.

Date: April 21st., 1969.
ABSTRACT

Most theories of promotion deal almost exclusively with behavioral parameters, and only superficially with the all-important action component. There have been few prior studies examining the sales effects of advertising.

The major purpose of this thesis is to analyze the association between a number of advertising variables and the weekly sales volume of an automobile dealership. A corollary objective is to ascertain the role of average price and distance as related to sales.

Relationships are tested by a multiple regression analysis on empirical data. Among the more important findings are:

1) Weekly Sales Dollars = -42.78 + .01 Dealer's Newspaper Lineage t-1 + .47 Average Distance + 39.47 Average Price.
   \[ N = 51 \quad R^2 = .40 \quad F = 10.97 \]

2) Weekly Sales Dollars = -34.31 + .01 Dealer's Newspaper Lineage t-1 + 39.51 Average Price.
   \[ N = 51 \quad R^2 = .39 \quad F = 15.81 \]

Both equations were significant at the .001 level.

Regression estimates indicate that the dealer's newspaper advertising, average price of the automobile and distance travelled by consumers are related to weekly sales. The study is unable to conclude whether the retailer's broadcasting expenditures or the manufacturer's local advertising outlays
are significant sales determinants.
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I wish also to extend thanks to the management of the dealership who willingly supplied the data on which this study is based.

D. C. LOCKHART
CHAPTER I

INTRODUCTION

The Importance of the Problem

Recently an advertising agency executive published "a perfect measure of advertising's contribution to the firm:

First, make a list of all the working functions of the business (research and development, maintenance, accounting, sales etc.).
BUT DO NOT INCLUDE ADVERTISING.
To each one of the listed functions allocate the exact amount of sales or profit which can properly be credited to that activity.
Add up the allocations.
Deduct the sum of these allocations from the known total of sales or profit for the business. ^
What remains is the contribution of advertising".

Unfortunately, no one has yet devised an exhaustive technique for measuring the productivity of advertising. Wallace's "perfect" formula embodies a defeatest attitude, prevalent in many advertising circles today: the feeling that the sales effects of advertising cannot be measured simply because the quest thus far has proved fruitless.
Irrespective of the many difficulties involved, there is great pressure in modern business for the development of inexpensive, practical techniques to evaluate total advertising effectiveness.

In the past, advertising researchers have estimated

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what was easier to measure. As a result, we now have reasonably sophisticated techniques to determine recall, impact and a host of other "intervening variables" which have no necessary relationship to ultimate consumer purchasing behavior.\textsuperscript{2} "Such substitute activities may be completely justifiable, but their vindication can come only from a successful assault on the basic objective".\textsuperscript{3} Advertising research has simply sidestepped the main concern of practicing advertisers--what are the sales effects of advertising?

In making the decision to advertise, the marketing manager implicitly assumes that advertising will stimulate sales. He is not interested in such effects as "noted", "seen-associated" or "read most", for "the ultimate measurement of advertising performance is buying action."\textsuperscript{4} The part-whole fallacy is no more evident than in advertising research. Just because three advertisements are judged effective, does not imply that the sales results of the combination of these advertisements are effective. It would appear much easier to analyze the whole advertising campaign rather than attempting to ascertain the contribution of individual parts.


Probably at no other time in the history of advertising has the need for measurements of advertising's productivity been more acute than it is today. A recent study detailing increases in the "average cost" of advertising in Canada between 1961 and 1966 shows: 5

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With this trend toward increased costs for time and space, management is demanding more objective evidence that advertising is an economical and proven stimulator of sales. Management's concern is certainly not unfounded, as the following table testifies: 6

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From a macro viewpoint, the rate of growth in advertising expenditures has been slower than that of disposable income or consumer expenditures. Since the marketed value of goods and services has grown more dramatically than advertising


6 Ibid, p. 144.
expenditures, "the question arises whether in prosperous periods a relatively lesser amount of selling effort is required...". Clearly, the prudent businessman will want to examine his advertising-sales relationship for whatever causal influence may be exhibited.

If the potential consumer is exposed to more than 1500 commercial messages daily, each advertiser faces intense competition in attempting to complete his communication process. In the light of growing advertising budgets, it is somewhat ironic to find that "few companies really know whether they are spending too much or too little for advertising, or what the effects of an increase or decrease in their advertising appropriations might be". The problem becomes even more complex when one considers the gap between advertising theory and practice. "Today there is little evidence in the literature to indicate whether business firms are in fact doing what the theorists say they ought to be doing or conversely, whether the problems the theorists have attempted to solve by mathematical or other means are really the ones the companies are faced with".

7Ibid, p. 8.
9Ibid, p. 2.
Purpose of the Study

Every businessman should be anxious to determine, even crudely, the relationship between the costs of his advertising and its sales benefits. Often there are clues within a company's past experience that are laying dormant, awaiting proper analysis. The major purpose of this study is to examine a series of sales and advertising volumes for whatever causal influence may be indicated.

Measurement of past advertising efficiency is desirable so as to provide the basis for greater productivity in future advertising operations. Inability to determine the sales and profit contributions of parts of the marketing program does not hinder a good management from trying to secure some measurement of these parts. Without measurement, effective advertising may be discarded because its contribution has not been recognized, or conversely, ineffective advertising may be continued because someone wrongly assumes it has been successful.

In planning the "optimal" advertising program, it is necessary to assemble all information that completely explains variations in sales over time. Unfortunately, such perfect information is rarely available. If one cannot ascertain the net effectiveness of advertising, at least he can determine the basic advertising-sales relationship. Perfection in advertising research is an unknown phenomenon, and a small step toward that state should prove rewarding.\textsuperscript{11} With this modest

\textsuperscript{11}For a succinct discussion of the goals of advertising
goal in mind, the writer has analyzed the sales and advertising volumes of a large Vancouver automobile dealership.

**Units of Analysis**

In driving an automobile, one must continually readjust his speed to accommodate new information from the changing environment. In operating an automobile dealership, one must constantly reappraise his advertising expenditure in the light of changing sales trends. Whereas the automobile is a purely mechanistic system facilitating simple research, advertising productivity is a Gestalt, requiring complex investigation.

The "efficiency of advertising" implies two distinct aspects. "One is the productivity of the advertising process, and this refers to the effectiveness of advertising in inducing potential sales. The other is the productivity of the operations of the advertiser as a result of, or at least in part induced by the advertising process." 12 Obviously, the first dimension implies a cost, the second, a benefit. In the marketplace, the cost of advertising for all automobile dealerships is the same; what each receives from his advertising expenditure is highly variable. This differential in advertising effectiveness conceivably could be so pronounced as to be transformed into a

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12 O. J. Firestone, op. cit., p. 64.
powerful competitive advantage.

Using historical data, the costs of advertising can be easily calculated. Criteria for dividing the total promotional budget into its advertising, sales promotion and personal selling categories were not required in this study, since the controller of the dealership had already performed this function. However, it is another matter to diagnose the benefits of advertising, simply because there is little agreement as to what the precise advantages are. In a final analysis, it would appear that the benefits of advertising are basically the buying power of the advertising dollar. Purchase of an automobile is a definite, ultimate measure of advertising performance, and in the present context, will serve as the measure of advertising effectiveness.  

This use of sales data as a criterion of effectiveness must be clarified. The theory of the firm assumes that business strives toward maximization of profit. Advertising is only one marketing input designed to achieve this lofty objective. In theory, then, the universal criterion on which to measure advertising efficiency is contribution to profit. Using a marginal approach, the firm will dispense advertising dollars until the last dollar spent equals the profit resulting from

13That is, the firm's advertising objective is assumed to be synonymous with its marketing objective. For a contrary viewpoint see, Russel H. Colley (ed.), Defining Advertising Goals For Measured Advertising Results (New York: Association of National Advertisers, 1961).
that expenditure. Rarely, however, does the firm have sufficient information to equate the marginal revenue product of its advertising dollars to its marginal cost.14

By industry standards, the automobile dealership under consideration is extremely profitable; its high sales volume has contributed to this success. While contribution to profit is the ideal determinant of advertising productivity, if we assume a direct correlation between profit and sales volume, then the latter may be used as the criterion of effectiveness. This assumption is necessary because profit figures were not available for the study.

Since the time period to be analyzed spanned only one year, weekly sales and advertising volumes were arbitrarily chosen as the most suitable unit of study. When both series are subjected to multiple regression analysis, it is anticipated that underlying relationships will be clarified. The specific units employed in the regression equations are discussed further in Chapter III.

Advertising and the Automobile Dealer

As a prerequisite to obtaining his franchise, the automobile dealer contractually undertakes to implement an ambitious

promotional policy. The importance of such promotion is well demonstrated by the following clause extracted from the franchise agreement of a leading automobile manufacturer:

The Dealer shall promote vigorously and aggressively the sale of Products, using as fully as is practical the Company's advertising and sales promotions and merchandising material, and shall develop energetically and satisfactorily the potentiality for such sales and obtain a reasonable share of the market in the Dealer's Territory. Whether or not the Dealer shall have vigorously and aggressively promoted such sales and shall have obtained a reasonable share of market shall be determined by reference to such criteria as the Company may develop from time to time. In the case of Vehicles these criteria may include, but shall not be limited to, the relationship of the Dealer's retail sales of Vehicles to users located in the Dealer's Territory to (a) the total registrations of Vehicles in the Dealer's Territory, (b) the fair and reasonable retail sales objectives of Vehicles established for the Dealer for the Dealer's Territory, and (c) the registrations of automobiles (or trucks) of other manufacturers selected by the Company and generally competitive with Vehicles in price and product characteristics in the Dealer's Territory.

Perhaps the role of advertising from the automobile dealer's perspective is further illustrated by considering the following description of automobile shopping behavior: 15

The first stage is one of "preliminary exploration". It may be described as a gradual evolution of a state of readiness to buy. It culminates in a definite decision, expressed in verbal commitments, to enter the market. This exploration is set in motion almost imperceptibly, in response both to external events and to internal psychological changes. A man arrives at this state, for example when his car has passed a certain age (which he defines as "old" in comparison with the model year of cars owned by people he considers significant). Or he may be impelled from the stage of unconsciousness sensitivity to one of active readiness by a change in

life circumstances—a marriage, a change of job or residence, the birth of a new child, a death in the family—anything which alters his functional or status requirements. A buildup of tension takes place gradually over months for most people. During this period, anything that goes wrong with the prospect's current car assumes an importance it did not have before. If the car burns oil or gets less mileage to the gallon of gas, or if minor parts have to be replaced, this now becomes a matter of family conversation. (Family discussion, in fact, accompanies all of the subsequent stages in the process of decision-making).

As the car owner finds himself talking more about cars, he also becomes more sensitive to advertising and editorial matter dealing with automobiles. He pays more attention to new models he sees on the road. Automobile shows and new model introductions intensify the process by creating fresh occasions for conversation and reflection.

As this preliminary exploration goes on, the car buyer comes more and more to think of himself as being actively engaged in the market. He may define his interest now in terms of a target date for his purchase. This may be related to the introduction of the new models, to the end of winter, or to the anticipated lowering of prices at the end of the old model year.

Often some decisive incident or event (a major repair job, or an occasion to celebrate) forces the prospect to begin his active shopping. Even before he reaches the point of decision to buy, he has become highly conscious of the different makes and models, and of the dealers in his area of residence.

Once he has made up his mind to buy a car, the customer starts to look into showroom windows and even to browse through floor displays. He starts studying the ads to compare features, and prices. He consults the "experts" of his acquaintance—like filling station attendants. He chats with friends about his own past experience. At the final stages he talks to dealers about features, prices and trade-ins and, on the basis of comparison, closes his deal. In a majority of cases he makes up his mind within a matter of weeks after he had made the decision to buy.

Throughout the crucial weeks, the prospect's feeling about the reputation of a make is buttressed now by what he sees in the advertising to which he has suddenly become sensitive. But the ads he sees with new interest produce their effect by reactivating all the other advertising—not to mention all the news and rumor—that has reached him from that company over the years.

This general description depicts the automobile purchase decision as essentially a two stage process:
1) The prospect first enters the market, and from the universe of accessible automobile dealerships, selects a sample of dealers from which to seek further information.

2) On the basis of offers received, the individual decides to accept or reject a particular proposition.

Now, dealership advertising functions only as a means of stimulating potential buyers to contact a particular seller. Advertising entices prospects to walk into the automobile showroom, but personal selling ensures that potential customers become buyers.

Most dealers have a vague idea regarding the efficiency of their advertising. A popular measure is a comparison of the number of automobiles sold with those models featured in the dealer's recent newspaper advertisement. It is one thing to glance at sales figures and recall the advertising recently placed. It is quite a different matter to isolate the effect of one variable, advertising.

An advertising manager must perform an herculean task in comparison to the sales manager. When the latter approaches the dealership president regarding probable benefits of hiring an additional salesman, he says, "This man will cost $X in salary, $Y in commission and $Z in fringe benefits. I am

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projecting he will return \$2X + \$3Y + \$4Z in increased sales". Alternatively, the advertising manager is unable to place a similar accurate monetary value on advertising's contribution to the sales objective. But, if he can roughly demonstrate the sales response to advertising, the advertising manager is in a better position to obtain scarce promotional funds.

From a practical standpoint, the advertising manager would not expect today's advertisement to result in a sale two years hence. Yet sales effects may occur a day or a month after the advertising has been run. The cumulative effects of advertising, whether they be of a residual, sleeper or boomerang nature, complicate delineation of the advertising-sales relationship. In accordance with the above model of automobile shopping behavior, we shall assume that the dealer's patronage advertising is of the "direct action type—a selling document, complete enough in itself to induce immediate action by the consumer either in the form of placing an order or that of seeking additional information before placing an order". Given the automobile dealer's annual sales target, we are realistically assuming that the sales effects of advertising during any given year are more or less immediate.

Limitations of the Study

"Advertising effectiveness" is a curious phrase. It

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is at once both exciting and somewhat embarrassing to advertiser, researcher and management. It is exciting because of its promise, but embarrassing because of its elusiveness." Why does a solution to the problem of advertising productivity remain so obscure? The answer probably stems from the fact that advertising researchers "cannot for the life of them tell how to isolate the contribution of one cause to an effect of many causes (experimental design), how to learn what communication caused which sales (measure both), how to project from few to many (probability sampling), or how to do all this within the organizational constraints of the advertising business." 

More specifically, the practical difficulties to be encountered in studying the sales effects of advertising can be reduced to four basic factors: 

1) The Marketing Mix Situation - Because the automobile dealer exercises many tools of marketing action, it is readily apparent that advertising, per se is not the sole stimulator of sales. It is much easier to measure results of a total

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marketing effort, all factors in the marketing mix, than to isolate the effects of only one variable.

"Even if the results produced in the past by each component of the mix could be discovered, information as to what a different mix would have produced would be lacking. And information about past results would not point with certainty to the results likely to be produced by a similar or identical mix in the future".  

In other words, the first complication is the internal dimension—the effectiveness of advertising decisions is dependent upon other courses of action available to the firm.

2) The Environmental Situation - While the advertiser can control the mix situation, his ability to manipulate important ecological factors affecting demand, is far less certain. Next to a house, the purchase of an automobile is the largest expenditure most people make in a lifetime. Such economic considerations as competitor's prices or the consumer's ability to buy are largely beyond the control of any one dealership. In the same vein, the individual's psychological constitution, his buying habits and desires, are only minimally influenced by dealership advertising.

3) The Temporal Situation - It is generally recognized that a lag exists between the moment the advertising expenditure is made and the time the sales results are obtained.

Palda has summarized why such a lag may exist:

1) Continued brand preference, though probably maintained by satisfaction with the quality of the product, may have its origin in the action of a single long forgotten advertisement.
2) It may take a series of advertisements to break through a threshold of buying resistance.
3) The potential customer, persuaded though he may be by the advertisement is not immediately in the market for the product.
4) A particularly lengthy lag may result when a product can only be used from a certain age on.

Advertising research cannot take place in a vacuum—to isolate the sales effects of advertising one must know the duration and amplitude of the lag. However, in examining advertising's productivity for a given year, we are, in effect, taking a static view of the dynamic marketplace. This abstraction from an obscure reality is necessary, but, of course, is an inherent limitation of the study.

4) The Correlative Situation - Most techniques currently employed to measure aspects of advertising effectiveness display methodological weaknesses—their reliability and validity should be subjected to close scrutiny. In analyzing the sales responses to advertising, these methodological difficulties are compounded. The advertiser should not interpret a high (low) correlation between sales and advertising as indicative of high (low) advertising efficiency. For instance, if the advertising appropriation is budgeted on

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a percentage of sales basis, one would expect to find a
relatively high, yet spurious correlation, between advertising
and sales volume. Thus, one must supplement statistical
analysis with informed judgment in analyzing the findings of
this report.

**Advertising and Distance**

While the study is mainly concerned with the sales
effects of advertising, it also focuses on the relationship
between advertising and consumer spatial behavior. If pro-
motion really exerts "pulling power", is its potency signif-
icant in time and space? More particularly, do customers
travel greater distances to purchase an automobile when
advertising effort is augmented?

Centrality is a basic principle of consumer behavior—
other things equal, people prefer to purchase products near
their homes, thereby minimizing travel costs. It is relatively
easy to document historical patterns of consumer spatial
behavior; it is very difficult to analyze and interpret these
spatial relationships. The attraction-repulsion continuum,
depicted in the following diagram, seems a first step toward
better understanding the many interactions between sales,
advertising and distance.
Advertising is viewed as a positive force—it attempts to attract customers over an increasing geographical area. As a counterforce, distance limits the extent to which potential consumers are willing to travel for the purpose of purchasing goods. At some point, there is a trade-off between the consumer's positive expectations of purchase, instilled by advertising, and the negative expectations of nonpurchase, associated with distance. The size of the retailer's trading area is determined at this trade-off point.

Research in marketing geography is a relatively new area of endeavour, and to the writer's knowledge, there has been no attempt to relate sales, advertising and spatial behavior. This would seem to justify the present study, albeit of an exploratory nature.

Organization of the Report

With the preceding limitations in mind, the paper now turns to a brief description of the theoretical relationships between advertising, sales and distance. The latter part of Chapter II is devoted to a review of previous research findings on the advertising-sales relationship—the paucity of relevant
studies will soon become apparent.

Prior to regression analysis, it is necessary to select and obtain accurate data on a number of factors. The units in which these chosen variables are to be measured are discussed in Chapter III.

Much work remains to be done and future research must explicitly consider a variety of endogeneous and exogeneous variables. What direction these variables may take is outlined, and where possible, implications for marketing strategy are suggested.

The final chapter presents the more significant regression results. The ability of the independent parameters to explain sales fluctuations is deduced utilizing theoretical and statistical criteria.
CHAPTER II

INTRODUCTION

The aim of this chapter is to review previous findings on the nature of the advertising-sales relationship. However, a conceptual framework is first developed so the reader may better understand the academic relevancy of advertising to sales. Then, a theoretical interpretation of consumer spatial behavior is developed, with particular reference to the advertising-distance dichotomy.

THEORETICAL RELATIONSHIP--ADVERTISING TO SALES

At the outset, note that the models presented below are not profound, nor are they new. The representations are an aid to analyzing the advertising expenditure problem but owing to their simplistic assumptions, the models are certainly not to be construed as the method of analysis.

Underlying any study of the advertising-sales relation is the concept of advertising elasticity: if advertising expenditures are increased "X" percent what percentage increase in sales will result. To calculate the advertising elasticity coefficient, one would require such finite information as that presented in Table I. ¹

In placing the advertising expenditure problem into

the ideal framework of contribution to profit, it is apparent
that the optimal advertising appropriation is $5000. Beyond
that amount, additional sales are achieved at excessive cost
and net profit declines rapidly.

TABLE I

CUMULATIVE SALES VOLUME, GROSS AND NET
PROFIT resultNG FROM $1000 advertising
APPROPRIATION INCREMENTS

<table>
<thead>
<tr>
<th>TOTAL ADVERTISING</th>
<th>TOTAL $</th>
<th>TOTAL SALES</th>
<th>TOTAL GROSS PROFIT ($)</th>
<th>TOTAL NET PROFIT ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1000</td>
<td>600</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>1000</td>
<td>5000</td>
<td>3000</td>
<td>2000</td>
<td>1000</td>
</tr>
<tr>
<td>2000</td>
<td>10000</td>
<td>6000</td>
<td>4000</td>
<td>2000</td>
</tr>
<tr>
<td>3000</td>
<td>14000</td>
<td>8400</td>
<td>5600</td>
<td>2600</td>
</tr>
<tr>
<td>4000</td>
<td>17333</td>
<td>10399</td>
<td>6934</td>
<td>2934</td>
</tr>
<tr>
<td>5000</td>
<td>20189</td>
<td>12113</td>
<td>8576</td>
<td>3566</td>
</tr>
<tr>
<td>6000</td>
<td>22689</td>
<td>13613</td>
<td>9076</td>
<td>3076</td>
</tr>
<tr>
<td>7000</td>
<td>24689</td>
<td>14813</td>
<td>9876</td>
<td>2876</td>
</tr>
</tbody>
</table>

The data in Table I illustrate an important principle,
that advertising is subject to the law of diminishing
returns:

...we can see that the first units of advertising
have little effect in overcoming the inertia of the buying
public; that successive units receive more and more re­
response at a rapidly rising rate to a point where the rel­
ationship for the moment is theoretically linear, and
that from there on additional amounts of advertising
result in progressively smaller additions to sales. At
some point to be determined through analysis of the
individual enterprise's break-even points, the additional
advertising expenditure will not produce its own worth.
Below that point, reducing the advertising expenditure
will only result in still more diminished returns. 2

2 Sidney Hollander, "A Rationale for Advertising
1949.
Although he offers little proof, Hollander suggests that "the return per dollar of advertising is more likely to be expressed as an S-shaped curve—up to a certain point, increasing; past that point decreasing". This hypothesis is shown graphically in Figure 1.

![Graph showing the relationship between Advertising Dollars and Sales in Units.](attachment:image)

**FIGURE 1**

**THE ADVERTISING-SALES RELATIONSHIP**

Adding the cost element, the academic relationship of advertising expenditures to sales and profit is depicted in Figure 2.

With the exception of advertising, all factors affecting demand are held constant—thus in Figure 2 varying sales levels are attributed to fluctuating advertising expenditures. This relationship between costs and benefits is further explained as follows:

The rising diagonal line represents advertising cost and the curved line labeled gross profit represents the difference between sales and all costs except advertising.

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3 Ibid, p. 80.
Therefore, the only cost not yet subtracted to obtain gross profit, is advertising cost. Hence, net profit is the shaded area between gross profit and advertising cost. The net profit curve, when plotted separately on the horizontal axis, takes the inverted bathtub shape as shown in the diagram.

FIGURE 2
THE ADVERTISING-PROFIT RELATIONSHIP

Consequently, if profit is the criterion of effectiveness, the optimal advertising expenditure is the amount "OA", which in turn, induces a sales level of "OS" and net profit "OB".

THEORETICAL RELATIONSHIP--ADVERTISING TO DISTANCE

A substantial body of literature has demonstrated the importance of distance in analyzing trade movements. Most studies conclude that travel costs, whether in temporal or monetary units, exert a potent influence on spatial patterns of consumer behavior. The oft-observed inverse relationship between distance and the density of consumers highlights the importance of consumer travel costs.

The theoretical relationship of travel cost to distance is depicted in Figure 3.

![Figure 3](image-url)

**FIGURE 3**

RELATIONSHIP OF TRAVEL COST TO DISTANCE TRAVELLED
The curve "AA" begins somewhat above the origin—this demonstrates that any shopping trip involves certain fixed costs, either in expended time or monetary units. Beyond this fixed amount, the trip expenditure rises slowly with incremental increases in distance, until, at some point, it rises disproportionately. This point of inflection varies with the consumer's perception of his needs, the distance he is willing to travel, and his opportunity cost. At least hypothetically, the impact of travel costs is to constrict the retailer's trading area.

While the effect of distance in shaping the firm's demand curve is doubtless an important concept, it must not be overemphasized. The consumer's life space, the areas in which he works, shops and socializes, has increased immensely in recent years. Rising incomes, greater spending on shopping goods and the dynamics of merchandising tend to lessen the importance of distance. Moreover, the automobile is the epitomy of the term "shopping good", that is, one "for which the probable gain from making price and quality comparisons is thought to be large relative to the time and effort needed to shop properly for the good". Since travel costs are somewhat insignificant, relative to the price of the automobile, consumers may visit several showrooms. While the automobile dealer can never be certain that even the consumer next door...
will patronize his showroom, he might realistically assume that the nearer the household, the more likely the consumer's automobile shopping will include a visit to his location.

To the consumer, there are limits of time and cost, but such boundaries should theoretically become more ambiguous the greater the effective level of advertising effort. Figure 4 depicts this phenomenon: the curve increases slowly, but eventually, irregardless of advertising effectiveness, rises rapidly.

![Graph showing the relationship between travel cost and advertising effectiveness.](image)

**FIGURE 4**

**RELATIONSHIP OF TRAVEL COST TO ADVERTISING EFFECTIVENESS**

Advertising enables the consumer to gain some a priori knowledge of the probability that an advertising dealership might satisfy his automobile requirements. The automobile showroom is truly a generative location, that is, "one to which the consumer is directly attracted from his place of
residence; to shop there is the principal purpose of the consumer in leaving his residence." If such advertising is effective, the consumer exhibits a willingness to incur greater travel expenditures in anticipation of greater need satisfaction. Consequently, advertising may tend to increase the ratio of trip distances the consumer is willing to travel, and simultaneously, to expand the dealer's trading area.

SALES AND ADVERTISING: A REVIEW OF THE LITERATURE

In surveying the literature of the advertising-sales relationship, one is immediately impressed by the paucity of relevant studies. There are at least three reasons for this scarcity of data: (1) research has traditionally applied measures of "attention, interest and desire" as estimates of advertising's effectiveness, (2) the expense of measuring the advertising-sales relationship often cannot be justified relative to the cost of the advertising being evaluated, and (3) companies which have documented the relationship are reluctant to disclose their findings. That research which has found its way to the publisher is particularly interesting and relevant to the present study. To examine this research systematically, it is necessary to structure the following discussion with reference to the product investigated. Since

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delineation of the advertising-sales relationship is beset with many methodological difficulties, it is indeed revealing to note the many techniques employed by previous researchers.

General

A survey by Vidale and Wolfe affords a departure point in reviewing previous empirical research and, at the same time broadens our understanding of advertising theory. Having analyzed the sales performance of many consumer products, these theorists propounded a model based on three parameters. The general model is of the form, \[ \frac{ds}{dt} = rA(t) \frac{M-S}{M-\lambda S} \]
and is interpreted as follows: the increase in the rate of sales, \( ds/dt \), is proportional to the intensity of the advertising effort, \( A \), reaching the fraction of potential consumers, \( M-S/M \), minus the number of customers being lost \( \lambda S \). The three parameters merit further attention.

1) Sales Decay Constant (\( \lambda \)) - In the absence of advertising Vidale and Wolfe found that sales of many products decline as a constant percentage lost annually. For established products, the sales decay rate is relatively small, but grows larger for mature products facing highly competitive market conditions.

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2) Saturation Level \((m)\) - Depending upon the product type and the effectiveness of media, there is a practical limit to the sales volume that can be generated by a specific advertising campaign. The researchers found a declining rate of increase in sales per dollar of advertising, suggesting existence of a limit, beyond which additional advertising expenditures in the same media will be superfluous.  

3) Response Constant \((r)\) - The third dimension, sales generated per advertising dollar, is almost impossible to measure. Were the marketer able to estimate the response constant, his problems would be over! The Vidale-Wolfe model is an oversimplification, yet it is apparently based on empirical data. It is unrealistic in that it completely omits a consideration of repeat purchasing phenomena.

On a more practical level, Kolliner examined the marketing costs of 893 companies to determine if greater advertising expenditures implied lower sales expense. He found that the consistent downward trend in sales expense continues when advertising increases as a percentage of sales expense. Kolliner's data, summarized in Table II shows that

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8 Ibid, p. 379.


for various size firms, a higher advertising to sales expense ratio decreases the total cost of sales.

### TABLE II

TREND OF SALES EXPENSE WHEN ADVERTISING INCREASES AS A PERCENTAGE OF SALES


<table>
<thead>
<tr>
<th>ADVERTISING AS PERCENTAGE OF SALES</th>
<th>SALES EXPENSE--ADVERTISING PLUS DIRECT SELLING COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 9</td>
<td>11.3</td>
</tr>
<tr>
<td>9 - 14.2</td>
<td>11.8</td>
</tr>
<tr>
<td>14.3 - 18</td>
<td>10.4</td>
</tr>
<tr>
<td>18.2 - 24.8</td>
<td>9.3</td>
</tr>
<tr>
<td>24.9 - 33.9</td>
<td>8.9</td>
</tr>
<tr>
<td>Over 34.2</td>
<td>8.4</td>
</tr>
</tbody>
</table>

This inverse relationship may be a completely spurious finding, for it neglects the nature of each firm's selling activity. In aggregating the data of many firms, Kolliner's survey implies economies of scale. This finding is in sharp contrast to that of Weinberg, who, in a similar study concluded that sales of an industrial product declined logarithmically as a function of advertising.\(^\text{11}\) However, the two studies are not directly comparable, because they employ different variables.

**Department Store Sales** - Cover et al examined the sales of women's clothes in selected Chicago department stores between 1926 and 1931.\(^\text{12}\) The advertising series studied was units of

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newspaper lineage; sales were viewed as percentage increases or decreases from a particular month to the corresponding month in the subsequent year. Trend and seasonal factors were then measured and eliminated. Using graphic analysis, the researchers found that newspaper advertising generally conforms to cyclical fluctuations in department store sales. The fact that as sales decrease, advertising falls off, is a logical finding. To what extent department stores create demand, as opposed to following consumer desires, was an unsolved problem.

In a later inquiry, Brown and Mancina hypothesized that the relationship between the sales and advertising expenditures of 108 department stores could be expressed by a linear function of the following general type:

\[ S = A X_1^{K_1} X_2^{K_2} X_3^{K_3} \cdots X_n^{K_n} \]

where: \( S \) refers to sales volume
\( A \) is the advertising constant
\( X_1, X_2, X_3, X_n \) are selling inputs
\( K_1, K_2, K_3, K_n \) are constants.

Hence, advertising is proportional to total selling effort.

While this linear function appears to imply that advertising should be a fixed percentage of sales, the authors emphasize that "a perfect relationship (between sales and advertising) should not be expected, for the theory implies that the effect of advertising is continuous over an infinite range, whereas in reality there is a certain minimum amount that can successfully be spent on advertising".\(^\text{13}\) Brown and

Mancina found that the ratio of advertising expense to total selling expense varied between nine and fifteen percent. Although their analysis of variance technique yielded only rough results, they concluded "that the relationship between sales and advertising is describable by a function homogeneous in the first degree".\textsuperscript{14}

Although he offers no empirical data, Maranz states that one measure of the effectiveness of department store advertising "can be obtained by noting its impact on the weekly moving average sales curve".\textsuperscript{15} The curve is calculated as follows:

\[
M_1 + Tu_2 + W_3 + Th_4 + F_5 + S_6 = \text{Weekly Moving Total One}
\]
\[
Tu_2 + W_3 + Th_4 + F_5 + S_6 + M_8 = \text{Weekly Moving Total Two}
\]

where each letter represents daily sales and each number represents the date. If advertising does influence sales, the smoothed sales curve will deviate from the normal curve, (that is, sales without advertising).

**Novels**

Berreman analyzed the sales and advertising figures of 234 novels selected from publishers' lists between 1933 and 1938. Initially, he noted an apparently high correlation between the total amount spent on advertising and the total

\textsuperscript{14}Ibid, p. 1.

sales of novels. Looking closer at the temporal dimension, Berreman found conflicting evidence—he discovered that books which receive "the most early advertising can generally be counted on to have superior sales". Yet Berreman concluded that "the bulk of advertising of best sellers accompanies or follows sales rather than precedes them, and it is impossible to predict from advertising even a month after publication date, the relative success which best selling novels will achieve". Then, too, one wonders how much sales volume actually depends on positive reaction by reviewers, public acclaim and word-of-mouth advertising.

Lettuce

Assuming that variations in the per capita consumption of lettuce are a function of the area's per capita income, its temperature, retail price and the intensity of advertising effort, Meissner performed a multiple regression analysis of lettuce sales in 22 cities. In the period 1950--1955, "only four variables, price, temperature, fieldman and newspaper advertising had a significant influence on lettuce consumption." The eleven independent variables analyzed by Meissner "explained" only half of the total variation in the per capita


17 Ibid.

consumption of lettuce—38 percent "was explained" by price, income and weather, and only twelve percent by the eight advertising variables. As a result, the author did not provide any concrete conclusions regarding the advertising-sales relationship. Moreover, his use of partial correlation coefficients as indicative of causal influence on sales has been challenged. ¹⁹

Cookware

Following declining sales of Teflon-coated cookware, Dupont began an advertising experiment employing a factorial design. Thirteen American cities received three levels of advertising effort in late 1962 and 1963. "The major research measurement of sales during each test period was a wave of telephone interviews conducted with samples of 1000 female heads of households in each of the test markets". ²⁰ Becknell and McIsaac's findings are summarized below.


The researchers also investigated the carry-over effect of advertising, and concluded that the promotional campaign "worked at the high level but had no discernible effect at the lower level."  

TABLE III

COOKWARE UNITS PER 1000 FEMALE HEADS OF HOUSEHOLDS

<table>
<thead>
<tr>
<th></th>
<th>FALL 1962</th>
<th>WINTER 1963</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HIGH ADVERTISING</td>
<td>LOW OR NO ADVERTISING</td>
</tr>
<tr>
<td>Total Units (All Types)</td>
<td>404</td>
<td>317</td>
</tr>
<tr>
<td>Units Coated with Teflon (All Types)</td>
<td>38</td>
<td>16</td>
</tr>
<tr>
<td>Skillets and Griddles Coated with Teflon</td>
<td>28</td>
<td>16</td>
</tr>
<tr>
<td>Teflon Market Share</td>
<td>9%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Apples

Tousley compared per capita advertising expenditures to the consumption of apples in 38 different areas. "A consumption trend for each market was obtained by computing the percentage change in the average annual car-lot unloads of Washington apples between two periods, 1932--1935 and 1937--1939".  

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Unfortunately, the test markets were rather atypical and Tousley was forced to conclude that the advertising-sales relationship was not entirely consistent.\(^{23}\)

**Oranges**

Investigating promotion's role in the sale of oranges, Nerlove and Waugh analyzed the 1910--1959 advertising expenditures of Sunkist Growers, Incorporated. An interesting theory of cooperative advertising without supply control is first propounded.\(^{24}\) The writers then studied the value of the orange crop with respect to quantity sold \((Qt)\), consumer income \((Yt)\), the current advertising appropriation \((At)\) and the mean advertising expenditure \((\bar{A}_t)\) over the 50 year period. Several regressions were run using numerous lagged values of the advertising appropriation—a unique two parameter form of distributed lag gave better results than an exponentially distributed lag. The estimating equation obtained was:\(^{25}\)

\[
U_t = -2.939 - 0.390 Qt + 0.924 Y_t + 0.233 A_t + 1.03 \bar{A}_t
\]

\(^{23}\)However, Tousley's article is an excellent summary of many studies investigating the effectiveness of advertising for farm products.


The authors concluded that advertising and consumer income were omnipotent factors in the expansion of orange sales; the equation indicates that "if orange production remained constant, an added dollar of advertising would raise the gross returns to orange producers by over twenty dollars". Other regressions demonstrated that marginal returns from advertising rapidly decline as advertising expenditures increase. As Figure 5 shows, the effect of advertising has been to increase farm value by much more than the cost of advertising.

FIGURE 5

NET REGRESSIONS OF VALUE ON ADVERTISING EXPENDITURE

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27 *Ibid*, p. 832,
Disregarding the low advertising-sales ratio maintained by orange growers, Nerlove and Waugh may be attributing far more to advertising than is realistically justified. The model is essentially static, and as they point out, "when supplies are uncontrolled, it is impossible to judge the long run effects of advertising without taking account of such matters as the long run elasticity of supply and external economies or dis-economies". Finally, the writers compute an optimal advertising budget, assuming that the above estimating equation remains valid beyond the range of the data. As any econometrician well knows, such an assumption is highly suspect.

**Dairy Products**

In a simple pilot study, Dickens presented evidence that sales of dairy products can be increased by point of purchase advertising in grocery stores. Dicken's findings are summarized in Table IV; however, her before-after study raises many more questions than it answers.

Clement measured the effect of three increasing levels of advertising expenditures on total milk sales. Government sales data, supplemented by retail audits and waves of telephone interviews gave an accurate measure of milk consumption. In this elaborately designed experiment, "sales increased with each higher level of expenditure and expenditures in the previous

---

28Ibid, p. 836

period had an effect on sales in the present period". From the experimental data, Clement succeeded in determining the optimum advertising expenditure by substituting the optimum sales level (10.4 thousand pounds of sales per day) in the estimated advertising cost function:

\[
\text{Total Cost} = 78.3 - 10.7 + 1.52X^2
\]

\[
\text{Total Cost} = $131
\]

**TABLE IV**

SALES INCREASES ATTRIBUTED TO ADVERTISING


<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>SALES DURING CONTROL PERIOD</th>
<th>PERCENTAGE INCREASE IN SALES DURING TEST PERIOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Milk</td>
<td>457</td>
<td>15</td>
</tr>
<tr>
<td>Buttermilk</td>
<td>341</td>
<td>- 4</td>
</tr>
<tr>
<td>Chocolate Milk</td>
<td>50</td>
<td>- 16</td>
</tr>
<tr>
<td>Chocolate Drink</td>
<td>~150</td>
<td>25</td>
</tr>
<tr>
<td>Cheddar Cheese</td>
<td>231</td>
<td>18</td>
</tr>
<tr>
<td>Ice Cream</td>
<td>216</td>
<td>22</td>
</tr>
<tr>
<td>Evaporated Milk</td>
<td>651</td>
<td>4</td>
</tr>
<tr>
<td>Condensed Milk</td>
<td>52</td>
<td>- 2</td>
</tr>
</tbody>
</table>

**Coffee and Cleansers**

Using multiple regression analysis, Banks found that brand preference, price and in-store promotional effort were significant in determining the market shares for various brands of scouring cleanser. Alternatively, brand preference

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was the only obvious determinant of brand share for coffee. Incidentally concerned with the sales effects of advertising, Banks makes a particularly interesting assertion: whereas Maxwell House was spending 40 percent of the total coffee advertising volume in Chicago, it was receiving only sixteen percent of total coffee sales. "In contrast, Manor House was spending only nine percent of the total advertising volume, but receiving 30 percent of total sales". 31

Lamb

Hoofnagle cites two controlled experiments to gauge the effect of promotion on lamb sales. The 1956 study employed a crude subdivided time series approach wherein retail sales were checked before, during and after the advertising period. This procedure did not give definitive results. Using a double changeover design, the 1961 experiment attempted to assess the effectiveness of a cooperative and consumer advertising program. "Results of the experiment showed that the combined weekly lamb sales for (three) northeastern and midwestern cities averaged 26 percent higher for cooperative advertising and ten percent greater for the regular promotion program than for comparable periods of no advertising and merchandising support". 32


Cigarettes

Examining the relation between the consumption and price of cigarettes, Schoenberg briefly considered the effects of promotion: "advertising data were introduced into the analysis on the assumption that the consumption of cigarettes depends on the price, on the amount of advertising and on other factors...the relationship between the foregoing variables is almost perfect, the coefficient of multiple correlation being almost unity (.998)". 33

Wagner, too, correlated cigarette sales and advertising indices. While both indices tended to more coincidentally, he found that "beginning in 1937, the advertising index rose higher than the sales index". 34 This reflects diseconomies, since increased advertising dollars had little affect of sales.

In a widely acclaimed study, Telser used regression analysis to investigate the relation of sales to advertising for three large cigarette brands. Given that profit maximization requires diminishing marginal productivity of advertising, he examined four regressions with different implications concerning the nature of the returns to advertising. 35

1) Advertising has a constant marginal product, the second derivative of sales with respect to advertising is zero.

\[ q_t = A + Bx_t + Cy_t + Dp_t + E_t \]

2) Advertising exhibits a decreasing marginal product; the second derivative of sales with respect to advertising is \( -B/x^2 < 0 \).

\[ q_t = A + B \log x_t + C \log y_t + D \log p_t + E_t \]

A regression on first differences of the above variables was also run.

3) Advertising has an increasing marginal product wherein the second derivative of sales with respect to advertising is \( B/q > 0 \).

\[ \log q_t = a + bx_t + cy_t + dp_t + e_t \]

Note in the above equations that:

- \( q_t \): Sales in billions of cigarettes
- \( x_t \): Advertising outlay in millions of dollars
- \( y_t \): National income divided by the consumer price index
- \( p_t \): Retail price per package of cigarettes divided by the consumer price index
- \( t \): Linear trend

Although Telser's "research" may be criticized on grounds that it is merely a collection of statistics to prove a predetermined viewpoint, this censure certainly does not invalidate his findings. The best regression for predicting the marginal sales effects of advertising was the first difference form of
equation two—its residuals had the lowest serial correlation, and it had the lowest standard error of prediction.

Telser also investigated the competitive effects of advertising by scrutinizing the relation between market share and advertising expenditures. He suggests there was "closer competition between the advertising on Camels and Lucky Strike than between any one of these brands and the Chesterfield expenditures". Perhaps more important, Telser determined that "advertising outlays built up a fund of goodwill that depreciated at a rate varying between fifteen and 20 percent per year". Of course, this depreciation decreased as the relative advertising expenditures increased.

Drugs

Hollander isolated six variables which apparently explained the sales variations of "a nationally advertised drug product". Using graphic multiple correlation, he determined the quantitative relationship between advertising and sales. To measure the cumulative effects of advertising, Hollander successfully tested a "moving average formula built on assumptions inherent in the advertising situation regarding the rate at which the advertising effect is built up and runs out". Unfortunately, Hollander presented no empirical data.

36 Ibid, p. 487.
38 Hollander, op. cit., p. 85.
Robinson reported a case study in which a pharmaceutical firm, content with its present sales, decided to drop its advertising program. As shown in Figure 6, this strategy proved disastrous and the advertising was soon restored.

FIGURE 6
A DRUG PRODUCTS ADVERTISING–SALES RELATIONSHIP

Applying multiple regression techniques to consumer panel data, Roberts uncovered evidence that firm A's "advertising was much more productive with respect to A's sales than was B's advertising with respect to B's sales". In addition, he found that the relation between advertising and sales was curvilinear; because of this, "one can infer that a reallocation of insertion schedules among media may result in increased productivity".

Palda applied many regressions, lagged and nonlagged, in an attempt to explain annual variations in the sales of a vegetable compound. More specifically, his dissertation questioned whether the measurement of cumulative advertising effects could be improved by using Koyck's model of distributed lags. A priori reasoning suggested that the time-shape of the sales reaction to advertising could be expressed by a distributed lag. Unlike previous models, the simple Koyck model employs only one lagged and one nonlagged exogenous variable. "If this substantially simpler model were to give nearly as good a picture of reality as the more complicated ones, it would be


41Ibid, p. 145.

advantageous to employ it".\textsuperscript{43}

Applied to the advertising-sales situation, the Koyck model hypothesizes that movements in sales assume the distribution of a geometric progression from time period one, onward:

$$S_t = \alpha + \alpha \lambda A_{t-1} + \alpha \lambda^2 A_{t-2} \ldots + \alpha \lambda^{n-1} \epsilon_t$$

Lagging this equation one time period, multiplying it by $\lambda$ and subtracting the result from the above, one arrives at the basic Koyck equation:

$$-\lambda S_{t-1} = \lambda \alpha + \lambda \alpha A_{t-1} + \lambda \alpha \lambda^2 A_{t-2} \ldots + \alpha \lambda^{n-1} \epsilon_{t-1}$$

$$S_t = (1-\lambda) \alpha + \lambda A_t + \lambda S_{t-1} + \epsilon_t - \lambda \epsilon_{t-1}$$

Applying numerous statistical tests, Palda concluded that the distributed lag model, with a logarithm of advertising as an independent variable, gave the best fit to the data. Not only did the "cumulative models tend to outperform the non-cumulative ones",\textsuperscript{44} but the "semilogarithmic functional forms of the regression models gave consistently better results than those in which the advertising variable was not used in logarithmic form".\textsuperscript{45}

Because some noncumulative models performed almost as well as similar cumulative ones, Palda's findings are not wholly conclusive. The results show advertising as a major stimulator of sales. Whether the Koyck hypothesis can be successfully employed by advertisers other than Lydia Pinkham

\textsuperscript{43}Ibid, p. 15.
\textsuperscript{44}Ibid, p. 77.
\textsuperscript{45}Ibid, p. 77.
is certainly questionable. Like mail order data, the relationship between Pinkham's advertising and sales was completely measureable—there was an absence of intervening marketing inputs. Today, few companies utilize only one facet of the marketing mix, and fewer survive unaware of their competitive environment.

Automobiles

Vaile analyzed the relative variations in the sales and advertising volumes of eighteen automobile manufacturers between 1920 and 1924. His data is summarized below. Apparently, the difference between the sales of those firms which increased their advertising lineage and the sales of those who decreased it, is relatively small. Nevertheless, on the basis of numerous other studies, Vaile concluded it was beneficial to increase advertising expenditures during a "depression" so as to gain a differential advantage over competitors. What such a policy does to the firm's profit picture was carefully avoided.

TABLE V

RELATIVE MOVEMENT OF SALES ASSOCIATED WITH DIFFERENT ADVERTISING POLICIES


<table>
<thead>
<tr>
<th>POLICY</th>
<th>1920</th>
<th>1921</th>
<th>1922</th>
<th>1923</th>
<th>1924</th>
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<td>Increased Advertising</td>
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<td>109</td>
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<td>95</td>
</tr>
<tr>
<td>No Advertising</td>
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<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Decreased Advertising</td>
<td>100</td>
<td>77</td>
<td>98</td>
<td>85</td>
<td>88</td>
</tr>
</tbody>
</table>

Also relevant to the present paper is Cowan's 1936 sales analysis study. Assuming "that if any chosen type of advertising affects sales, the effect should be greater in some areas than others", he examined the association between Chevrolet registrations and the circulation of the Saturday Evening Post. The automobile was advertised in this magazine for many years.

TABLE VI

ASSOCIATION BETWEEN SATURDAY EVENING POST AND CHEVROLET REGISTRATIONS PER 1000 PEOPLE IN 500 AREAS


<table>
<thead>
<tr>
<th>COPIES OF SATURDAY EVENING POST</th>
<th>ESTIMATED CHEVROLET REGISTRATIONS PER 1000 PEOPLE</th>
<th>INCREASE IN CHEVROLET REGISTRATIONS % INCREASE WITH EACH SUCCESSIVE ADDITION OF 10 SATURDAY EVENING POST PER 1000 PEOPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6.0</td>
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</tr>
<tr>
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<td>4.0</td>
</tr>
<tr>
<td>100</td>
<td>72.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Cowan's marginal data clearly demonstrates that heightened automobile advertising is first accompanied by increased

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sales, but ultimately economies of scale are evidenced.

By comparing automobile sales and advertising, Wagner was able to demonstrate that both indices tended to move together. "Correlations run to determine the timing of fluctuations in advertising and in sales indicated that changes in advertising volume preceded changes in sales". With advertising lagged two months, the highest correlation was evident:

TABLE VII

CORRELATIONS - AUTOMOBILE SALES AND ADVERTISING

<table>
<thead>
<tr>
<th>CORRELATION (r)</th>
<th>ADVERTISING</th>
</tr>
</thead>
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<tr>
<td>.73578</td>
<td>Ahead one month</td>
</tr>
<tr>
<td>.81197</td>
<td>Same month</td>
</tr>
<tr>
<td>.84501</td>
<td>Lagged one month</td>
</tr>
<tr>
<td>.85659</td>
<td>Lagged two months</td>
</tr>
<tr>
<td>.84382</td>
<td>Lagged three months</td>
</tr>
</tbody>
</table>

Summary and Conclusions

Although it is generally accepted that economies of scale do exist in advertising,49 this brief review of the literature shows that the evidence is inconclusive. Researchers

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48 Wagner, op. cit., p. 132.
have been struggling with the advertising-sales ratio for many years, and it appears impossible to derive specific axioms at this time. Moreover, the many methodological difficulties inherent in an investigation of the advertising-sales relationship will only be overcome in small stages.
CHAPTER III

INTRODUCTION

As the literature survey revealed, controlled experimentation is frequently used in documenting the sales response to advertising. The small businessman has neither the expertise nor financial capacity to design such elaborate marketing experiments despite an urgent need to discover the underlying quantitative relationship between advertising and sales. To this end, multiple regression analysis has become fashionable as a successful alternative to experimentation. Using only accurate company records, the regression technique should enable one to gauge the degree of association between sales and advertising.

Multiple regression analysis basically employs quantitative evaluations of data—consequently, the particular units chosen to express the primary data used in this study must be outlined. First, a few introductory comments may be in order.

It is important to recognize that the automobile dealer's advertising appropriation was allocated on an ad hoc basis. As a result, the correlation between advertising and sales may not be purposefully high, though it may be low. Moreover, the influence of competitive advertising on the dealer's promotional strategy is of course, an unquantifiable phenomenon; doubtless, this variable is important. To the academic mind, the advertising expenditures may appear insignificant relative to the
sales volume. To the practicing businessman, however, any promotional expenditure which does not increase sales becomes intolerable.

Previous empirical research has demonstrated that many factors influence automobile sales. Such socio-economic data are typically collected in yearly form, and hence cannot be included in the regression analysis. By the same token long term secular factors are assumed to affect all automobile dealers in similar manner—there is little need to consider these variables further.

Because the sales effects of advertising reflect both media and copy qualities, the exclusion of the latter variable from the analysis is an oversimplification. Since careful evaluation of the advertising copy suggested that most promotion emphasized immediate buying action, this oversight should not contaminate the results.

THE PRIMARY DATA

Raw data subjected to regression analysis was gleaned from various company records and occasionally secondary sources:

**Newspaper Advertising**

The newspaper was the principal medium for advertising. This variable was defined to include advertising placed in daily and weekly newspapers circulated throughout the greater metropolitan area. Advertisements were mainly two types:
display and classified. "Display advertising usually involves illustrations and appears throughout the paper; classified advertising is usually concentrated on special pages of the newspaper under headings that classify the various items". \(^1\)

Over ninety percent of the newspaper advertising expenditure was concentrated in Vancouver's two daily editions; suburban weekly publications accounted for the remainder. Because circulation figures were fairly stable throughout the year, it was decided not to include this factor among the independent variables.

Invoices provided the information necessary to determine the two newspaper advertising series. All billings were reduced to weekly lineage and dollar expenditure totals. While this procedure proved tedious, it was essential for comparing dealer and manufacturer newspaper advertising volumes.

Radio Advertising

Commercial announcements were aired on five local stations, the intensity of advertising pressure being greatest during the initial and latter weeks of the year. A physical index, such as "gross media audience" was contemplated as a measure of radio advertising. Because the rate structure in the broadcasting industry explicitly assumes differential audience sizes, weekly expenditures on all radio stations were

thus subjected to regression analysis. At best, audience figures are an extremely crude indicator of advertising effectiveness.

Television Advertising

During January, February and March spot announcements were placed on two television stations. Again, weekly expenditures on this medium were totalled from invoices. Although television was used sparingly, it was included in the analysis because of its relative high cost. Only to the extent that sales are responsive to television advertising is this higher cost justified.

Broadcast Dollars

This independent variable is merely the summation of weekly radio and television expenditures.

Manufacturer Advertising

During the year, three methods of communication were used by the manufacturer: national television, magazines and local newspapers. Although it was desirable to collect this data, the national figures could not be secured. However, this deficiency is not crucial. Had such information been available, it would be severely understated by the amount of "splash-over advertising" from the United States.

The manufacturer's local newspaper advertising lineage and dollar expenditure must therefore serve as a rough indicator of advertising intensity. Two further limitations on this data must be recognized. Whereas the manufacturer paid almost
$1.25 per newspaper line, the automobile dealer paid approximately forty cents. Since this rate differential between national and local advertising is not directly applicable to units of newspaper lineage, this variable may be a better indicator of advertising volume. Secondly, the manufacturer's advertising series was available only in monthly form. Because this data was pro-rated on a weekly basis, the figures will be overstated in some weeks, but understated in others.

Operating within the confines of a franchise system, the automobile dealer bears a significant part of the manufacturer's promotional expenditure. Whether the franchisor's local advertising statistically influences dealer sales is a question of concern to all franchisees—it was thus included in the analysis.

**Total Advertising**

The dealer's weekly expenditure on all media are summarized in this variable. Note that "total advertising" does not include advertising placed by the manufacturer.

**Weather**

Just as the automobile industry's health traditionally reflects that of the economy, so automobile sales mirror climatic variations. To assess the influence of weather upon sales, precipitation was chosen as an independent variable. This factor was defined to include the measurable amount of rain and snow falling on any given day. Records were secured from the weather office at Vancouver International Airport, and summed to a weekly basis.
Sales

Every automobile salesman recognizes that the selling price of a vehicle is an outstanding factor in the choice of a dealer. As the dependent variable in this study, "sales volume" refers to the total retail selling price of all automobiles sold during the week. Such figures exaggerate the dealer's return in that the trade-in value of the old model is deducted from the retail price. Net cost to the consumer was not employed as a measure of sales because the actual mechanics of the buyer agreement are the function of the salesman. Since advertising copy mentioned only gross selling price, this figure was utilized. It was also convenient to measure sales volume in physical units. Then for each week, another variable, average selling price was calculated; this is simply the total retail selling price divided by the number of units sold.

Distance

To assure profitability, management should know which areas of the city are being successfully exploited. From buyer agreements, each customer's address was obtained and plotted on a map of the Greater Vancouver area. A grid of one mile by one mile squares was then placed upon the map. Using a space-distance approach, the grid enables a row and column number to hit approximately every household which purchased an automobile. Although the grid could have been drawn so precise as to intersect at each customer's residence, this would have proved extremely cumbersome. As a result, all residences within a
zone are treated equally—we assume that customers are located at the nearest intersecting coordinates.

The origin-destination technique facilitates a general picture of the spatial relations between seller and buyer. By merely subtracting the coordinates of the customer's address from those of the dealership and applying the Pythagorean theorem, the approximate distance between the retailer and every customer was computed. Finally, weekly average and median distances were calculated, using the computer program displayed in the Appendix.
CHAPTER IV

INTRODUCTION

The previous chapter discussed a number of variables that could be used to explain fluctuations in an automobile dealer's sales volume. This thesis is but a brief investigation of the subject, for there exist numerous seemingly unquantifiable factors which influence the automobile buying process. A discussion of these parameters is the focus of this chapter. Where applicable, guidelines for future inquiry are suggested.

ADVERTISING PERFORMANCE AND OTHER FACTORS

**Consumer Product Preferences**

Within a geographical area, the franchisees of a given manufacturer can anticipate only a limited market share. To a large extent, each dealer's ceiling sales level is determined by customer product preferences. The automobile buying process is probably the most documented aspect of patronage behavior. Whether one believes the assertions of Vance Packard or Franklin Evans is immaterial. It is crucial to recognize that many studies consistently find that brand preference among automobile purchasers, certainly not mutable, is somewhat consistent. The used car showroom of any automobile retailer substantiates this axiom. An examination of trade-ins in the present study suggests that repurchase of the currently owned make occurs almost three times as often as purchase of a different make.
That brand loyalty toward the currently owned make is relatively high has important repercussions for marketing strategy. The franchise system of distribution guarantees there will be no "mass market" for the "total product" offerings of a given dealership. Rather, the market is limited to the extent of potential buyers desiring, manifestly or latently, the products of each manufacturer. At this level, each franchise system competes vis-a-vis every other; similarly, each franchisee's advertising competes with the promotional "noise" of all contiguous dealers. If consumers prefer a specific manufacturer's product, intra-dealership competition also exists within the same franchise system. Whether inter-franchise or intra-franchise competition is more significant must ultimately depend upon the consumer. If brand loyalty is high, prospects will generally be more receptive to the advertising of those franchisees marketing the currently owned or originally preferred model.

On the other hand, the choice of an automobile is definitely not an habitual act. Customer product preferences change through time, as the Volkswagen and Mustang successes testify. If consumers perceive the offerings of several manufacturers as homogeneous, they may meander from retailer to retailer seeking that one last price. As the intensity of shopping increases, both inter and intra-franchise promotional competition will probably heighten. However, evidence suggests that the search will be of a limited nature, perhaps considering only two or three alternative makes and dealers. The burden on advertising
will be great, especially if consumers choose the desired model before shopping!

**Competition and Location**

Models of the advertising process rarely mention retail availability as an explicit parameter. It is readily apparent that this variable is linked to the factor discussed above. In automobile retailing, "availability" implies not only a consideration of the competitive interface, but also the influence of location upon advertising strategy.

Since an automobile franchise is difficult to obtain, the number of newly-appearing dealerships is restricted. Such a situation appears conducive to analyzing the sales effects of franchisee advertising. Yet the universe of dealerships remains sufficiently large that competitors' marketing activities conceivably influence purchasing behavior. A University of Nevada survey of advertising by small business concluded that automobile dealers "set their advertising expenditures in the light of competitive activity in twenty eight percent of the cases versus an average of only eleven percent".¹ Within bounds, this method is certainly justifiable; knowing where, when and how competitors are advertising assists the dealer in planning his own promotion. From a research standpoint, the difficulty obviously lies in quantifying competitive advertising activity.

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Location is another potent merchandising variable often neglected in advertising research. However, the accessibility and quality of a location complement the effects of an aggressive advertising campaign. If the dealer possessed an "optimal location" relative to that of his competitors, he could probably allocate less dollars to advertising. At best, marketing geography is still very much an art; research isolating spatial contributions to sales remains in the fetal stage. To what extent human ecology may be manipulated by advertising should be the subject of much inquiry.

Over the years, Vancouver automobile dealers' land requirements have been increasingly met by sites located on the outer fringe of the built-up urban area. Locating on major radials and ribbons has proved popular. Yet the spacing of dealers is reasonably close--this is no doubt a function of geographically concentrated purchasing power, the constrained Vancouver transportation network and the limited time-distance people are willing to travel. As a result, advertising will continue to play a major role in demand stimulation.

Seasonal Demand and Price Levels

Even if advertising were of no consequence in automobile retailing, one would expect weekly movements in sales volume. External influences, such as holidays, weather and other events cause sales to fluctuate. As the year progresses, automobile sales usually increase, peak and decline. Planned obsolescence,
in the form of new model introductions, is designed to expand demand when it is otherwise at a low ebb.

Throughout the annual sales cycle, the price level of the automobile may vary. If the "economic man" foresees price reductions during the "clean-up" model period, he can easily forego purchase. Conversely, if his need is urgent, he may purchase immediately. This dichotomy illustrates a perplexing problem to advertising researchers: does a high correlation between current sales and advertising indicate that the dealer is just selling in March what he would otherwise have sold in September? At present, the answer is indeterministic.

Credit, Disposable Income and Intentions To Buy

Measurements performed on one year's advertising productivity probably include a history of previous promotion and market conditions. Because each year contains dissimilar events that alter the firm's demand curve, it is suggested that business research be of a longitudinal nature. In this way, the effect of rising disposable income and consumer willingness to entertain debt may be more accurately assessed.

A potentially rich source of information, often overlooked in advertising research, is consumer intention to buy data. In Canada, this service is offered by the MacLean Hunter Research Bureau. One might use this data to determine whether a rise in expectations has historically been associated with an increase in company sales. Is analysis of the automobile "consideration
class" useful in planning the advertising campaign? Do they become members of the "purchasing class"?

By their very nature, expectational data summarize a host of factors influencing the demand for durables. Because the MacLean Hunter survey is published quarterly, the reader may feel this information is outdated for purposes of operationalizing current advertising strategy. However, a recent study indicates that "both lagged purchasing plans and plans at time t had about the same predictive ability"\(^2\) in estimating Canadian automobile sales. Highlighting the importance of disposable income, Murray found that the regression equation for British Columbia automobile sales (1960-1967) was:

\[
SALES = 0.214 \text{ It} + 2.143 \text{ Yt-1} - 12150.33
\]

where purchasing plans (It) and disposable income from the previous period (Yt-1) are the explanatory variables. The significant coefficient of multiple determination, .842, indicates that buying intentions may prove a useful variable in future studies of advertising productivity.

The Efficiency of Personal Selling

An understanding of the interdependency between advertising and personal selling is prerequisite to sound advertising research. Within the automobile retailing context, a convincing argument can probably be voiced extolling the function of the sales force

and minimizing that of advertising. This proposition is not true. If the "economics of advertising" is an inconclusive concept, then the "economics of personal selling" is far less certain. In theory, the complexities involved in measuring the productivity of each function are similar. In practice, more tangible criteria may be applied to documenting each salesman's performance than to each advertisement's effect.

Isolating personal selling's contribution from that of advertising seems virtually impossible. Although the persuasive and communication aspects of each differ, both inputs are complementary. Advertising probably functions at an early point in the consumer's purchase cycle, salesmanship during the latter stages. Such a "push-pull" concept is only partially applicable to automobile retailing. Nevertheless, it illustrates this essential degree of complementarity; simultaneously, the difficulty of isolating individual contributions is apparent.

Advertising studies notoriously relegate personal selling to the "other things equal" category. This is an especially dangerous assumption in automobile retailing. The mobility of automobile salesmen often reaches velocity proportions and consequently, the calibre of the sales force is in a constant state of flux. Future research on advertising efficiency might employ "dummy" variables to represent sales force quality. Such an approach has intuitive appeal and is based on a simple premise—
the salesman who is immobile between dealerships is less dependent upon advertising as a generator of showroom traffic than is his wandering counterpart. By examining personnel and sales records, sales force calibre may be indexed over time and its effect statistically isolated from that of advertising. Note that this design would still recognize both variables as "investments", for in the writer's view, there is no other type of business activity in which the term "franchise building" is more applicable than to the modern automobile dealer.
CHAPTER V

INTRODUCTION

This section presents a statistical analysis of the automobile sales and advertising data outlines in Chapter III. Only the more interesting results are discussed, and where possible, implications for marketing strategy are suggested.

THE CORRELATION MATRIX

General Comments

An initial step in the analysis is to present a correlation matrix for some of the variables, this appears in Table VIII. The lagged forms of important predictors were not included in the matrix due to computer programming difficulties. However, most correlations can be derived from the $R^2$ values presented in the simple regression estimates of succeeding Tables. The variables included in the matrix are:

1) UNITS - the number of automobiles sold each week.
2) SALES - weekly dollar retail sales volume.
3) TOTAD - dealer's total weekly advertising expenditure.
4) BROAD - dealer's weekly expenditure on radio and television.
5) RADIO - dealer's weekly expenditure on radio.
6) NEWS $ - dealer's weekly newspaper advertising expenditure.
7) TV $ - dealer's weekly expenditure on television.
8) DLNWNL - dealer's weekly newspaper advertising lineage.
9) MNNWL - manufacturer's weekly newspaper advertising lineage.
10) MAN $ - manufacturer's weekly newspaper advertising expenditure.
11) AVEDI - average distance travelled by buyers each week.
12) MEDIS - median distance travelled by purchasers each week.

The relationships in the correlation matrix support the
<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>SALES</th>
<th>TOTAD</th>
<th>NEWS $</th>
<th>BROAD</th>
<th>RADIO</th>
<th>TV $</th>
<th>DLNWL</th>
<th>MNNWL</th>
<th>MAN $</th>
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<th>MEDIS</th>
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regression equations presented in the following section. The only unanticipated finding is the negative relationship between the sales variables and all the advertising factors except the dealer's total advertising, newspaper lineage and newspaper expenditure variables. This negative relationship is probably due to the infrequency with which these media were employed.

The Precipitation Variable

After the correlation matrix was computed, it became obvious that many other factors influence retail sales. In periods of high precipitation consumers may confine their shopping to immediate needs and may forego extensive shopping until weather conditions improve. Because data were readily available, precipitation was introduced as an explanatory variable.

Precipitation must be viewed as a random shock. At no time did the parameter explain more than one percent of the weekly sales variation. This finding contrasts with the known sales pattern of the dealership. In aggregating daily rainfall figures to a weekly basis, the real influence of precipitation is distorted. Consequently, the factor was not considered further.
SALES AND ADVERTISING

General Comments

As a point of departure, it would be useful to determine how the case dealer's sales compared to those of all Vancouver dealers. Weekly data summarizing automobile sales within the metropolitan area were not available. However, one measure of the dealer's relative performance is a percentage comparison of his monthly sales to all retail automobile sales in the Vancouver market.

<table>
<thead>
<tr>
<th>MONTH</th>
<th>ALL GREATER VANCOUVER DEALERSHIPS</th>
<th>CASE DEALER</th>
<th>DEVIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>7.3</td>
<td>6.4</td>
<td>- .9</td>
</tr>
<tr>
<td>February</td>
<td>8.4</td>
<td>6.9</td>
<td>- 1.5</td>
</tr>
<tr>
<td>March</td>
<td>8.7</td>
<td>8.7</td>
<td>0</td>
</tr>
<tr>
<td>April</td>
<td>8.6</td>
<td>7.7</td>
<td>.9</td>
</tr>
<tr>
<td>May</td>
<td>8.2</td>
<td>9.1</td>
<td>.9</td>
</tr>
<tr>
<td>June</td>
<td>9.4</td>
<td>8.2</td>
<td>- 1.4</td>
</tr>
<tr>
<td>July</td>
<td>9.0</td>
<td>7.8</td>
<td>- 1.2</td>
</tr>
<tr>
<td>August</td>
<td>9.3</td>
<td>12.4</td>
<td>3.1</td>
</tr>
<tr>
<td>September</td>
<td>6.9</td>
<td>6.9</td>
<td>0</td>
</tr>
<tr>
<td>October</td>
<td>7.5</td>
<td>8.1</td>
<td>.6</td>
</tr>
<tr>
<td>November</td>
<td>8.2</td>
<td>7.3</td>
<td>.9</td>
</tr>
<tr>
<td>December</td>
<td>8.5</td>
<td>10.5</td>
<td>2.0</td>
</tr>
</tbody>
</table>

The deviations in Table IX seem important. As an example, the dealer's sales were relatively higher than those of its competitors during August and December. Is it mere chance to find that during these two months, the dealer's advertising expenditures reached their highest peaks?
FIGURE 7
DEALER'S MEDIA MIX

- Newspaper Expenditure
- Radio Expenditure
- Television Expenditure
Media allocation is an integral part of the advertising decision. The dealer's media mix is presented in Figure 7. If his advertising strategy is typical of most automobile retailers, then the media mix is a relatively constant phenomenon. It has also changed little over time. A 1961 study concluded that, in the opinion of automobile retailers, newspapers were the "most effective medium".

**TABLE X**

**AUTOMOBILE DEALER'S MEDIA CHOICE**


<table>
<thead>
<tr>
<th>MEDIUM</th>
<th>FIRST</th>
<th>SECOND</th>
<th>THIRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newspapers</td>
<td>29</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Radio</td>
<td>--</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Television</td>
<td>14</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Directory</td>
<td>5</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

Is this concentration on newspaper advertising justified? Multiple regression analysis should shed some light on which media are best related to the sales criterion.

In studying the sales effects of advertising, the analyst hopes to establish a causal relationship. One might first examine the concomitant variation hypothesizing that a higher level of sales should be observed in the presence of advertising than in its absence. This is a simple postulate to
prove, but interpretation is hazardous. Figure 8 depicts the dealer's aggregated sales and advertising curves. Disregarding the many explanations for a moment, it is apparent that the amplitude of the advertising cycle mirrors that of the sales cycle in eight of the twelve months. From May to September, the better months for automobile marketing, the sales and advertising curves appear correlated. That promotional expenditures tend to reflect sales rates partially explains this finding.

When the advertising cycle is lagged one month, the two curves appear to be fluctuating in antithesis. Diagnosis is difficult. Perhaps sales are completely inelastic to
advertising pressure--however, intuitive judgment would suggest a more erudite explanation. It seems plausible that the cumulative effects of dealership advertising decay very rapidly and after one month approach zero. This hypothesis accords with theory: promotion conveying "sale" and "action" is known to decay quickly. If this is true, continuous advertising is necessary.

It is equally possible that a month is too lengthy a period in which to analyze the sales effects of dealership advertising. Are weekly data more sensitive? In Figure 9, the relative change in weekly sales is plotted on the vertical scale. The ordinate represents the percentage change in advertising expenditures during the same period. Because the points are spread out in Panel A, the sales-advertising relationship is not strong. As Panel B demonstrates, lagging promotional expenditures one week reduces the scatter. The apparent distribution of points from lower left to upper right evidences the existence of some positive correlation. Since the clustering indicates no curvature, a linear relationship between sales and advertising is assumed.

Unfortunately a simple correlation coefficient reflecting the association between advertising and sales does not distinguish cause and effect. If advertising is to stimulate sales it must clearly precede the actual sale. In Figure 10 there is some evidence to suggest that increased advertising during week resulted in heightened sales the following week. However,
FIGURE 9
RELATIVE CHANGE IN SALES VERSUS RELATIVE CHANGE IN ADVERTISING

Sales \( s_t \) = Sales in Week \( t \)/Total Yearly Sales
Advertising \( t \) = Advertising in Week \( t \)/Total Yearly Advertising
Change \( = \) Sales \( s_t \) - Sales \( s_{t-1} \) : Advt \( t \) - Advt \( t-1 \)
graphic results are not easy to interpret, therefore multiple regression was used for further analysis.

Sales and Total Advertising

Ten percent of unit sales variation was explained by the retailer's total advertising expenditure, as shown in Table XI. Is a better fit to the data given when total advertising is lagged one week? Regression results are inconclusive—
<table>
<thead>
<tr>
<th>PREDICTOR</th>
<th>CONSTANT</th>
<th>REGRESSION COEFFICIENT</th>
<th>t-VALUE</th>
<th>R²</th>
<th>F-RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Total Advertising</td>
<td>31.28</td>
<td>.006</td>
<td>2.43</td>
<td>.10</td>
<td>5.92</td>
</tr>
<tr>
<td>(2) Total Advertising t-1</td>
<td>30.93</td>
<td>.006</td>
<td>2.81</td>
<td>.13</td>
<td>7.94</td>
</tr>
<tr>
<td>(3) Dealer Newspaper Lineage</td>
<td>29.22</td>
<td>.003</td>
<td>4.02</td>
<td>.24</td>
<td>16.23</td>
</tr>
<tr>
<td>(4) Dealer Newspaper Lineage t-1</td>
<td>28.22</td>
<td>.003</td>
<td>5.06</td>
<td>.34</td>
<td>25.68</td>
</tr>
</tbody>
</table>

# significant at .01 level  
¢ significant at .001 level  
* significant at .05 level  
@ significant at .005 level  
### TABLE XII

RESULTS: SALES DOLLARS CORRELATED WITH -

<table>
<thead>
<tr>
<th>PREDICTOR</th>
<th>CONSTANT</th>
<th>REGRESSION COEFFICIENT</th>
<th>t-VALUE</th>
<th>$R^2$</th>
<th>F-RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Total Advertising</td>
<td>87.86</td>
<td>.025</td>
<td>3.14 @</td>
<td>.16</td>
<td>9.87 #</td>
</tr>
<tr>
<td>(2) Total Advertising t-1</td>
<td>90.47</td>
<td>.024</td>
<td>3.15 @</td>
<td>.16</td>
<td>9.93 #</td>
</tr>
<tr>
<td>(3) Dealer Newspaper Lineage</td>
<td>89.57</td>
<td>.009</td>
<td>3.31 @</td>
<td>.17</td>
<td>10.96 #</td>
</tr>
<tr>
<td>(4) Dealer Newspaper Lineage t-1</td>
<td>84.07</td>
<td>.011</td>
<td>4.57 @</td>
<td>.29</td>
<td>20.97 ¢</td>
</tr>
<tr>
<td>(5) Average Price</td>
<td>2.67</td>
<td>.002</td>
<td>2.53 #</td>
<td>.11</td>
<td>6.42 *</td>
</tr>
</tbody>
</table>

# significant at .01 level
¢ significant at .001 level
* significant at .05 level
@ significant at .005 level
the value of $R^2$ moves from .10 to .13, hardly a significant increase. The low coefficient of determination is probably caused by collinearity between the components of the total advertising appropriation. If the dealer allocates more dollars to radio advertising, he usually spends less on newspapers. The correlation coefficients support this conclusion.

Sales and Dealer Newspaper Advertising

The existence of cumulative advertising effects is illustrated by the dealer's newspaper lineage variable (Table XI, equations three and four). While 24 percent of the unit sales variation is explained by the coincidental newspaper advertisements, 34 percent is explained when the variable is lagged one period. Both regression equations are significant at the .0001 level.

The dealer newspaper expenditure variable, lagged one week, was not as good a predictor of sales as dealer newspaper lineage lagged one period ($R^2=.14$ versus .29). The higher correlations for lineage probably reflect the influence of price—the expenditure variable is a conglomeration of various rates per agate line. The lineage factor includes this price differential while the expenditure variable does not.

SALES AND DISTANCE

Sales are strongly oriented to the region immediately surrounding the dealership. However, a significant amount of patronage was received from transients, that is, customers who
purchased automobiles beyond their normal trading areas. The magnitude of this transient trade confirms that Vancouver is the automobile retailing centre of British Columbia.

![Graph showing out-of-town sales and dealer's advertising expenditure over time.]

**FIGURE 11**
**ADVERTISING EXPENDITURE AND OUT-OF-TOWN SALES**

Although the transient sales curve roughly mirrors the advertising curve in Figure 11, there are important deviations. The most notable exception occurs during the latter weeks of August—whereas advertising remained almost constant, out-of-town sales rose dramatically. This phenomenon reflects an annual recreational event near the dealership, which doubtless draws thousands of people past the showroom.

There is a positive correlation between distance and sales—the average distance travelled by consumers typically increases as advertising expenditures rise. This is the
implication drawn from Figure 12. Median distance, being less affected by extremeties, remains surprisingly constant throughout the year.

Specific statistics appear in Tables XIII and XIV. Simple correlation coefficients between the distance and sales variables were typically about .25. Although correlations between advertising and distance data are also very low, it is impossible to conclude that promotion does not "pull" consumers from a wide geographical area.

![Graph showing units sold, average distance, and median distance over time.](image-url)
## TABLE XIII
### RESULTS: DISTANCE AND ADVERTISING

### A. CRITERION - AVERAGE DISTANCE

<table>
<thead>
<tr>
<th>PREDICTOR</th>
<th>CONSTANT</th>
<th>REGRESSION COEFFICIENT</th>
<th>t-VALUE</th>
<th>R²</th>
<th>F-RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Total Advertising</td>
<td>16.26</td>
<td>.0027</td>
<td>1.52</td>
<td>.04</td>
<td>2.32</td>
</tr>
<tr>
<td>(2) Dealers Newspaper Lineage</td>
<td>16.87</td>
<td>.0009</td>
<td>1.58</td>
<td>.04</td>
<td>2.50</td>
</tr>
<tr>
<td>(3) Dealers Newspaper Lineage t-1</td>
<td>17.98</td>
<td>.0007</td>
<td>1.46</td>
<td>.02</td>
<td>1.31</td>
</tr>
</tbody>
</table>

### B. CRITERION - MEDIAN DISTANCE

<table>
<thead>
<tr>
<th>PREDICTOR</th>
<th>CONSTANT</th>
<th>REGRESSION COEFFICIENT</th>
<th>t-VALUE</th>
<th>R²</th>
<th>F-RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Total Advertising</td>
<td>9.85</td>
<td>.0003</td>
<td>.86</td>
<td>.01</td>
<td>.75</td>
</tr>
<tr>
<td>(2) Dealers Newspaper Lineage</td>
<td>9.78</td>
<td>.0001</td>
<td>1.20</td>
<td>.02</td>
<td>1.45</td>
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</tbody>
</table>
### TABLE XIV

RESULTS : SALES AND DISTANCE

#### A. CRITERION - UNITS SOLD

<table>
<thead>
<tr>
<th>PREDICTOR</th>
<th>CONSTANT</th>
<th>REGRESSION COEFFICIENT</th>
<th>t-VALUE</th>
<th>R²</th>
<th>F-RATIO</th>
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</thead>
<tbody>
<tr>
<td>Average Distance</td>
<td>32.52</td>
<td>.369</td>
<td>1.85 *</td>
<td>.06</td>
<td>3.44</td>
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<tr>
<td>Median Distance</td>
<td>19.89</td>
<td>1.932</td>
<td>1.13</td>
<td>.09</td>
<td>5.53 *</td>
</tr>
</tbody>
</table>

#### B. CRITERION - SALES DOLLARS

<table>
<thead>
<tr>
<th>PREDICTOR</th>
<th>CONSTANT</th>
<th>REGRESSION COEFFICIENT</th>
<th>t-VALUE</th>
<th>R²</th>
<th>F-RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Distance</td>
<td>57.88</td>
<td>5.893</td>
<td>2.22 *</td>
<td>.09</td>
<td>4.94 *</td>
</tr>
<tr>
<td>Median Distance</td>
<td>2.67</td>
<td>.002</td>
<td>2.53 #</td>
<td>.11</td>
<td>6.42 *</td>
</tr>
</tbody>
</table>

# significant at .01 level
‡ significant at .001 level
* significant at .05 level
@ significant at .005 level
SALES AND PRICE

List price is an unsatisfactory unit in which to measure the dealer's weekly sales volume. A given automobile's retail price varies as a function of: i) the customer's willingness and ability to pay, ii) the accessories he chooses and iii) the commissioned salesman's ability to exact a higher price. The many models offered by the dealer assures a continuum of prices.

Weekly sales data should generally display an inverse relationship between average price and units sold: if average price declines, unit sales should increase. In the regression analysis, positive coefficients for average price contradict economic theory. However, a number of factors may be operating in the market to explain this situation. For instance, during periods of heightened marketing activity, intense "trading-up" by consumers will cause a direct relationship between average price and units sold. When new models are introduced, prices are relatively high, but so are sales. If a particular model is in heavy demand, there will be a direct correlation between price and sales. As a further example, price may be lowered to stimulate sales--if consumers do not react quickly, or are influenced by other patronage motives, unit sales will not increase substantially to assure the inverse relationship.

Price is known to be an omnipotent factor in automobile buying behavior. Approximately eleven percent of the weekly sales volume can be explained by differences in the average
price of the units sold. In Table XII, equation five, average price is a very significant predictor of sales ($t$ 2.53). Although, correlations between average price and sold units are low, this probably reflects the averaging process.

**OTHER PREDICTIVE EQUATIONS**

In the multiple regression equations, low $t$-values and negative coefficients were consistently observed for the dealer's broadcast expenditure variables. If radio and television variables are added to the equations of Table XV, the percentage of explained variance does not improve. Unfortunately, zero advertising expenditures on broadcast media during many weeks makes present evaluation of radio and television impossible.

A low level of prediction was also associated with the manufacturer's newspaper advertising variable. Appendix A illustrates the poor performance of equations containing this factor. Removing the effect of the dealer's newspaper advertising from each regression in Table XVI, the insignificant partial correlation coefficients show that almost none of the dealer sales variance can be attributed to the variance in the manufacturer's local advertising expenditure. In fact, Table XVIII suggests there was little correlation between the manufacturer's sales and his local newspaper advertising policy. Little coordination was also observed between the advertising appropriations of franchisor and franchisee. However, this analysis is incomplete as the manufacturer's national advertising figures could not be secured.
<table>
<thead>
<tr>
<th>PREDICTOR</th>
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<th>REGRESSION COEFFICIENT</th>
<th>t-VALUE</th>
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<th>F-RATIO</th>
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</thead>
<tbody>
<tr>
<td>(1) Dealers News. Lineage t-1</td>
<td>.010</td>
<td>4.69 @</td>
<td>.564</td>
<td></td>
<td>.40</td>
<td>10.51 @</td>
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<td>Median Distance</td>
<td>-48.91</td>
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<td>.58</td>
<td>.085</td>
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<td>10.97 @</td>
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<td>Average Price</td>
<td>39.653</td>
<td>2.77 @</td>
<td>.375</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Dealers Lineage t-1</td>
<td>.010</td>
<td>4.73 @</td>
<td>.568</td>
<td></td>
<td>.40</td>
<td>10.97 @</td>
</tr>
<tr>
<td>Average Distance</td>
<td>-42.78</td>
<td>.476</td>
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<td>.133</td>
<td>.39</td>
<td>15.81 @</td>
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<td>39.478</td>
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<td></td>
<td></td>
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<tr>
<td>(3) Dealers Lineage t-1</td>
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<td>4.95 @</td>
<td>.581</td>
<td></td>
<td>.39</td>
<td>15.81 @</td>
</tr>
<tr>
<td>Average Price</td>
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<td>2.78 @</td>
<td>.373</td>
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<td></td>
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# significant at .01 level
@ significant at .005 level
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<th>PREDICTOR</th>
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<th>t-VALUE</th>
<th>PARTIAL CORRELATION COEFFICIENT</th>
<th>$R^2$</th>
<th>F-RATIO</th>
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<td>4.74 @</td>
<td>.569</td>
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<tr>
<td>Median Distance</td>
<td>21.94</td>
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<td>.091</td>
<td>.34</td>
<td>8.41 #</td>
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<td>.014</td>
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<td></td>
</tr>
<tr>
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<td>.003</td>
<td>4.79 @</td>
<td>.573</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Average Distance</td>
<td>24.44</td>
<td>.143</td>
<td>.84</td>
<td>.122</td>
<td>.35</td>
<td>8.58 #</td>
</tr>
<tr>
<td>Average Price</td>
<td>.403</td>
<td>.08</td>
<td>.012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Dealers News. Lineage $t-1$</td>
<td>.003</td>
<td>5.01 @</td>
<td>.586</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Price</td>
<td>26.99</td>
<td>.412</td>
<td>.08</td>
<td>.012</td>
<td>.34</td>
<td>12.58 ¥</td>
</tr>
</tbody>
</table>

# significant at .01 level
¥ significant at .001 level
* significant at .05 level
@ significant at .005 level
SEVERAL VARIABLES AS PREDICTORS OF SALES VOLUME

Successive elimination of uninteresting results reveals that the more significant multiple regression equations contain the price, distance and lagged dealer newspaper lineage variables. The best predicting equation is that represented by regression three, Table XV. Thirty-three percent of the variance is explained by the dealer's lagged newspaper lineage variable and almost fourteen percent by the average price. The probability of obtaining an F-ratio as great as 15.81 if the two parameters were random occurrences is less than .001. Consequently, we must conclude that dealer newspaper lineage and price have an effect on sales volume. Of course, this leaves 60 percent of the variance to be explained by all other factors.

If an additional factor, namely average distance is added to equation three (Table XV), it may help account for part of the variation previously unexplained. As equation two, Table XV shows, the addition of the distance variable has not given a much better fit. Similarly, no other factor examined in the regression analysis improved the statistics of equation three.

SUMMARY AND CONCLUSIONS

Remembering that conclusions based on regression analysis are tentative, here is a summary of the major findings of this exploratory study.
Sales and Dealer Newspaper Lineage

The automobile dealer appropriated most advertising dollars to newspapers. Regression estimates indicate that sales volume is significantly related to the newspaper lineage variable. The behavior of the lineage variable also confirms the existence of cumulative advertising effects—consistent improvements in statistical measures result when this variable is lagged one week. Greater lags do not improve predictive ability. If cumulative advertising effects are slight, a policy of continuous advertising seems appropriate.

Distance

Two axioms of marketing geography are substantiated in the study: i) other things equal, people prefer to purchase automobiles near their residences if they are able to do so; ii) as the spatial distribution of customers increases, the greater must be the attraction to pull transient trade. At higher levels of advertising pulsation, the average distance travelled by automobile purchasers typically increases. That median distance remains surprisingly constant suggests existence of a time-distance limit, beyond which consumers are unwilling to travel. Weekly oscillations in out-of-town sales also suggest that such patronage is related more to holidays and other events than it is to advertising. In this instance, retail location is an important determinant of sales.
Price

Throughout the year, the average price of an automobile approximated $3000. This figure does fluctuate from week to week, crudely reflecting the actual purchase price of each model. Yet the addition of average price to the multiple regression equations reduces the unexplained variance significantly. Positive coefficients for average price are disturbing, but many extraneous influences are probably operating.

Other Variables

Inadequate data gathering and measuring procedures probably reduced the usefulness of other variables subjected to regression analysis. Intuitive reasoning would imply that weather is related to automobile sales—aggregating daily rainfall data no doubt mars this influence. Because radio and television were used infrequently, this paper is unable to ascertain whether or not the dealer's broadcasting variables are crucial determinants of sales. Finally, the manufacturer's local newspaper advertising apparently bears little relationship to his sales or those of the dealer. However, this finding is speculative in that it neglects the contribution of the franchisor's national advertising campaign.

Further Research

The findings of this study are interesting as a confirmation of a priori reasoning. Models of the advertising process must consider many more variables if the sales effects of
advertising are to be measured. Chapter IV outlined some of these factors which may apply to the automobile retailing situation. Regression estimates on one year's data are hardly conclusive—the sales response to advertising is complex and dynamic. More research on the unique data of many firms is needed if advertising axioms are to be supported. Only then will advertising theory grow from its present fetal stage to maturity. Only then will the findings of advertising research have general applicability.
BIBLIOGRAPHY

A. BOOKS


B. PERIODICALS


C. UNPUBLISHED MATERIALS


APPENDIX A
### TABLE XVII

**RESULTS : REGRESSION OF UNITS SOLD ON DEALER AND MANUFACTURER ADVERTISING VARIABLES**

<table>
<thead>
<tr>
<th>PREDICTOR</th>
<th>CONSTANT</th>
<th>REGRESSION COEFFICIENT</th>
<th>t-VALUE</th>
<th>PARTIAL CORRELATION COEFFICIENT</th>
<th>R²</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Dealers Total Advertising</td>
<td>31.56</td>
<td>.006</td>
<td>2.27 *</td>
<td>.309</td>
<td>.106</td>
<td>2.90 *</td>
</tr>
<tr>
<td>Manu. News. Expenditure</td>
<td>- .000</td>
<td>-.08</td>
<td>-.011</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Dealers News. Expenditure</td>
<td>27.92</td>
<td>.009</td>
<td>3.93 @</td>
<td>.489</td>
<td>.248</td>
<td>8.10 #</td>
</tr>
<tr>
<td>Manu. News. Expenditure</td>
<td>0.000</td>
<td>.03</td>
<td>.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Dealers News. Lineage</td>
<td>29.87</td>
<td>.003</td>
<td>3.89 @</td>
<td>.486</td>
<td>.246</td>
<td>8.00 #</td>
</tr>
<tr>
<td>Manu. News. Lineage</td>
<td>- .000</td>
<td>-.27</td>
<td>-.039</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) Dealers News. Lineage t-1</td>
<td>28.35</td>
<td>.003</td>
<td>4.92 @</td>
<td>.579</td>
<td>.343</td>
<td>12.58 #</td>
</tr>
<tr>
<td>Manu. News. Lineage t-1</td>
<td>- .000</td>
<td>-.058</td>
<td>-.008</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*# significant at .01 level
¢ significant at .001 level
* significant at .05 level
@ significant at .005 level
### TABLE XVIII
COMPARISON OF MANUFACTURER'S MONTHLY SALES AND ADVERTISING CYCLES

<table>
<thead>
<tr>
<th>MONTHS</th>
<th>% OF MANUFACTURER'S CARS SOLD</th>
<th>% OF ANNUAL ADVERTISING BUDGET</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>8.52</td>
<td>1.38</td>
</tr>
<tr>
<td>February</td>
<td>9.32</td>
<td>2.23</td>
</tr>
<tr>
<td>March</td>
<td>7.52</td>
<td>6.57</td>
</tr>
<tr>
<td>April</td>
<td>7.65</td>
<td>13.31</td>
</tr>
<tr>
<td>May</td>
<td>10.44</td>
<td>12.71</td>
</tr>
<tr>
<td>June</td>
<td>8.79</td>
<td>16.74</td>
</tr>
<tr>
<td>July</td>
<td>7.58</td>
<td>13.98</td>
</tr>
<tr>
<td>August</td>
<td>7.69</td>
<td>2.21</td>
</tr>
<tr>
<td>September</td>
<td>6.44</td>
<td>13.02</td>
</tr>
<tr>
<td>October</td>
<td>8.30</td>
<td>4.67</td>
</tr>
<tr>
<td>November</td>
<td>9.03</td>
<td>9.89</td>
</tr>
<tr>
<td>December</td>
<td>8.72</td>
<td>2.99</td>
</tr>
</tbody>
</table>
PROGRAM USED TO COMPUTE
MEDIAN AND AVERAGE DISTANCES

DIMENSION X(70), Y(70), XY(70), XBAR(70)

C X=XCORD, Y=YCORD, SY=COMPUTED DISTANCE, SBAR=AVERAGE DISTANCE

K=-18
1 FORMAT(I2, 2X, 19(2F2.0))
XD=14
YD=9
10 CONTINUE
K=K+19
L=K+18
READ(5, 1) IWEK, (X(I), Y(I), I=K, L)
IF(Y(L)-0.) 11, 11, 10
11 CONTINUE
K=-18
C TEST FOR NO. OF AUTS WITHIN METER AREA
L=1
12 CONTINUE
IF(X(L)-0.) 13, 13, 14
13 XY(L)=(((X(L)-XD)**2)+(Y(L)-YD)**2)**0.5
L=L+1
G0 TO 12
14 CONTINUE
C CHECK FOR OUT OF TOWN SALES
LCAL=L-1
15 CONTINUE
    IF(Y(L)-0.)17,17,16
16 XY(L)=Y(L)
      L=L+1
      G0 T0 15
16 LTOT=L-1
C  HAVE COMPUTED ALL DISTANCES
C  NOW RANK ORDER DISTANCES
    CALL LSORT(X,LTOT,)
C  COMPUTE MEDIAN
    FTOT=LTOT
    FTAT=FTOT/2.
    FTIT=LTOT/2.
    NTOT=FTIT
    IF (FTAT-FTIT)17,17,18
17 NMED=NTOT
      FMED=(XY(NTOT) + XY(NTOT 1))/2.
      G0 T0 19
18 FMED=XY(NTOT+1)
19 CONTINUE
    FSUM=0.
      D020 I=1,LTOT
20 FSUM=FSUM+XY(I)
      FDIS=FSUM/FTOT
C  WRITE OUTPUT
99 FORMAT(14H00WEEK NUMBER0,12)
100 FORMAT(15H00TOTAL SALES00,F10.5)
101 FORMAT(19H00AVERAGE DISTANCE0,F10.5)
102 FORMAT(18H00MEDIAN DISTANCE0,F10.5)

WRITE(6,99) IWEK
WRITE(6,100) FTOT
WRITE(6,101) FDIS
WRITE(6,102) FMED

103 FORMAT(1H0,19F4.1)
WRITE(6,103) (XY(L),L L,TOT
STOP
END