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A MICROANALYTIC SALES FORECASTING MODEL FOR NEW INDUSTRIAL PRODUCTS

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FOR DISCUSSION PURPOSES ONLY

BACKGROUND OF THIS PAPER

This paper is based on a research project on the use of quantitative approaches in the management of marketing information. The authors invite comments from interested readers.

Introduction

Developing the sales forecast is one of the most difficult problems of preparing a financial analysis for a new product investment decision. This paper discusses an approach which is designed to assist the persons responsible for the sales forecast of new industrial products prior to their introduction. The proposed model is specifically oriented toward predicting the growth rate of the new product in its early years. Although the model utilizes the "build-up" concept that is often used in industrial sales forecasting, the results of research on industrial buying behavior may be explicitly incorporated into the use of the model.

Since the forecasting requirements cannot be separated from the complete financial analysis, the model is designed to be an integral component of an economic analysis model. The first part of the paper will briefly describe the relationship of this micro-analytic model to the broader decision problem. The next two parts of the paper will discuss the behavioral elements underlying the model and the proposed mathematical formulation.

It should be emphasized that the purpose of this paper is to present a way of thinking about the forecasting problem and to illustrate it more concretely by using a specific model. The model is not intended to be applicable to all forecasting problems for new industrial products. Rather, we are hypothesizing that more relevant information exists in the firm than is normally used in the more traditional approaches to forecasting. We hope to demonstrate this by drawing upon some results of research on industrial buying behavior which show the many factors that are important in developing industrial sales forecasts. By showing how these factors might be incorporated into a mathematical model that can easily be used by marketing managers, we argue that valuable information existing in a firm can be incorporated into the forecasts for new products.

The Problem of Sales Forecasting

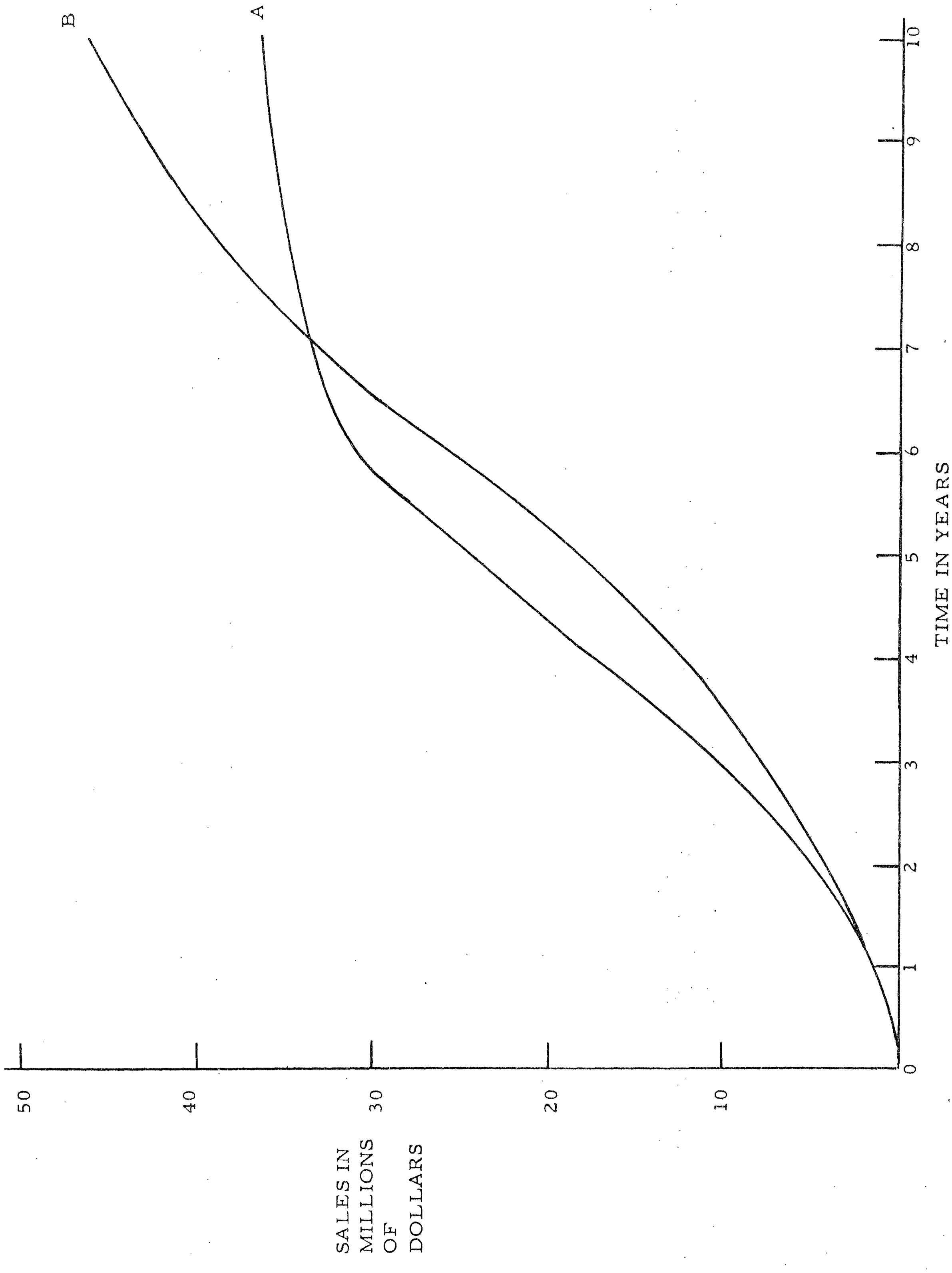
When a company is evaluating the profitability of introducing a new product that requires large capital investments, there is always a problem of accurately estimating the size and timing of unit sales for various marketing alternatives. The decision to accept or reject a new-product investment proposal is usually very sensitive to the sales forecasts. We are assuming that the relative importance of a sales forecast can only be assessed in the context of the complete financial analysis problem. Thus, the forecasts to be derived from the model discussed here are designed to be inputs into a more formal financial analysis project of the type described by Root [16]. Also, data collected by Tull [18] indicate that there are usually large errors associated with new-product sales forecasts. The justification for this model, therefore, is that sales forecasts are important and difficult to develop.

One of the most difficult components of the forecast for a new product is the growth rate of the sales in the early years. The most difficult aspect of forecasting is illustrated by a simple example of the effects brought about by the timing of the sales of a new product. Figure 1 shows two estimates of dollar sales for a proposed new product. These two forecasts have approximately the same dollar sales over the ten-year period, but if these are discounted using an 8 per cent rate, the present value differs by $6.2 million. That is, the present value of curve A is $138.7 million while that of curve B is $132.5 million.

Since many companies consider present value an important financial criterion, the effects of the growth rate of a new product may mean the difference between the acceptance or rejection of a new product proposal. Growth rate is therefore an important element of the forecasting problem. Equally important is the fact that the growth rate of the sales of a new product affects the cash flows and profits of the new product after it is introduced.

It is usually expected that a firm has some ability to influence the rate of growth of the new product by a particular marketing strategy. The forecasting approach, therefore, should be sensitive to changes in the marketing strategy being evaluated. It is also impor-

FIGURE 1


A
B
0
1
2
3
4
5
6
7
8
9
10
TIME IN YEARS
10
20
30
40
50
SALES IN
MILLIONS
OF
DOLLARS

tant, of course, that the forecast take into account the assumed reaction of competitors. Furthermore, the behavior of potential customers must be made as explicit as possible in order to evaluate the effects of a marketing strategy under assumed competitive conditions.

Given the importance of the forecast--particularly the timing and other factors that must be considered when developing it--the forecaster should be willing to use every available piece of information. One way to do this is with a microanalytic demand model, which Philip Kotler has defined as:

> ...one which specifies the intervening behavioral variables and sequences occurring between the reception of stimuli and its crystallization in action. Here interest centers in explicating exactly what transpires when customers are exposed to particular marketing and environmental stimuli. [8, p. 54]

Although the model to be developed here may not completely satisfy all of the requirements of Kotler's definition, we feel it is a step in the right direction.

The model discussed here is limited to those new products for which there is a small number of major potential customers. Thus it can be assumed that the introducing firm has or can economically obtain extensive information on various characteristics of each of these customers. The model is also intended for those products which can be purchased for trial use, such as raw materials or components--for example, a new chemical or a new electronic component. It should also be applicable to such things as a new aircraft for commercial air-lines or a new kitchen arrangement for institutional customers like military installations. Corfam, for example, would have met these conditions; there were probably no more than 50 or 60 major customers who could be expected to account for most of the early sales, and each of these customers could adopt Corfam on one or two particular price lines of shoes without deciding whether to convert totally to Corfam.

Behavioral Elements of the Forecasting System

The basic assumption of this model is that the amount of the new product used in any period by a potential customer is a function of certain characteristics of that customer, the marketing strategy employed, and the actions of competitors.

The estimate of the total potential usage by customer i of the generic product, P_i (as opposed to the introducing company's particular brand), is probably one of the easier factors to estimate for each potential customer. For example, in the case of an aircraft company introducing a new aircraft to the airlines, P_i for each airline would be the total number of planes owned by that airline which this plane might replace. In the Corfam example P_i would be the total quantity of leather used by shoe manufacturer i which Corfam might replace.

The model proposed here is mathematically described as:

$$S(t) = \sum_{i=1}^{n} P_i M_i(t) F_i(t)$$

where $S(t)$ is the total estimated unit sales in period t for all n customers when P_i is the total annual potential usage and

$$S(t) = \sum_{i=1}^{n} P_i M(t) F_i(t) - \sum_{i=1}^{n} P_i M(t-1) F_i(t-1)$$

when P_i is the total potential usage.

Each potential customer also needs to know the maximum fraction of the business that is potentially obtainable for the specified combination of marketing strategy and competitive reaction. This is denoted as Mi(t). For example, if it is assumed that there would be no competition from a similar new product, is it conceivable that 100 per cent of the potential could be obtained? If the customer has a strong preference for alternate sources, it may well be that 70 or 80 per cent would be the maximum expected share for the new product even under optimal conditions. The maximum share obtainable might be 100 per cent for a customer as long as competition doesn't have a similar product, but as soon as a competitor introduces a new product the maximum share might drop because of the customer's preference for the competing firm. It is also possible to introduce the effect of an expansion of the market by adjusting the Mi(t) estimate.

So far it has been shown how the actions of competitors and a single item of information about each potential customer, i.e., their total potential usage, would be incorporated into the model. We must now show how the effects of differences in the characteristics of each customer and different marketing strategies will be incorporated.

The function, $F_i(t)$, takes on values between 0 and 1 and represents the proportion of P_i converted to the generic new product by time period t. An assumption of this model is that this proportion is a function of both "individual needs and organizational needs" described by Webster [19, p. 256]. Ozanne and Churchill's [14] conceptual model suggests that the antecedents to the industrial adoption process "include the adopting firm's identity, the decision group's identity, and the participant's perceptions of the situation." Mansfield [13] lends support to this basic notion when he concludes that "the personality attributes, interests, training, and other characteristics of top and middle management may play a very important role in determining how quickly a firm introduces an innovation." Thus, the proportion used is a function of economic considerations and "extra-economic" considerations. Feldman and Cardozo [2] have broken this model down into three identifiable factors:

1. Economic factors
2. Risk preference
3. Resource allocation preference

In Cardozo and Feldman's model the objective, economic factors take on different relative weights depending on how the firm's risk preference affects its regard for the importance of each of these factors. Thus, each firm which is a potential customer may have a different optimum combination of economic factors depending on its particular risk preference. Since it is necessary for each of the potential customers to spend time and money determining what particular optimum combination of economic factors is best for them, their resource allocation preference affects the extent to which they are willing to seek this optimum combination. It may well be that they will settle for something less than optimal if time and money are scarce. All three of these factors are influenced both by characteristics of the particular firm and by the marketing strategy chosen by the introducing firm.

The problem with this latter model is that it is extremely difficult to measure both the concepts of risk preference and resource allocation preference. However, other work in the area of adoption of innovations by industrial firms and the intrafirm diffusion of these innovations yields several variables which may well act as surrogates for various dimensions of these two preferences. This same work has also determined several economic considerations which appear to be important. A discussion of each of the three factors in the Cardozo and Feldman model and possible surrogates for them will be briefly described before showing how they may be incorporated into the model.

A. Economic factors

Economic factors are those which have been historically associated with the rational, industrial buyer. In the classical "economic man" model of industrial buyer behavior, it is only necessary to consider these factors to be able to predict what a rational individual will do. Some of the factors which have been identified in the literature are:

1. Rate of return to be gained by incorporating the innovation in the operation of the firm. Mansfield [10] found a relation between this factor and the intrafirm rate of diffusion. He also found [13] that this factor is inversely related to the time for adoption.

2. Expected incremental profit or relative advantage to be realized from the innovation rather than from the alternatives. This advantage, discussed by Webster [20], can come about through an increase in revenues, a decrease in costs, or some combination of both.

3. Size of investment required to adopt the innovation has been discussed by Mansfield [13]. This is an economic factor but one that affects the buying firm's risk preference.

4. Webster [20] also found a relationship between the adoption decision and the firm's profitability trend, market share, and gross sales.

The economic factors listed are a result of both characteristics of the potential customers and the marketing strategy used in the introduction. Although the profitability trend, the market share, and the gross sales of the potential customers are primarily characteristics of the firm and are not influenced by the marketing strategy, the remaining economic factors are affected by the strategy. The rate of return to be gained, the expected incremental profit, and the size of the investment required can all be altered by a product development strategy which attempts to make the product as compatible as possible with each of the potential customer's individual needs. The pricing strategy will be directly related to each of these three economic factors. To the extent that the product minimizes quality control in the purchasing firm's plant, these three factors are also minimized. A firm can also accomodate a customer's needs by offering sales and technical service activities following the purchase of the product. If this latter approach is taken, the promotion of the product must stress the "post-purchase" portion of the total product package.

B. Risk preference

Scott Cunningham [4]describes perceived risk as "the perceived certainty of a given event happening and the consequences involved if the event should happen." Some of the variables which affect this factor are:

1. Size of firm. Mansfield [10 and 13] found that the size of the firm was inversely related to both the time before adoption and the rate of intrafirm diffusion. Thus it appears that the larger firm is better able to tolerate risk and

adopts earlier than the smaller firm. On the other hand, the rate of diffusion within the smaller firm may be more rapid than within the larger firm.

2. Time before adoption. The intrafirm rate of diffusion is increased as the time before adoption increases. It is suggested [10] that the risk involved decreases with time. This factor may help explain the difference in rates of diffusion between large and small firms.

3. Liquidity. As a firm's liquidity increases, so does its ability to tolerate risk. Accordingly, liquidity has been found to be directly related to the intrafirm rate of diffusion [10] and to the decision to adopt [20] .

4. Aggressive or self-confident management. Webster [21] feels that this characteristic of management should have a direct bearing on the firm's preference for risk.

5. Vertical versus horizontal integration. Sutherland [17] detected a relationship between the organization of the firm and the speed of adoption: vertically integrated firms have a tendency to adopt before horizontally integrated firms. Although the reasons aren't clear, it can be argued that this could have an

effect on the firm's ability and willingness to tolerate risk.

6. Information provided by selling firm. Webster [20] contends that this factor can have a significant effect on the extent of risk perceived by the adopting firm.

7. Size of investment. As the size of the investment required increases, the consequences of a wrong decision increase and, thus, so does the risk involved.

It would seem that a firm's preference for risk and the affect of risk on that firm's willingness to adopt a particular new product would have little relation to the marketing strategy used in the introduction of the new product. But consider the factors listed above. Certainly the promotional strategy would have a direct effect on the information provided, and the price and product strategy would have a direct effect on the size of the investment required. The remaining factors listed above are primarily characteristics of the firms. However, the fact that the time before adoption has an effect on the intrafirm rate of diffusion does imply that there will be revisions in strategy after introduction. Once the product has been introduced, it may be worthwhile to alter the marketing strategy to account for expected differences between early and late adopters.

C. Resource allocation preference

The preference for resource allocation is exhibited by a willingness to spend time and money evaluating innovations which are offered by various selling firms. Some factors which are related to and are part of this preference are:

1. Rate of internal new-product development. Webster [21] found that firms doing a greater amount of new-product development than other firms also spent a greater portion of their time evaluating new products.

2. Technical progressiveness. Carter and Williams [3] developed a procedure whereby firms could assess their relative degrees of technical progressiveness, which is a measure of their propensity and ability to introduce new products. Thus, this technical progressiveness relates, in turn, to item 1 above.

3. Internal capability for evaluating new products. It would seem apparent that this factor should be related to the resource allocation preference, since some degree of preference has already been exhibited by the firm's willingness to develop such capabilities. Empirical evidence also supports this relationship as discussed by Webster [21].

Although the rate of internal new-product development and the technical progressiveness of the firm are not subject to changes in the marketing strategy, the internal capability for evaluating new products can be subject to the strategy employed. Isn't it possible to enhance a firm's capability to evaluate new products by providing the necessary technical and marketing information which is most compatible with a firm's particular approach to evaluation? If so, then the resource allocation preference could also be affected.

A Model for the Growth Rate Element

We must emphasize that the model to be discussed is only an example of a possible class of models which might be used. This model, which uses a Weibull distribution [6], was selected because of the flexibility of the distribution. Until this model is evaluated through use in a particular situation, it must remain tentative.

The basic equation is of the form:

$$F(t) = 1 - [\exp -(t-a)^{b} / c] \tag{1}$$

where $t \geq a$, b positive, c positive and $F(t) = 0$ for $t < a$.

It can be seen that the use of a Weibull distribution implies that $F_i(t)$ increases as a function of time. That is, there is no point in time where the potential customer's use of the new product goes from 0 to 100 per cent. This would seem to be a reasonable assumption given that the customer perceives risk in conversion to the new material or component.

The parameter a is the location parameter and defines that point in time when the usage rate begins to rise (see Figure 2.) In terms of the model proposed here, then, the value of parameter a describes the length of the period between the introduction of the new product and its adoption by the particular firm. This model defines the time of adoption as that point in time when the product is first accepted for use on a trial basis. Thus, the trial period becomes a part of the period when the firm's use goes from 0 to 1.0, the intra-firm diffusion period. A positive evaluation by the adopting firm will result in a continuous rise in the usage, while a negative evaluation will result in either discontinuance, which would mean a return to the old product, or stabilization of the usage at the level achieved during the trial period. Either eventuality can be shown by a change in the value for $M_i(t)$ for the period t when such a negative evaluation would be expected.

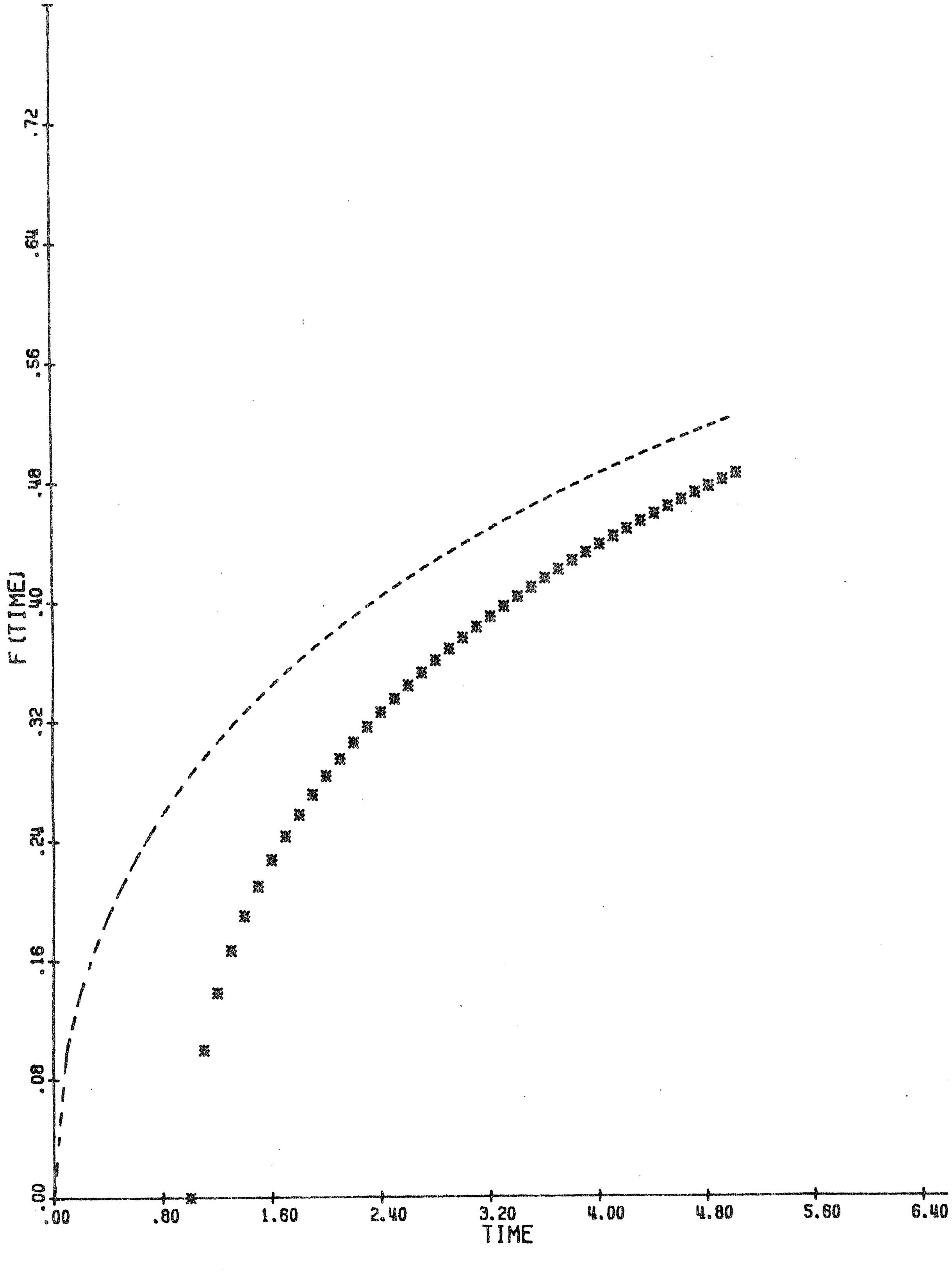
Parameter b is the shape parameter and is used to describe the path followed in going from 0 to 100 per cent usage. To better understand the role of b in this model, it is necessary to introduce the concept of instantaneous adoption rate, Z(t). This function is defined as

$$(2) \qquad Z(t) = f(t)/1-F(t)$$

$$\text{where } f(t) = dF(t)/dt.$$

In this discrete case, Z(t) is the number of units to be converted in a given period divided by the number of units not yet

FIGURE 2
KEY: DASHED=(A=0, B=.5, C=3) ASTERISKS=(A=1, B=.5, C=3)



converted to the new product. It can be shown for the simple Weibull distribution that

$$(3) \qquad Z(t) = \frac{b}{c}(t-a)^{b-1}$$

This function is an increasing function for $b>1$, a decreasing function for $b<1$, and a constant for $b=1$. The effect on F(t) of changing b while holding parameters a and c constant can be seen in Figure 3.

Parameter c controls the length of time it takes for the firm to go from 0 to 100 per cent usage. It does this by directly affecting the instantaneous adoption rate, Z(t). This relation can readily be seen by examining equation (2) with $b=1$; then $Z(t) = \frac{1}{c}$. Parameter c is inversely related to the instantaneous adoption rate, which makes it directly related to the time required for completing intrafirm diffusion. Figure 4 illustrates the effect on F(t) of changing c and holding parameters a and b constant.

This brief description of the model is intended to show how the model may be used to incorporate the previously mentioned results from studies on industrial adoption and diffusion. Parameter a is directly related to the time before a firm adopts, parameters b and c both relate to the firm's intrafirm rate of diffusion, and the variable $M_i(t)$ can be used to account for trials and evaluations which prove to be unsuccessful. It is this flexibility of the model and potential for close correspondence to research findings on industrial buyer behavior which make the model attractive to the authors.

FIGURE 3

KEY: DASHED=(A=0,B=.5,C=2) ASTERISKS=(A=0,B=3,C=2)

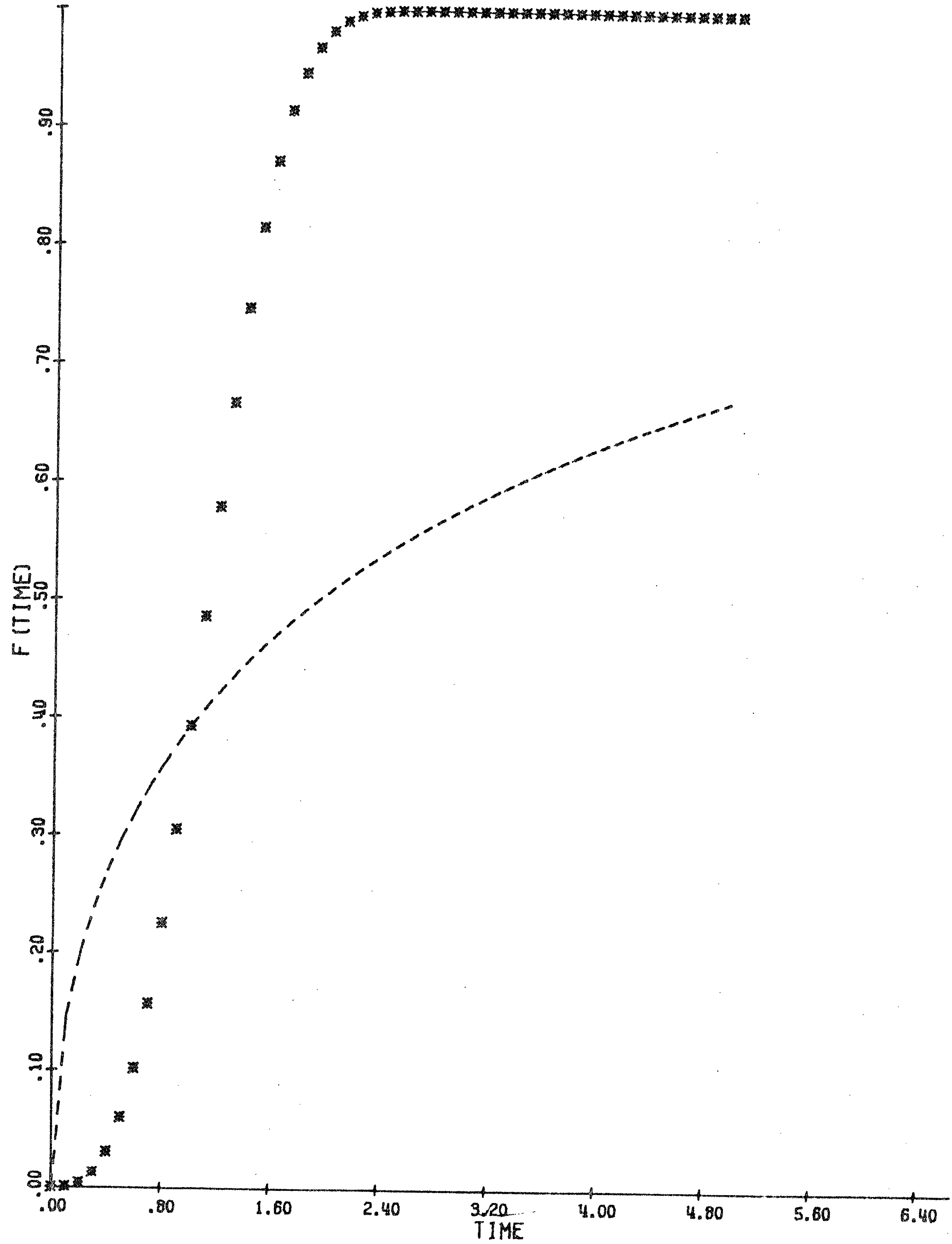
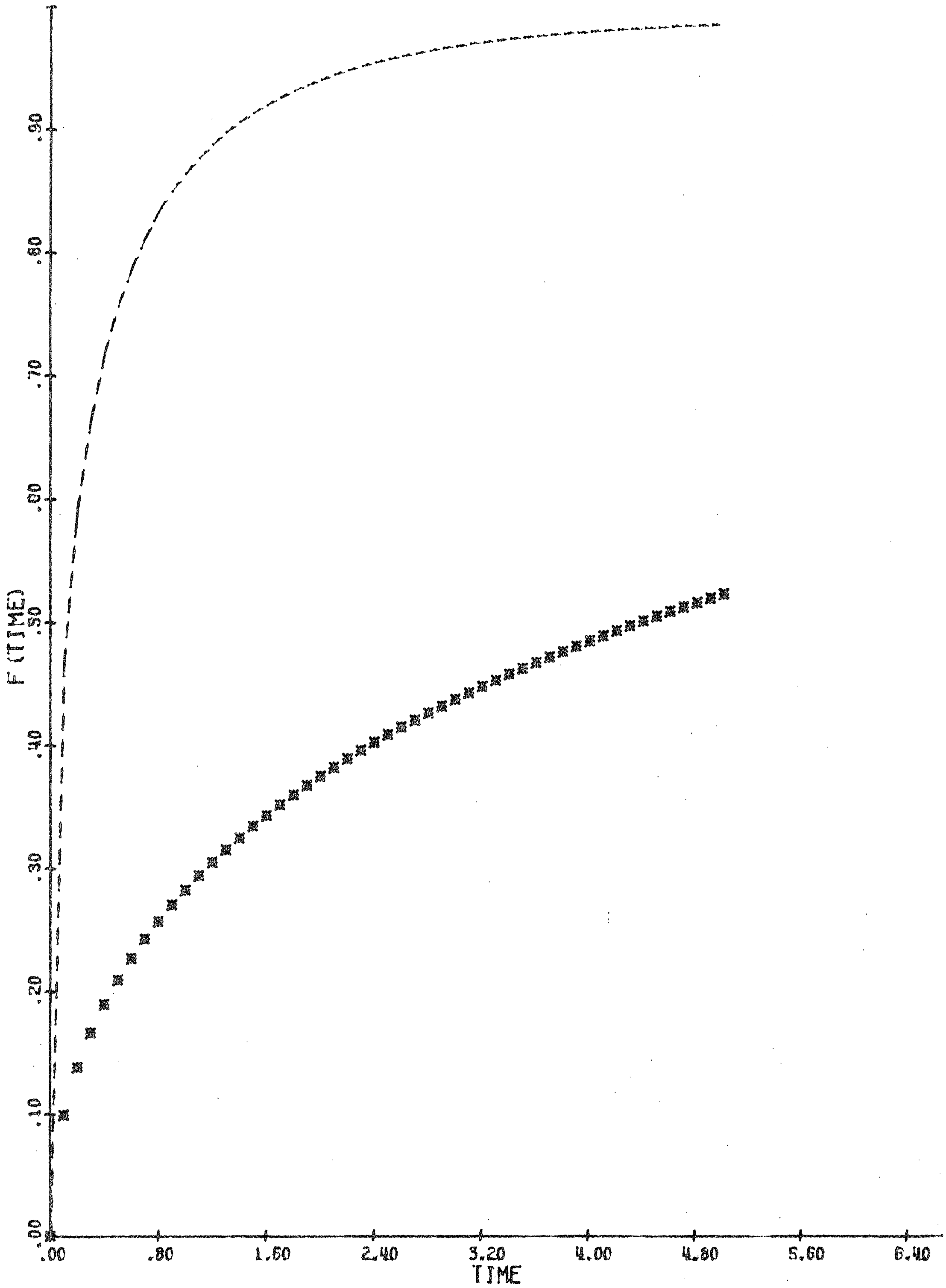


FIGURE 4

KEY: DASHED=(A=0,B=.5,C=.5) ASTERISKS=(A=0,B=.5,C=3)



It is possible to envision instances where one wishes to change the shape of the growth curve of use in a discontinuous fashion. This may be necessitated by a major change in the marketing strategy at some time in the future, or it may be required to show the effects of significant changes in the uncontrollable variables in the marketing environment such as economic conditions, technology, and so forth. To accomodate such an occurrence, the user of the model may wish to change the parameters b and c over time. This can be done by using the composite Weibull, which is defined as

$$(4) \qquad F(t) = F_j(t) \text{ for } S_j \leq x \leq S_j+1, \; j=0, 1, 2 \ldots \gamma$$

This is known as an γ-component composite Weibull, as described by Kao [6] , where the j^{th} component in cumulative density function form is:

$$F_j(t) = 1\text{-}\exp[-(t-a)^{bj}/cj]$$

Thus, the parameter values of equation (1) can assume different values for different time periods.

Obtaining Parameter Estimates

One of the major advantages of using this model is that the estimates of the parameters are specific functions of the information discussed in the section, "Behavioral Elements of the Forecasting System." This is evidenced by the relationship between parameters a and time before adoption and between parameters b and c and the intrafirm rate of diffusion. It is thus possible to incorporate directly the findings of research on adoption and diffusion into this model.

The relationship described in the paragraph above makes it possible for the practitioner to use the model. The first step would be to describe the relationship between various independent variables and the three parameters by analyzing the data from previous new-product introductions. The relationship could then be used to produce a preliminary sales forecast for each potential customer over the planning period of interest. If the model is put into a computer, the forecast could be illustrated on a screen through the use of video display units for those knowledgeable about the specific customer. It would then be possible to alter the parameters in accordance with additional subjective or objective information. The effects of these revisions to the parameters on both the individual customer's forecast and the overall forecast could be observed. Sensitivity analysis of this type could prove beneficial in determining additional information needs.

Once the product had been introduced, the parameters could be adjusted in the light of this additional information. They might be used as observed, or they might be combined with the a priori estimates described in the preceding paragraph to obtain new posterior estimates for updating the sales forecasts. If the parameter estimates could never be verified, the proposed model would be of little value because it could never be improved. Since this model can be empirically tested, it is possible to continually modify and improve it.

In the Appendix, parameter estimates are provided for ten hypothetical customers. No attempt is made to justify the parameter estimates by assigning any characteristics to the firms. The F(t)'s are then computed for each of the firms and the estimates of P(t) and M(t) are used to generate estimates of annual unit sales. These sales forecasts for individual customers are summed and the totals plotted. The resulting sales curve has a shape which appears to be reasonable.

Summary and Recommendations

The goal of this paper was to provide a method of generating annual unit sales forecasts by utilizing information about (1) a proposed marketing strategy, (2) assumptions on competitive actions, and (3) individual customer characteristics. We do not claim that this goal has been fully achieved. It is evident that achieving this goal is difficult, but the direction for achieving it is now more visible.

Although the approach discussed in this paper has many obvious weaknesses, we feel that it could be refined to improve current simulation approaches. Kotler's paper [7], which is a simulation approach to the growth of sales with different competitive strategies, also has many assumptions which can never be verified, even with future data. We feel, however, that this approach has been worthwhile and should be pursued further. The flexibility of the three-parameter Weibull distribution, the model's capacity for readily integrating new research findings, and its sensitivity to changes in marketing strategy and competitor's actions are the main reasons for maintaining interest in the proposed model. One further advantage is that the model is constructed in such a fashion that it implicitly suggests possible revisions to the marketing strategy.

Data on the sales of new industrial products will be gathered concurrently with efforts to improve the model, so that posterior estimates of the parameters can be made. Additional research will be conducted on the use of the model by managers charged with developing forecasts for new product proposals.

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APPENDIX

Parameter Estimates

Potential Customer	Parameter a	Parameter b	Parameter c
1	1.0	1.0	3.0
2	1.5	1.0	3.0
3	.5	1.0	2.0
4	.5	.5	1.0
5	1.0	.5	3.0
6	1.5	.5	2.0
7	2.0	1.5	3.0
8	1.7	1.5	1.0
9	.5	2.0	3.0
10	1.0	1.5	1.0

Customer 1

Period	F(t)	P	M(t)	S(t)
1	.0	13,000	1.0	0
2	.2835	13,000	1.0	3,685
3	.4866	13,000	1.0	6,326
4	.6321	13,000	1.0	822
5	.7364	13,000	1.0	957
6	.8111	13,000	1.0	1,054
7	.8647	13,000	1.0	1,124
8	.9030	13,000	1.0	1,174
9	.9305	13,000	1.0	1,210
10	.9502	13,000	1.0	1,235

Customer 2

Period	F(t)	P	M(t)	S(t)
1	.0	4,000	1.0	0
2	.1535	4,000	1.0	614
3	.3935	4,000	1.0	1,574
4	.5654	4,000	.5	1,131
5	.6886	4,000	.5	1,377
6	.7769	4,000	.5	1,554
7	.8401	4,000	.5	1,680
8	.8854	4,000	.5	1,771
9	.9179	4,000	.5	1,836
10	.9412	4,000	.5	1,882

Customer 3

Period	F(t)	P	M(t)	S(t)
1	.2212	2,000	1.0	442
2	.5276	2,000	1.0	1,055
3	.7135	2,000	1.0	1,427
4	.8262	2,000	.4	661
5	.8946	2,000	.4	716
6	.9361	2,000	.4	749
7	.9612	2,000	.4	769
8	.9765	2,000	.4	781
9	.9857	2,000	.4	788
10	.9913	2,000	.4	793

Customer 4

Period	F(t)	P	M(t)	S(t)
1	.5069	25,000	1.0	12,673
2	.7062	25,000	1.0	17,655
3	.7943	25,000	1.0	19,858
4	.8460	25,000	.8	16,920
5	.8801	25,000	.8	17,602
6	.9042	25,000	.8	18,084
7	.9219	25,000	.8	18,438
8	.9353	25,000	.8	18,706
9	.9458	25,000	.8	18,916
10	.9541	25,000	.8	19,082

Customer 5

Period	F(t)	P	M(t)	S(t)
1	.0	16,000	1.0	0
2	.2835	16,000	1.0	4,536
3	.3759	16,000	1.0	6,014
4	.4386	16,000	1.0	7,018
5	.4866	16,000	1.0	7,786
6	.5254	16,000	1.0	8,406
7	.5580	16,000	1.0	8,928
8	.5860	16,000	1.0	9,376
9	.6105	16,000	1.0	9,768
10	.6321	16,000	1.0	10,114

Customer 6

Period	F(t)	P	M(t)	S(t)
1	.0	3,000	1.0	0
2	.2978	3,000	1.0	893
3	.4579	3,000	1.0	1,374
4	.5464	3,000	1.0	1,639
5	.6076	3,000	1.0	1,823
6	.6538	3,000	1.0	1,961
7	.6904	3,000	1.0	2,071
8	.7205	3,000	1.0	2,162
9	.7457	3,000	1.0	2,237
10	.7672	3,000	1.0	2,302

Customer 7

Period	F(t)	P	M(t)	S(t)
1	.0	18,000	1.0	0
2	.0	18,000	1.0	0
3	.2835	18,000	1.0	5,103
4	.6105	18,000	.5	5,495
5	.8231	18,000	.5	7,408
6	.9305	18,000	.5	8,374
7	.9759	18,000	.5	8,783
8	.9925	18,000	.5	8,932
9	.9979	18,000	.5	8,981
10	.9995	18,000	.5	8,995

Customer 8

Period	F(t)	P	M(t)	S(t)
1	.0	12,000	1.0	0
2	.1515	12,000	1.0	1,818
3	.7729	12.000	1.0	9,275
4	.9694	12,000	.25	2,908
5	.9975	12,000	.25	2,993
6	.9999	12,000	.25	3,000
7	1.0000	12,000	.25	3,000
8	1.0000	12,000	.25	3,000
9	1.0000	12,000	.25	3,000
10	1.0000	12,000	.25	3,000

Customer 9

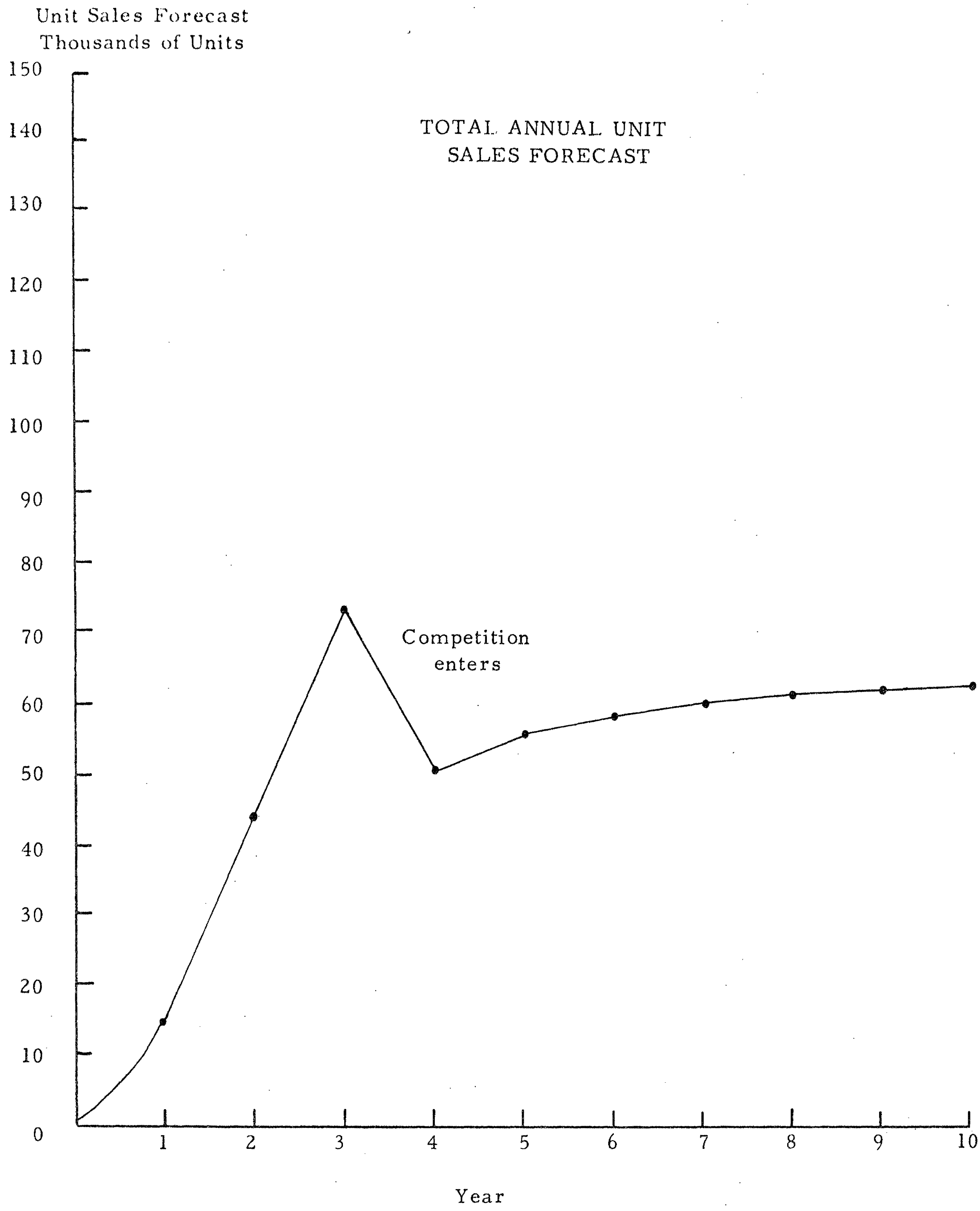
Period	F(t)	P	M(t)	S(t)
1	.0800	20,000	1.0	1,600
2	.5276	20,000	1.0	10,552
3	.8755	20,000	1.0	17,510
4	.9831	20,000	.5	9,831
5	.9988	20,000	.5	9,988
6	1.0000	20,000	.5	10,000
7	1.0000	20,000	.5	10,000
8	1.0000	20,000	.5	10,000
9	1.0000	20,000	.5	10,000
10	1.0000	20,000	.5	10,000

Customer 10

Period	F(t)	P	M(t)	S(t)
1	.0	5,000	1.0	0
2	.6321	5,000	1.0	3,161
3	.9409	5,000	1.0	4,705
4	.9945	5,000	1.0	4,973
5	.9997	5,000	1.0	4,999
6	1.0000	5,000	1.0	5,000
7	1.0000	5,000	1.0	5,000
8	1.0000	5,000	1.0	5,000
9	1.0000	5,000	1.0	5,000
10	1.0000	5,000	1.0	5,000

Annual Unit Sales Forecast

Potential Customer	Period									
	1	2	3	4	5	6	7	8	9	10
1	$ 0	$ 3,685	$ 6,326	$ 822	$ 957	$ 1,054	$ 1,124	$ 1,174	$ 1,210	$ 1,235
2	0	614	1,574	1,131	1,377	1,554	1,680	1,771	1,836	1,882
3	442	1,055	1,427	661	716	749	769	781	788	793
4	12,673	17,655	19,858	16,920	17,602	18,084	18,438	18,706	18,916	19,082
5	0	4,536	6,014	7,018	7,786	8,406	8,928	9,376	9,768	10,114
6	0	893	1,374	1,639	1,823	1,961	2,071	2,162	2,237	2,302
7	0	0	5,103	5,495	7,408	8,374	8,783	8,932	8,981	8,995
8	0	1,818	9,275	2,908	2,993	3,000	3,000	3,000	3,000	3,000
9	1,600	10,552	17,510	9,831	9,988	10,000	10,000	10,000	10,000	10,000
10	0	3,161	4,705	4,973	4,999	5,000	5,000	5,000	5,000	5,000
Totals	$14,715	$43,969	$73,166	$51,398	$55,649	$58,182	$59,793	$60,902	$61,736	$62,403


Unit Sales Forecast
Thousands of Units
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
TOTAL ANNUAL UNIT
SALES FORECAST
Competition
enters
1
2
3
4
5
6
7
8
9
10
Year

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