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A SYSTEMS MODEL OF A MAGAZINE
PUBLISHING FIRM

by

ROGER ISHAM HALL

A dissertation submitted in partial fulfillment
of the requirement for the degree of

DOCTOR OF PHILOSOPHY
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Department

Date

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Date: 17 April 1973

We have carefully read the dissertation entitled A Systems Model of a Magazine Publishing Firm

submitted by
Roger Isham Hall in partial fulfillment of
the requirements of the degree of Doctor of Philosophy
and recommend its acceptance. In support of this recommendation we present the following
joint statement of evaluation to be filed with the dissertation.

The reading committee has read the subject dissertation and believes that it is a substantial contribution to the field of Business Administration in the development of a simulation model and its interpretation with reference to the subject of this study.

This study investigated the underlying causes for the financial difficulties of many magazine companies, several of which have failed in the past few years, such as Look, Life, and the Saturday Evening Post.

The methodology of system dynamics is applied to modeling a typical large magazine publishing company to simulate the interrelated flows and accumulations in the system of subscribers, advertising pages, editorial pages, revenues and expenses. The assumptions built into the model are tested by an empirical study using data covering a twenty year period of operations of the old Saturday Evening Post. A computer simulation was designed on which experiments were conducted to trace over time the impact in changes of management decisions. From this an understanding of the cause and effect relationship resulting from certain management decisions were identified.

The computer program was also used to examine the specific decisions made by the management of the old Saturday Evening Post and from an interpretation of the results, an attempt was made to generalize the findings. The implications of the methodology employed contributes to the construction and understanding of cooperate simulation models.

DISSERTATION READING COMMITTEE:

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Doctoral Dissertation

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CHAPTER I

INTRODUCTION

Considerable interest has been generated recently in the plight of the large publishing firms. For instance, the Curtis Publishing Company was eclipsed in 1969 with the death of the Saturday Evening Post after a series of panic measures that included cancelling subscriptions to reduce its circulation and going biweekly to reduce production costs. More recently, the Cowles Communications Inc. announced a planned reduction in circulation and advertising rates of the Look magazine, following a period of financial loss (Dougherty, April 21, 1970) and stopped publication in 1971. A similar move was made by the Time Inc. over its magazine Life following a poor reported financial performance. An article in the Wall Street Journal (October 2, 1970) summarized these moves as:

"Life is the fifth major magazine this year to announce circulation cuts amid sharply rising publishing, printing and postal costs... Life's circulation cutback struck industry sources as inevitable, and less drastic than two other possible moves about which there has been speculation. One is cutting the page size, as McCall's will do next February. The second is switching to biweekly from weekly, as the Saturday Evening Post did four years before it died."

At the time of their crises, each of these magazines reported its highest circulation and largest advertising revenue. What can be the explanation for such a paradoxical situation wherein a record circulation and revenue is associated with a poor profit performance? If the cause is sharply rising publishing, printing and postal rates, one cannot help to wonder whether reducing circulation will improve the profit performance, since reducing circulation also reduces circulation

and advertising revenue proportionally. The editor of the Saturday Review suggests that the problems of the large circulation magazines stems from two sources, namely: the deficit made on each magazine sold that has to be made up by advertising, and the high promotion expenditure caused by the substantial increases in the cost of acquiring additional readers (Saturday Review, November 7, 1970). Friedrich (1970, p. 477) suggests that the management of the magazine is responsible for the situation, since with bigness comes a multitude of managerial problems concerning controlling and coordinating the diverse activities of a host of specialists hired to run the publishing empire. He notes (Friedrich, 1970, p. 15 and p. 125) that the Curtis Publishing Company in the early 1960's employed about eleven thousand people coordinated by thirty vice-presidents, whilst the editorial staff of its largest circulation magazine numbered only 125 persons. In his opinion, the leadership (or lack of it) and not the editorial policy brought about the company's decline (Friedrich, 1970, p. 478):

"The decisive fact is that the Post was part of our competitive economic system - a system it had glorified as long as it suffered little competition itself - and magazines, like everything else within this system, survive not because they are good or bad but because they make a profit. And they make a profit not because of their inherent quality but because somebody is hard at work on the relationship of costs to revenues. That involves the price of ink and the weight of paper and the financing of subscription offers and many other details that do not interest people who like to talk about the publishing business as a matter of changing life styles. To be a successful magazine editor today (and perhaps in any day) means to leave the actual process of editing to someone else and to join in the process of managing a business, and to manage a business, in turn, means to control costs, to negotiate contracts, to make speeches, to sell the product, and to lead a public life far beyond

the level of the people who actually create what the company sells. What I am saying, to put it another way, is that a skillful management could have made a profit from Emerson's Post, or Blair's Post, or even Sherrod's Post, but that no amount of editorial genius could have made up for the failings of the various rulers of the Curtis Publishing Company."

And yet, is it credible that a large number of the leading magazines are being mis-managed simultaneously? In spite of keen competition with other large circulation magazines and other mass-communications media such as T.V., the circulation and revenues of these magazines continue to grow. This suggests that the pathology of magazine publishing is, perhaps, a complex phenomenon.

The Dynamics of Publishing

The economics of a magazine publishing firm is complicated by the fact that its revenues come from two different but related sources, namely, advertising revenues and circulation revenues. They are related by the number of readers of the magazine. Circulation revenues are obviously directly related to the readership. Advertising revenues, on the other hand, are indirectly related to readership since the price that advertisers are prepared to pay for magazine advertising space depends, to a large extent, upon the exposure of their advertisements. Also, if companies tend to finance readership growth out of current revenues, then the level of readership is also dependent, over time, upon itself. This suggests that a magazine publishing company may be viewed as a rather complex system of parts dynamically related over time, and that a systems study of magazine publishing may provide a convenient starting point for analyzing the interplay of the various forces at

work in shaping the destiny of a company. We may start by asking how much does the structure of the system account for the observed behavior of large firms. This study will attempt to answer this question.

Objectives of the Study

The main objective, therefore, is to make a systems study of magazine publishing in order to find out how it works. The means for achieving this are: (1) to construct a model of a typical magazine publishing firm what will incorporate the dynamic interrelatedness of the parts of the publishing system, (2) to make an empirical study of a magazine publishing firm to test the assumptions built into the model and to provide the coefficients necessary to operationalize a simulation version of the model, and (3) to use this model as a vehicle for analyzing the impact of management decisions through the system over an extended time period.

Research Typology and Methodology

This piece of research should be classified, perhaps, as 'integrative', since the concepts used to build the model of a magazine publishing firm are borrowed from a number of fields of study. For example, the notions of stable relationships of the firm with its environment (such as the price and volume relationships) are economic in flavor. The financial accounts provide the beginning point of the model building exercise, which relies on accounting concepts. The performance measures that are used to stimulate decision making are basically financial.

The methodology employed is also drawn from a number of fields. However, the focus of the study concerns conceptualizing a magazine

publishing firm as a system of dynamically interrelated parts, with the purpose in mind of explaining the characteristic behavior of the firm in terms of the structure of the system. The interrelationships mentioned can be either physical flows, such as magazine readers and cash, or information flows, such as the current value of a performance measure. This part of the study utilizes Industrial Dynamics (Forrester, 1961 and 1968, and Meier, Newell and Pazer, 1969) as a meta-theory or a model for constructing the model, since the model itself constitutes a theory of how the system works. Thus, it should be stressed that the major theoretical input to the study is Industrial Dynamics (also known by the name System Dynamics).

Industrial Dynamics as a System's Meta-Theory

Industrial Dynamics, which has also been referred to as the Theory of Structure (Forrester, 1968a), is based upon the concept of a bounded system of interrelated parts. These parts comprise the essential system 'states' and 'activities' that characterize the firm's gross behavior with its environment. For example, the level of readership of a magazine can be conceptualized as a system 'state' that changes from one time period to the next in response to the system 'activities', such as the inflow and outflow of subscribers to the readership level. The movement of readers in and out of the level of readership might be a function of the magazine's volume, price and appeal in comparison with other magazines. The dynamic feed-back characteristic of the system is imparted by the component interrelationships. For example, the cost of producing the magazine can be described as a function of the volume of the magazine (number of pages), which in turn is related to the amount of

advertising purchased, which in its turn is related to the level of readership, and so on. In this manner, a typical magazine publishing company can be conceptualized by a system of temporally interrelated parts. The 'art' in this kind of modelling lies in choosing a level of conception that includes the smallest number of components that will adequately describe the system (the firm and its environment), in drawing the boundary around the system to include the essential interrelationships that constitute the system's behavior, and, at the same time, allowing the smallest number of exogenous inputs that influence behavior.

Once conceptualized in the fashion described above, the system can be analyzed as if it were a wiring-diagram of a self-controlling electronic device. Concepts from Control Engineering can be borrowed to facilitate the analysis of the system. For instance, some of the system's dynamic behavior can be predicted by identifying 'positive' feed-back loops (groups of parts forming a closed circular pattern of interrelationships) that will cause unrestrained growth in response to a change in the system, and 'negative' feed-back loops that will tend to counteract or limit system changes. If the system is too complex for this kind of analysis alone, then one can resort to a computer simulation model. The programming language DYNAMO (Pugh, 1970) provides a ready made kit to assemble such a simulation model.

The Industrial Dynamics view of a company and its environment leads to the notion that the structure of the system accounts for a large part of the company's own peculiar growth and development. Complex systems with many feed-back loops can give rise to 'counter intuitive'

situations, whereby the intuitive judgemental decisions made by people in the system may, on occasion, not correct an out-of-control situation and may even make it worse. Magazine firms when viewed as a dynamic information feed-back system exhibit such situations, as will be elaborated upon in later chapters.

Research Strategy

Using Industrial Dynamics as a meta-theory, a model of a magazine publishing company was conceived as a system that includes the relationship among subscriptions sold, subscription 'rates', advertising sales, advertising 'rates', magazine volume pages, revenues, expenditures and performance measures. This part of the study was subjective in nature since the identification of the significant parts of the system and their interrelatedness was made from a review of the literature of magazine publishing. This consists of books concerning the rise and fall of one large publishing empire, case studies concerning the problems of controlling various aspects of magazine publishing, business articles relating to significant events in the magazine publishing industry and the chairmens' reports and financial statements of selected companies. It is doubtful whether another person would come up with exactly the same model, even when given the same informational inputs. Luckily, there is a research strategy that helps to minimize the chance of including irrelevant variables and leaving out relevant variables.

The soundness of any model, as measured by its ability to mirror reality, can be approached from two directions. Either the validity of the assumptions built into the model can be tested or the ability of the

model to predict outcomes can be demonstrated. Obviously, if both can be achieved simultaneously, then the model is a very sound one indeed. However, in practice we are rarely in this idyllic position and we have to build up confidence in our model from one direction or the other, depending upon the problem presented by the environment in gathering data and by the objectives of the study. Since the objective of this study is to use the model to understand how the system of magazine publishing works, rather than to build a model for some normative purpose, the former strategy of validating the assumption has been pursued. Fortunately, the wealth of data about the magazine publishing industry that is available over a period of twenty years or so, makes it possible to test empirically the assumptions built into the model. Therefore, we can have confidence in this partial model, because it is, so to speak, well anchored to reality through empirically based and statistically tested assumptions. This partial model tries to capture the essence of the publishing system; for example, how it reacts to changes instigated by the management of a magazine (such as changes to subscription or advertising 'rates'). It does not attempt to model the management's decision making behavior, as for example, what variables under its control to change and by how much to change them in response to information fed back from the system. Therefore, because it is not a complete model, its predictive abilities cannot be compared with the actual behavior of companies as a means of validating the model. An attempt to complete the model and perform this acid test of simulation models would constitute a major piece of research and is outside the scope of

this study. In the meantime, the problem of testing the assumptions of the partial model will be pursued.

~~The assumptions built into the model consist of the relationships~~ posited by the model. These were tested by applying the model to a particular magazine, namely, The Saturday Evening Post. Data covering a twenty year period of the history of this magazine were collected and submitted to a 'Stepwise Linear Regression' computer program that screened out the irrelevant relationships, computed the 'coefficients of regression' for the equations of relationships, measured the reliance that could be put on these coefficients and estimated the proportion of the observed behavior that could be ascribed to these posited relationships. The model was converted into a simulation model by expressing these relationships as 'time difference equations' as prescribed by the DYNAMO computer language. The model was primed with the 'coefficients of regression' and with the initial conditions prevailing for the company at a particular time, and let to generate twenty or so years of simulated company history. It was used as a test-bed for carrying out experiments. For example we may ask: what is the effect of a small change in the advertising 'rate' charged by the company? The results of such an experiment enable us to trace the impact of the change through the system, thus facilitating an understanding of those characteristics of behavior imparted by its structure.

As mentioned before, the original model was not expected to be a satisfactory predictor of the company's actual long-run behavior because it purposefully neglected the decision making behavior of the firm. It contained only the key relationships of the firm with its environment

but treated the decision variables as constants. It was as if the senior management of the firm took an extended vacation but fixed the advertising and subscription 'rates' and other such important policy determinants before they left. However, this did not detract from the use of the model as a vehicle for experimenting with the system, since the key relationships built into the model had been derived with a known statistical reliability.

Lastly, the effects of special events were added to the model. These events caused temporary distortions to the otherwise stable relationship built into the model. For example, the effect of paper rationing during World War II on the Saturday Evening Post was to reduce the number of pages in the magazine. The consequent saving in printing and paper costs raised its profits to unprecedented heights, which, so to speak, changed its destiny and set the scene for some of its future difficulties.

Limitations of the Study and Weaknesses of the Model

Although the model was constructed from the information available concerning a number of magazines, it was tested on only one magazine publishing company. Therefore it should be classified as a single firm model. However, some of the assumptions built into the model can be demonstrated to hold for many magazine publishing companies.

The process of building a model automatically involves the simplification of reality. The model presented in this study is no exception to this rule. The firm simulated was a multi-magazine publishing company; yet the model assumes a single magazine. It would not be impossible to simulate a multi-magazine company but the effort and complications

involved in doing this would be unlikely to justify the increase in precision. In fact, there might be no increase in precision, since the analysis of such a complex system may break down. But the causal relationships at work in publishing a magazine can be uncovered in the simpler model which still captures enough of the essence of reality to give reliance to the results.

One assumption of the model was particularly hard to verify. This concerned the relationship of the trial readers acquired by a magazine and its promotional expenditure. Not only is this an extremely sensitive subject for most publishers who are loath to divulge the information, but, when promotional expenditures are reported in the financial statements of companies, they are usually aggregated with other selling expenditures. The amount of this expenditure for the company simulated was broken-out of the financial statements over a period of twenty years as an aggregation of the expenditure on all of the company's five or six magazines. An estimation was made as to how much of this was spent on the particular magazine under study. The crucial assumption is not whether this estimate is accurate, but whether the proportion of total expenditure spent on the magazine in question remained constant over the period of the study. The Regression Analysis performed on the data tends to justify this assumption, but, naturally, there will always be room for doubt.

The strength of the assumptions of the model varied considerably. One measure for this is the ratio of the 'coefficient of regression' to the 'standard error' of the coefficient; the higher the ratio, the more reliance can be put on the assumed relationships. In Econo-

metric studies, for example, a ratio of one-to-one is thought to be acceptable. For this study the smallest ratio exceeded 2.5 to 1 and the largest was of the order 30 to 1. Taking into account the number of data points available (usually twenty), these results would seem to be acceptable for this kind of empirical study.

A basic assumption underlying the study concerns the automatic adjustment for changes in the value of money. The decision to pass on inflationary costs to the consumer is not considered to be a decision in this model. Similarly, the decision not to pass on inflationary costs is assumed to be a deliberate decision to reduce prices. The results of the empirical study seem to justify this assumption. For example, there is a very clear demand schedule for advertising pages in specific magazines, when the advertising rates are expressed in constant dollars. This relationship is much less clear when expressed in current dollars, since the value of money was roughly halved during the twenty years of the study. Unfortunately, there seems to be little precedence for deflating money values in a study of this kind. It is justified here because it works.

Finally, the model assumes stable relationships with its environment. This naturally limits the study to mature magazines that have passed through the unstable birth stages and have acquired a steadily growing clientel. Nor does the study cover the death throes of ailing magazines whose advertising clientel have deserted it, thus upsetting the previously stable relationships. Nevertheless, between these limits, a magazine (as will be demonstrated) can pass through the considerable

metamorphosis of charging a low subscription 'rate' and a high advertising 'rate' to charging a high subscription 'rate' and a low advertising 'rate' and back again, and from being a low circulation magazine to being a mass-circulation magazine.

Possible Significance of the Study

This study is the first to be reported that conceptualizes magazine publishing as a system and attempts to analyze the behavior of the system in terms of its structure. It must also be one of the first, if not the first study to utilize a research strategy that constructs an Industrial Dynamics model from empirically derived and statistically tested relationships. Researchers conducting similar systems studies of firms in other industries have pursued the other strategy of using the predictive ability of the model as the means of validating the assumptions built into it. As the authors of one such study note (Roberts, Abrams and Weil, 1968, p. B-675):

"Empirical data were not available sufficiently to permit use of statistical techniques for deriving some critical market relationships Industrial Dynamics methodology does not insist upon such data availability, although added confidence in the model formulation does result when derivation of relationships can be enhanced by statistical analysis methods."

The method of constructing this model suggests a way of systematizing the construction of corporate models. Also, the conclusions drawn from this study suggest that this kind of modelling could be refined as a tool for investigating the decision making processes of firms. In that it allows one to investigate the long-term stability of a firm and the impact of executive decision making and certain critical events upon

this stability, it holds some promise as a tool for financial analysis.

CHAPTER II

THE MAGAZINE PUBLISHING INDUSTRY

In 1970 there were more than 750 'consumer magazines' rolling off the presses in the United States (Business Week, 1970). They are usually referred to as 'consumer magazines' by the advertising industry which views them as providing an audience for its promotions. The advertising industry clearly assumes that the subscribers are influenced by magazine advertising, for it provides a large part of the total revenue for most magazine publishers. The advertising industry, as a whole, provided the magazine industry with annual revenues of over one billion dollars by 1969 (Dougherty, November 17, 1969). Advertising sales, for example, provided somewhere between 65 and 75 per cent of the magazine operating revenues for the Curtis Publishing Company during the two decades 1940 to 1960 (Moody's Industrial Manual). Similarly, advertising sales provided the Time Incorporated's book and magazine publishing business with some 60 to 70 per cent of its total operating revenues during the decade 1960 to 1970 (Time Incorporated, 1970). On the other hand, smaller circulation and more specialized magazines rely less on advertising revenues as the chief source of income. For example, the Atlantic Monthly Magazine derived only 33 per cent of its operating revenue from advertising sales in 1959 (Anthony, Dearden and Vancil, 1965), but by 1963 this had moved up to 44 per cent. Similarly, advertising revenue from the Playboy magazine contributed less than one per cent to the sales revenue of the HMH Publishing Company in 1955, but by 1961 this figure had risen to 36 per cent (Smith, Christensen and Berg, 1965). We can conclude that small circulation magazines with a specialized audience tend to rely more on

circulation sales as their source of income than large-circulation magazines. This is as one would expect when one takes into account the mode of launching a magazine.

Characteristics of Magazine Growth

The following description of how a typical magazine is launched and grows is based on sources concerning the mechanism of magazine publishing (Business Week, 1970; Anthony, Dearden and Vancil, 1965; Smith, Christensen and Berg, 1968; Friedrich, 1970; Culligan, 1970; Harvard Business School, 1959). A magazine is launched with some specialized niche of the market in view. For example, the Saturday Evening Post was originally launched as a literary magazine. Since, at this stage a magazine has no established readership, its sponsors must rely on newsstand sales as the principal outlet and source of revenue. The magazine has to have some basic appeal which can be exploited to achieve the necessary sales volume and to charge a cover price high enough to be financially viable. One editor of a small but growing specialist magazine describes the formula for success as (Business Week, 1970, p. 68):

"A magazine today must be visceral. . . . It must hit readers where they live and think."

At the same time, regular subscriptions to the magazine can be solicited; thus guaranteeing a regular clientel and regular source of revenue for planning future activities. Once so established, advertising space can be offered at a competitive price geared to a guaranteed circulation. The revenue generated from advertising sales results in a substantial increase in total revenue which brings the magazine's management to a point where several expansionist policies can be pursued. The

magazine's size (number of pages) can be increased to embrace more content of interest to a wider audience. That is, it can be moved in the direction of becoming a more popular magazine with the expectation of attracting more readers. For example, the Saturday Evening Post grew in size from an average of a 96 pages per issue in 1938 to an average of 150 pages in 1950. Alternatively, the owners can spend more on promoting the magazine. There are a multitude of promotional means such as increasing the availability of newsstand copies through generous commissions on sales and repurchasing unsold magazines, door-to-door selling with own or another agencies salesmen, and mass-mailing reduced price subscriptions. Each method has its advantages and disadvantages. Whereas newsstand sales are an efficient means of promotion in the early years of a magazine's life when its 'visceral' appeal is high, if a thicker magazine is produced to broaden its appeal, then the cost of over-runs (i.e. producing more copies than will be sold in order to increase the newsstand availability) may become prohibitive, and more efficient promotional means must be sought. This is particularly true if the management of the magazine cannot or does not choose to pass on the extra cost of publishing a thicker magazine to the reader. A comment in a business article concerning successful specialist magazines reflects this point (Business Week, 1970, p. 68):

"With circulation confined almost exclusively to newsstand sales, Cosmo regularly sells more than 90% of its print run, despite a steady increase in its cover price, from 35¢ to 75¢. Most publishers are happy with a 70% to 80% newsstand sale."

The decline in newsstand sales as circulation grows is illustrated in the following quotation concerning the Life and Look magazines (Dougherty,

May 10, 1970):

"In 1949 when Life's total circulation was just over 5.3 million, over 1.9 million of these copies were sold at the cover price (on news-stands). For Look it was 1.29 million out of just over 3 million.

Last year, however, of Life's 8.59 million only 275,000 were sold from the (news) stands and 302,000 of Look's 7.8 million."

The fact that a magazine has regular subscribers commits its management to engage in promotional activities, if only to replace those regular subscribers who, over time and for a variety of reasons, stop renewing their subscriptions. The more expansion-minded the management is, the more resources will be committed to circulation promotion. After all, advertising revenue, which now constitutes an important source of revenue, is geared to total circulation, so that the more readers there are, the more advertising revenue there will be. Expansion can be pursued in three other ways, namely, horizontal and vertical integration and diversification. By buying other magazines or by creating new magazines, a company expands horizontally. By owning its own printing works, papermill, forests and distribution network, a company expands vertically downwards to control its own raw material supplies, and vertically upwards to control its own outlets. Diversification into book publishing, Radio and T.V. is the third form of expansion. For example, the Curtis Publishing Company once held the reputation as the world's greatest integrated publishing company. It owned its own forests, produced, printed and delivered almost 200,000 tons of paper each year for its five or six magazines. However, the company declined to buy into the Radio and TV business. Time Incorporated, on the other hand, diversified into a communications conglomer-

ate that currently owns Radio and T.V. stations, publishes books as well as publishing some five magazines. However, its magazine printing is still contracted out to an independent printer.

Special Events

This growth pattern from small to large circulation and from specialist to popular is by no means a steady progression. Like any business, a magazine is subject to a number of special events that can vitally effect its growth. Unforseen incidents such as wars, strikes and technical changes can have a traumatic effect which may either foster or retard growth. Also the more subtile and creeping changes of a social nature that effect peoples tastes and life styles will have a cumulative effect over time on the growth of a magazine. Internal to the company, changes in editorial policy and management strategy will also leave their mark. Different editors and different presidents will redirect, or at least attempt to redirect, the magazine's course, and each era will be punctuated with critical situations that determined the future growth or decline of the magazine. The turbulent history of the Curtis Publishing Company and the Saturday Evening Post is a case in point. From a newspaper, reputed to have been started by Benjamin Franklin in 1728, it was launched as a literary magazine in 1821 under the guidance of Atkinson and Alexander, its then co-owners, and evolved into an illustrated popular literary magazine under the aegis of its most famous editor, George Horace Lorimer, from 1899 until 1936. Editor Ben Hibbs (1942-1961) espoused a set of values associated with middle america - loyalty, freedom and love of country - which connected with the prevailing war time mood to raise

The Post's circulation and profits to unprecedented heights. However, the change in social climate and competition with other mass-circulation magazines and communications media reduced its popularity in the post war years. In spite of this, the circulation continued to grow due to an aggressive circulation promotion policy. Editors Blair and Emerson (1962-69) had moved the magazine towards being an illustrated news weekly at the time of its death in 1969.

The owners and managers of the Curtis Publishing Company also had an impact on The Post's growth. In 1899, Cyrus H. K. Curtis, the owner of the successful Ladies Home Journal purchased the moribund Saturday Evening Post for \$1,000 and hired editor Lorimer. Curtis built the magazine into a vehicle for promoting the wares of the emerging giant public corporations. President Walter Fuller turned the company in the 30's and 40's into an integrated printing and publishing empire and his protege, Robert A. MacNeal, pursued this vertical empire building philosophy by purchasing a paper company for \$20-million in 1950. President Matthew Culligan, a man from the advertising industry, tried unsuccessfully to retrieve the sagging advertising sales (1962-1964) and President MacClifford (an expert cost-cutter with the nickname 'Mac-the-knife') performed the unpleasant surgical operation on the company's excess capacity (1964-1968). The editors and the presidents were, to a large extent, the products of the situations that brought them into power, and, also, agents in driving the magazine towards a future crisis that required new leaders with new skills to deal with it.

The Sub-Culture of Publishing

The people who work in the magazine industry are a part of a group sub-culture. They meet each other formally and socially to exchange views, ideas and do business. The industry collectively establishes measures of performance to compare the magazines. Editors tend to compare thickness, (number of pages), glossiness, and other more subjective measures of editorial content. Publishers tend to compare advertising pages and revenue. Presidents tend to look to total revenue, total assets and other measures of bigness. Pecking orders are established and when one magazine innovates, others will tend to follow. There is a natural rivalry for top or near top positions in the pecking order. At times this competition can be intense and almost senseless. For instance, the circulation war between the big three magazines is described by Dougherty (May 10, 1970) as: -

"In 1949, Life, with a circulation of more than five million had already pulled ahead of The Post, once the country's leading national advertising medium, which was still ahead of Look - 4 million to 3 million. And these are the one-two-three positions they held for at least a decade . . . And troubles for Life in the circulation war came in 1963, when Look which had passed The Post in 1961, moved into the number one spot. The figures were 7.49 million to 7.17 million And, oh, how Look rubbed it in. It ran ads with headlines such as, "Look is bigger than Life". . . . It was this sort of goading, several publishers thought, that led Life into taking what they considered a major tactical misstep. . . ."

It would seem that when the corporate ego gets involved, a company can take irrational actions.

Summary

Thus it appears that a magazine, like a living organism, is subject to a maturation process. It starts life with a small newsstand sales but a high basic appeal and expands its circulation to a size where it can solicit advertising sales and regular subscriptions. The advertising sales so increase the magazine's revenues that its existence becomes dependent upon the revenue from advertising and not from circulation sales. The increased size of the magazine resulting from the advertising and from the management's attempts to broaden its appeal, makes newsstand sales unprofitable due to the high cost of overruns needed to make the magazine available, and so newsstand sales decline. Finally (as was mentioned in Chapter I) for reasons that we have yet to investigate and understand, large magazine companies, whilst recording a record revenue and readership, fall into financial difficulties and attempt to remedy the situation by cutting circulation. Empirical data, concerning the mechanism of publishing a magazine, will be supplied in subsequent chapters.

CHAPTER III

A GENERAL MODEL OF A MAGAZINE PUBLISHING FIRM

This chapter describes the construction of a model of a typical magazine publishing company. In one respect, this model is an elaboration of an Accounting model of a firm. As Goetz has pointed out, there are certain similarities between Accounting and Industrial Dynamic models of a firm (Goetz, 1969, p. B-506):

"Accounting and Industrial Dynamics analogs are both assemblages of 'levels' and 'flows'. Accounting stresses the history of the enterprise, with budgeting as a projection of the accounting analog into the realm of prediction, as a speculative projected history. Industrial Dynamics models are built from historical data to be sure, but after construction they ignore history. They emphasize the behavior of the system; they are an attempt to construct an analog that 'works like' the enterprise"

From this point of view, the income and expense accounts of a firm can be viewed as an 'open system' model, since they simply record in dollar values the results of the interaction of the management's decisions with the firm's environment. They do not attempt to demonstrate how the firm's environment will react to the management's decisions or how the management will react to the performance measures computed from the accounts. On the other hand, a 'closed system' model attempts to capture these reactions. For example, imagine a firm in which the management's response to an unsatisfactory profit reported in the accounts is to increase the price of its goods. The firm's environment reacts to this price increase by buying less of the firm's goods. At the end of the accounting period (usually one year) the result is recorded in the accounts. The profit is now satisfactory but the sales revenue has declined or not grown as fast as

was expected. In response to this, the management decides to increase sales promotion activities. At the end of the next period, the sales have increased to a satisfactory level but the extra expenditure on sales promotion has reduced the profit, and so on. It is this latter aspect of the dynamic interrelatedness between the financial accounts, measures of performance based on the accounts, management's decisions based upon the measures of performance, the reaction of the firm's environment to the decisions and, the results of this interchange as reflected in the accounts, that completes the circle and forms a 'closed system'. The model to be described is based on this 'closed system' concept. The model could be described as a simple corporate model. However, it differs from most other corporate models in that it generates its own history from relationships built into it, rather than merely computing the financial results to be expected from a given sales forecast using company financial ratios based upon past performance (see Schrieber, 1970 for examples of corporate simulation models).

Overview of the Model

The relationships incorporated in the model of magazine publishing are conceived as four basic interrelated categories, namely, 'accounting information flows', 'measures of performance', 'managed variables' and 'relationships with the environment' (see Exhibit 3.1). The 'accounting information flows' represent the set of income and expense accounts of a magazine publishing firm. The relationship in this category, with noted exceptions, are simple additions of costs or extensions of prices and volumes derived in other parts of the model. The 'measures of performance' represent the key indices that are thought to influence

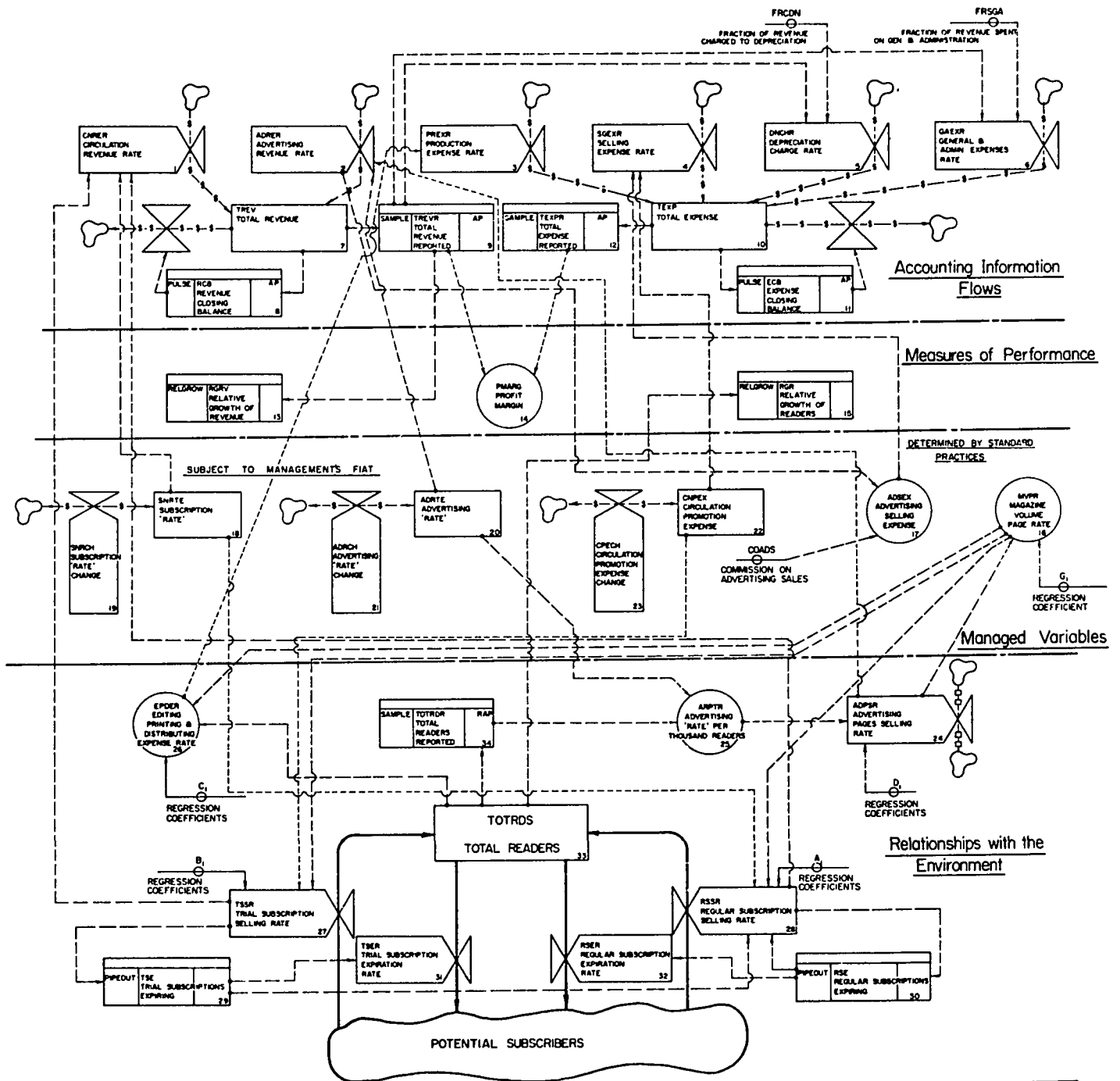
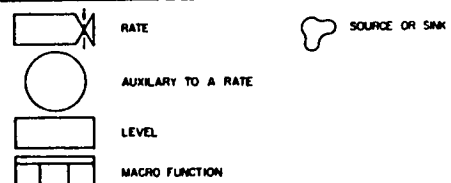


EXHIBIT 3.1
MODEL OF A MAGAZINE PUBLISHING FIRM



management decisions at the particular level of administration that the model is concerned with. These are computed from the accounting and readership information originating within the model. The 'managed variables' represent the major variables under the management's control. The model assumes that these variables alone will be manipulated by the management of a firm in response to the changes in the 'measures of performance'. There are two sub-categories of 'managed variables', namely variables 'subject to management fiat' and variables 'determined by standard practices'. The former variables are changed only by a conscious decision-making process initiated by changes to the 'measures of performance', but the latter variables are automatically adjusted by relationships governed by industry or company standard practices. Finally, the 'relationship with the environment' represent the firm's interaction with its principal marketing and technical environments. It concerns such things as the number of advertising pages sold and the number of subscriptions sold in response to the advertising and subscription 'rates' set by the management, and it concerns the cost of producing and distributing the magazine in response to the magazine's volume pages and total readership.

Note, however, that the model is still incomplete. We have not specified, nor can we with the present state of knowledge, how the management will respond to the stimulus provided by the 'measures of performance'. We do not know, for example, which of the 'managed variables' will be altered or by how much in response to a drop in the 'profit margin'. Nevertheless, we can use the model, uncoordinated as it is, to find out how good are the assumptions built into the publishing part of the model, and, if they are any good, how does the system

react to typical management decisions.

The following sources have been drawn upon in constructing this model of a typical magazine publishing firm: The Atlantic Monthly Company (Anthony, Dearden and Vancil, 1965); HMM Publishing Company (Smith, Christensen and Berg, 1965), Time Magazine (Harvard Business School, 1959), Time Incorporated (Time Incorporated, 1970), The Saturday Evening Post (Fiedrick, 1970 and Culligan, 1970), various articles concerning magazine publishing (Dougherty 1969, 1970 and 1970a; Wall Street Journal, 1970; Business Week, 1970 and Saturday Review, 1970), the published accounts and chairman's reports of Time Incorporated, Curtis Publishing Company and Cowles Communications Incorporated (individual Chairman's reports and Moody's Industrial Manual) and published industry statistics (Association of National Advertisers, 1969). The origin of the relationship among the various parts of the modelled magazine publishing system are so diffused throughout this literature that, with a few exceptions, it is not particularly useful to give citations. The reader should refer to the diagrammatic representation of these relationships (Exhibit 3.1) when reading the following detailed description of the construction of the model. Each circle or box in the diagram represents an equation. The dependent variable in the equation (the title in a circle or box) is dependent upon the variables in the other circles or boxes from which the arrowed lines emerge that impinge on the dependent variable. This dependent variable may itself be an independent variables in the equation for another dependent variable and so on. In this way, the model represents a feedback information system whereby every variable is defined by some other variable or constant. Accompanying the diagram is a

verbal description of each model relationship and a listing of the equations used to represent each relationship quantitatively within the simulation model. The principles behind the construction of the simulation model are explained in Forrester, 1968. The number within each circle or box in the diagram indicates the relevant equation in the text. Several different high-level computer languages, such as FORTRAN, could be employed in analyzing the model. However, DYNAMO is best suited for the study of the dynamic behavior in economic systems. It is specifically designed to represent the feedback closed loop structures which determine behavior, and it is extremely efficient in terms of the computing required for quite complicated simulation models. Thus, the model relationship are represented in equations compatible with DYNAMO. A complete explanation of DYNAMO is given in: Pugh, 1970.

Accounting Information Flows - A Starting Point

Industrial Dynamics embraces many kinds of flows, and relationships that are ignored in Accounting, which tends to report financial flows exclusively. Nevertheless, the financial accounts represent the major information system in any firm. They provide the basis for financial measures of the firm's performance and must therefore be expected to influence managerial decision making. This suggests that the financial accounts will provide a good starting place for building a model. As Goetz puts it: (Goetz, 1969, p. B-507):

"...the set of income and expense accounts provide a good beginning on the task of cataloging significant flows to be incorporated into an industrial dynamics simulation."

The set of income and expense accounts chosen to provide this starting

point in the task of cataloging significant flows of information for a typical magazine publishing company are: circulation revenue, advertising revenue, production expense, selling expense, depreciation charge and, general and administration expense. These accounts are conceptualized as continuous flows of information analogous to the continuous process of posting transactions in dollar amounts to particular accounts. In order to facilitate the comparison of the model with empirical data gleaned from such sources as company financial statements, these flows of information are expressed as annual rates of constant dollars. These rates of flow, however, are changing all the time in response to changes (such as advertising 'rate' change) derived from other parts of the model system.

The reporting process of Accounting is modelled by accumulating incremental flows of accounting information into 'levels' of 'total revenue' and 'total expense.' At the end of the simulated accounting period, the values of the quantities in the levels are sampled and stored for reporting purposes. The 'levels' are emptied, so that the accumulation of revenues and expenses can be repeated.

A detailed description of this accounting analog, accompanied by definitions of the relationship in DYNAMO notation (Pugh, 1970), follows:

Circulation Revenue

The circulation revenue rate of information flow is computed by a simple multiplication of the total subscriptions sold and an average subscription 'rate'.¹ It assumes that the full subscription 'rate' for

¹The magazine publishing industry uses the word 'rate' to connote 'price'. On the other hand, the same word is used in Industrial Dynamics terminology to mean 'rate of flow'. To avoid any confusion between the two uses of the word, when 'price' is implied the word 'rate' will be written within single quotation marks.

trial readers is recorded as revenue, and that any difference between the actual price that a trial subscriber pays and the average subscription 'rate' is charged to the selling expense account. Also, an average annual subscription 'rate' is used, for simplicity's sake, in place of the host of different subscription 'rates' offered by a magazine publisher.

$$\text{CNRER.KL} = (\text{TSSR.JK} + \text{RSSR.JK}) * \text{SNRTE.K} \quad 1, \text{R}$$

CNRER - circulation revenue rate (\$ per year)

TSSR - trial subscription selling rate (number per year)

RSSR - regular subscription selling rate (number per year)

SNRTE - subscription 'rate' (\$ per year per subscriber)

* is the DYNAMO multiplication operator.

Advertising Revenue

The advertising revenue rate of information flow is computed by multiplying the number of pages of advertising purchased in the magazine by the average advertising 'rate' charged by the publisher for each page. A simple average 'rate' is used in place of the several advertising 'rates' quoted by a publisher.

$$\text{ADRER.KL} = \text{ADPSR.JK} * \text{ADRTE.K} \quad 2, \text{R}$$

ADRER - advertising revenue rate (\$ per year)

ADPSR - advertising pages selling rate (pages per year)

ADRTE - advertising 'rate' (\$ per page)

Production Expense

The rate of flow of production expense information is determined by the interaction of the firm with its technical environment. This information is merely transferred from another part of the model and explained in another part of this chapter.

$$\text{PREXR.KL} = \text{EPDEX.K}$$

PREXR - production expense rate (\$ per year)

EPDEX - editing, printing and distributing expense
(\$ per year)

Selling Expense

The rate of flow of selling expense information is computed by the simple addition of the circulation promotion expense and the advertising selling expense.

$$\text{SGEXR.KL} = \text{CNPEX.K} + \text{ADSEX.K} \quad 4, R$$

SGEXR - selling expense rate (\$ per year)
 CNPEX - circulation promotion expense (\$ per year)
 ADSEX - advertising selling expense (\$ per year)

Depreciation Charge

Normally, the depreciation charge is derived from a company's asset account which includes the investment in such things as printing plant and office furniture. To try to simulate the investment decision process would unnecessarily complicate the model. This problem can be circumvented by assuming that a company's investments in assets will remain in line with its revenues over time. Implicit in this statement is the notion that the technical environment for magazine companies is stable. If the ratio of assets to sales revenue remains constant, then we can make a further simplifying assumption that the depreciation charge will also remain in proportion to revenue. Fortunately, the depreciation charge accounts for a very small portion of the expenses for the magazine companies examined so far, and appears to remain an almost constant proportion of annual revenues over extended periods of time. For example, the ratio of depreciation charge to sales revenue for the Curtis Publishing Company varied between 0.5% and 2.4% over the two decades 1940 - 1960 inspite of an enormous investment program in printing works, paper mills and forests (Moody's Industrial Manual). Similarly, this ratio varied between 0.6% and 0.9% for the Time Incorporated over the period 1963 - 1969, and bet-

ween 0.9% and 1.7% for the Cowles Communications Inc. over the period 1965 - 1969. Despite the small effect of depreciation charges on total expenses, it is included in the model as a function of revenues so that we shall not neglect to test its applicability to any particular magazine company. Should this assumption not hold for a particular company, then we have here an adapter for affixing an elaboration of the basic model to simulate capital investment behavior.

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DNCHR.KL = FRCDN * (TREVR.K/AP)      5,R
AP = 1                                5.1,C
```

DNCHR - depreciation charge rate (\$ per year)
FRCDN - fraction of revenue charged to depreciation
(dimensionless)
TREVR - total revenue reported (\$)
AP - accounting period (years)

General and Administration Expense

The flow rate of general and administration expense information is assumed to be proportional to revenues for reasons similar to those for the depreciation charge. Implicit in this assumption is the notion that the administrative staff (and hence their expenses) and the financial charges (such as interest on loans), making up the general and administrative expense, will stay in line with the size of a company's activities as measured by its sales revenues. Again, it represents a small and almost constant proportion of revenues. For example, the ratio of general and administration expense to revenues for the Curtis Publishing Company varied between 0.8% and 1.4% over the period 1940 to 1960. Similarly, the Atlantic Monthly Company spent between 5.5% and 6% of its total revenues on general and administration expenses during the years 1959 to 1963.

$$\begin{array}{llll} \text{GAEXR.KL} & = & \text{FRSGA} * (\text{TREVR.K}/\text{AP}) & 6, \text{R} \\ \text{AP} & = & 1 & 6.1, \text{C} \end{array}$$

GAEXR - general and administration expense rate (\$ per year)
 FRSGA - fraction of revenue spent on general and
 administration (dimensionless)
 TREVR - total revenue reported (\$)
 AP - accounting period (years)

Total Revenue Reported

The following DYNAMO equations represent the process of accumulating revenue information over the accounting period, sampling and storing the end-of-period quantity and clearing the balance, before repeating the process. The revenue flows are accumulated in a 'level' (equation 7) that is emptied (by equation 8) at the end of each accounting period. Before the 'level' is cleared, its end-of-period value is sampled and stored for one accounting period (equation 9). The accounting period is assumed to be one year.

$$\begin{array}{llll} \text{TREV.K} & = & \text{TREV.J} + \text{DT} * (\text{CNRER.JK} + \text{ADRER.JK} - \text{RCB.JK}) & 7, \text{L} \\ \text{TREV} & = & (\text{CNRER} + \text{ADRER}) * \text{AP} & 7.1, \text{N} \\ \text{AP} & = & 1 & 7.2, \text{C} \\ \\ \text{RCB.KL} & = & \text{PULSE} (\text{TREV.K}/\text{DT}, \text{SYEAR}, \text{AP}) & 8, \text{R} \\ \text{AP} & = & 1 & 8.1, \text{C} \\ \text{SYEAR} & = & 1 & 8.2, \text{C} \\ \\ \text{TREVR.K} & = & \text{SAMPLE} (\text{TREV.K}, \text{AP}, \text{TREV.K}) & 9, \text{A} \\ \text{AP} & = & 1 & 9.1, \text{C} \end{array}$$

TREV - total revenue (\$)
 CNRER - circulation revenue rate (\$ per year)
 ADRER - advertising revenue rate (\$ per year)
 RCB - revenue closing balance (\$ per year)
 TREVR - total revenue reported (\$)

SYEAR - start year of simulation (#)
 AP - accounting period (years)
 DT is a DYNAMO parameter representing the interval of time for integrating the flows of information (see Pugh, 1970, p. 2).

PULSE (P, Q, R) is a DYNAMO macro function providing a train of pulses of width DT and height P. The first pulse appears at time Q and subsequent pulses appear at intervals R (see Pugh, 1970, p. 30). SAMPLE (X, Y, Z) is a DYNAMO macro function for sampling a variable. The sample value of X is retained until the next sample is taken. The sampling interval is Y and the initial value of the sample is Z (see Pugh, 1970, p. 31).

Total Expense Reported

An identical formulation is used to represent the process of accumulating and reporting the expense flows:

TEXP.K	=	TEXP.J + DT * (PREXR.JK + SGEXR.JK + DNCHR.JK + GAEXR.JK	
		- ECB.JK)	10,L
TEXP	=	(PREXP + SGEXP + DNCHR + GAEXP) * AP	10.1,N
AP	=	1	10.2,C
ECB.KL	=	PULSE (TEXP.K/DT, SYEAR, AP)	11,R
AP	=	1	11.1,C
SYEAR	=	1	11.2,C
TEXPR.K	=	SAMPLE (TEXP.K, AP, TEXP,K)	12,A
AP	=	1	12.1,C

TEXP	-	total expense (\$)
PREXR	-	production expense rate (\$ per year)
SGEXR	-	selling expense rate (\$ per year)
DNCHR	-	depreciation charge (\$ per year)
GAEXR	-	general and administration expense rate (\$ per year)
ECB	-	expense closing balance (\$ per year)
AP	-	accounting period (years)
SYEAR	-	start year of simulation (#)
TEXPR	-	total expense reported

Measures of performance

Three measures of performance are identified as influencing management decision at the level of coordination that we are interested in. These are: relative growth of revenues, profit margin and relative growth of readers.

Relative growth of revenues

It has been suggested that because an executive's salary and influence is related to the revenues or sales that his activities generate, he will direct the energies of his organization towards increasing revenues rather than towards increasing profits. As Baumol puts it (Baumol, 1958, p. 187):

"....I believe that the typical large corporation in the United States seeks to maximize not its profits but its total revenues which the businessman calls sales. That is, once his profits exceed some vaguely defined minimum level, he is prepared to sacrifice further increases in profits if he can thereby obtain larger revenues."

Evidence to support the contention that executive's salaries are more closely related to revenues than to profits has been supplied by McGuire, Chui and Elbing (McGuire, Chui and Elbing, 1962). A measure of performance that assesses the increase in revenue is the 'relative growth of revenue'. This measure indicates by what fraction of last year's revenue this years revenue has increased or decreased. The main assumption concerning this measure is that it is either explicitly or implicitly calculated and used by the management.

Its calculation poses some problems for the DYNAMO compiler which is not equipped for storing quantities (such as last year's revenue). This problem is circumvented by creating an User-Defined Macro Function (Pugh, 1970, p. 35) called RELGROW which stores last year's quantity and resurrects it at the correct time to calculate the relative growth of the quantity using the formula:

Relative growth of quantity $Q = (Q_T - Q_{T-1})/Q_{T-1}$

Q_T - quantity Q in year T

Q_{T-1} - quantity Q in year $T-1$

A detailed listing of the macro-function is given in Appendix B.1.

In DYNAMO symbols the relative growth of revenues is defined as:

RGRV.K = RELGROW (TREVR.K) 13,A

RGRV - relative growth of revenue (Dimensionless)
 TREVR - total revenue reported (\$)
 RELGROW(Q) - a macro function defining the relative growth of
 the quantity Q over a one-year period (see Appendix
 B.1)

Profit Margin

This performance measure concerning profit is adopted for a variety of reasons. Firstly, the business of magazine publishing is characterized by large revenues and expenditures and a small investment in assets in comparison to these revenue flows. An article in a business magazine (Business Week, 1970, p. 65) notes that the industry profit margin (profit before taxes on gross revenues) "runs about 5% to 6%", so that the measure is used by the industry to compare company performance. Secondly, the shareholders or owners of a magazine company must be satisfied in their expectations concerning dividend or capital appreciation (and hence the value of their shares) in relation to the risks of investing in the company. Profit margin provides a crude but adequate measure for assessing this quality since one would normally expect to find a large profit margin associated with a large risk and visa-versa. The profit margin is defined as:

$$\text{PMARG.K} = (\text{TREVR.K} - \text{TEXPR.K}) / \text{TREVR.K} \quad 14, A$$

PMARG - profit margin (dimensionless)
 TREVR - total revenue reported (\$)
 TEXPR - total expense reported (\$)

Relative Growth of Readers

This performance measure concerning growth of readers is chosen because of the magazine publishing industry's preoccupation with circulation figures. At least one independent body has been formed to audit the readership of magazines (Audit Bureau of Circulation) and several bodies digest and report these figures (e.g. Publishers' Information Bureau and the Association of National Advertisers). The reports take the form of comparative figures between magazines, comparative statistics concerning a particular magazine (such as a comparison of circulation and advertising 'rates') and comparative figures over time (circulation trends of magazines). The latter statistics are usually portrayed graphically to illustrate the growth trends in circulation (see Association of National Advertisers, 1969). Also, it is part of the country's heritage to pursue growth for its own sake. As Friedrich puts it (Friedrich, 1970, p. 392):

"In a society that demands advance and growth, even the most necessary retreat must seem like a defeat, and no organization is going to admit defeat."

Although no specific mention is made of 'relative growth of readers' in the literature, this measure is proposed as a surrogate for the implicit measures suggested by the preoccupation of the people in the industry with the trends of circulation. The relative growth rate is defined in DYNAMO terminology as:

$$\text{RGR.K} = \text{RELGROW}(\text{TOTRDS.K}) \quad 15, \text{A}$$

RGR - relative growth of readers (dimensionless)
 TOTRDS - total readers (number)
 RELGROW(Q) - a macro function defining the relative growth of a
 quantity Q over a period of one year (see appendix B)

Managed Variables

The relationships in this category are considered to be determined by management decree or by decision rules determined by company or industry practice. The 'managed variables' consist of the output decisions, price setting decisions and decisions to fix the amount of 'managed costs.'

Magazine Volume Pages

The output decisions can be further broken down into decisions concerning the number of magazines to supply and decisions concerning how many pages should be allowed in each magazine (called hereafter the Magazine Volume Pages). The number of magazines to supply is not considered to be a decision point at all. It is assumed to be completely determined by the total readership of the magazine. Once having acquired a certain number of readers, the magazine must be supplied to each reader. It is, therefore, deleted from the list of 'managed variables'. Volume Pages on the other hand is determined by standard company practice. It is related to the amount of advertising purchased in the magazine. Friedrich refers to the (Friedrich, 1970, p. 244) 'traditional advertising-editorial formula, whereby an increase in the sale of advertising pages also permitted the publication of more editorial pages.' The relationship can be viewed as a simple linear regression model for testing with empirically derived data for a particular company:

$$\text{MVPR.K} = G_0 + G_1 * \text{ADPSR.JK} \quad 16,A$$

MVPR - magazine volume page rate (pages per year)
 ADPSR - advertising pages selling rate (pages per year)
 G_0 - coefficient of regression (pages per year)
 G_1 - coefficient of regression (pages per page of advertising)

The coefficients of regression can be derived from an empirical study of a particular company.

Advertising Selling Expense

Advertising agents, who sell the advertising space in a magazine, are paid a fixed commission of fifteen percent on advertising sales. This is an industry standard practice that is honoured by most publishers. Therefore, the advertising selling expense is assumed to be directly related to advertising revenue:

$$\begin{aligned} \text{ADSEX.K} &= \text{COADS} * \text{ADRER.JK} & 17,A \\ \text{COADS} &= 0.15 & 17.1,C \end{aligned}$$

ADSEX - advertising selling expense (\$ per year)
 COADS - commission on advertising sales (dimensionless)
 ADRER - advertising revenue rate (\$ per year)

Subscription and Advertising 'Rates'

Both the subscription and advertising 'rates' are assumed to be system 'states' or 'levels' that remain constant until a decision is made to increase or decrease them by a certain amount.

$$\begin{aligned} \text{SNRTE.K} &= \text{SNRTE.J} + \text{DT} * \text{SNRCH.JK} & 18,1 \\ \text{SNRTE} &= \text{ISNRTE} & 18.1,N \end{aligned}$$

SNRTE - subscription 'rate' (\$ per year per reader)
 ISNRTE - initial subscription 'rate' (\$ per year per reader)
 SNRCH - subscription 'rate' change (\$ per year per reader per year)

DT is the DYNAMO variable 'delta-time' representing the time increment between calculations of the system's 'levels.'

Similarly,

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ADRTE.K = ADRTE.J + DT*ADRCH.JK          20,L
ADRTE    = IADRTE                        20.1,N

ADRTE - advertising 'rate' ($ per page)
IADRTE - initial advertising 'rate' ($ per page)
ADRCH - advertising 'rate' change ($ per page per year)

```

The decision process for changing the 'rates' is, at present, an unknown quantity. In the meantime, so that we might experiment with this model to see how the publishing part of the system reacts to changes in the 'rates', experimental functions are used to define the 'rate' changes:

```

SNRCH.KL = PULSE (A*SNRTE.K/DT, ST, ST + 50)      19,R

SNRCH - subscription 'rate' change ($ per year per reader
                                             per year)
SNRTE - subscription 'rate' ($ per year per reader)
ST     - step time (year #)
A      - fraction change to subscription 'rate' (dimension-
                                             less)

```

PULSE is a DYNAMO function used to impart an impulse to the system. Its effect is to increase the subscription 'rate' abruptly by a fraction (A) at a time (ST). For example, if $A = 0.2$, $ST = 1945$, then the subscription 'rate' will be increased by a fraction of 0.2 in the simulated year 1945.

Similarly,

```

ADRCH.KL = PULSE(B*ADRTE.K/DT, ST, ST + 50)      21,R

ADRCH - advertising 'rate' change ($ per page per year)
ADRTE - advertising 'rate' ($ per page)
ST     - step time (year #)
B      - fraction change to advertising 'rate' (dimensionless)

```

Circulation Promotion Expense

The circulation promotion expense is treated here as a 'managed cost'. Like the subscription and advertising 'rates', it is modelled as a system 'state' that is changed from time to time by management edict.

$CNPEX.K = CNPEX.J + DT * CPECH.JK$ 22,L
 $CNPEX = ICNPEX$ 22.1,N
 $CNPEX$ - circulation promotion expense (\$ per year)
 $CPECH$ - circulation promotion expense change (\$ per year
per year)
 $ICNPEX$ - initial circulation expense (\$ per year)

As for the 'rates', the decision to change the circulation promotion expense was used initially as an experimental device to trace the effect of a sudden change through the system.

$SPECH.KL = PULSE (C * CNPEX.K / DT, ST, ST + 50)$ 23,R
 $CPECH$ - circulation promotion expense charge (\$ per year)
 $CNPEX$ - circulation promotion expense (\$ per year)
 ST - step time (year #)
 C - fraction change to circulation promotion expense
(dimensionless)

Relationships with the Environment

The interactions of a magazine publishing company with its environment are visualized as involving a price-demand relationship for the advertising space purchased in the magazine, a cost-volume relationship for the volume of production (magazine pages printed and delivered) and relationships to determine the number of trial readers and regular subscribers of the magazine. It is assumed that these relationships remain stable over time.

The Demand for Advertising

The collective decisions of the advertisers, which determine the quantity of advertising purchased in a magazine, is assumed to be regulated by the price of advertising, so that the higher the price the fewer the pages purchased and visa-versa. The management of magazines announce at periodic intervals (usually annually or biannually) any changes to the advertising 'rates' per page and at the same time they report the

current total circulation of the magazine or the guaranteed number of readers for the forthcoming period. The advertisers, in making their purchasing decisions, weigh the advertising 'rate' charged against the potential audience for their promotions by using a unit of price expressed in dollars per page per thousand readers (Association of National Advertisers, 1969). The following simple regression equation is assumed for this demand schedule:

$$\text{ADPSR.KL} = D_0 + D_1 * \text{ARPTR.K} \quad 24, R$$

ADPSR - advertising pages selling rate (pages per year)

ARPTR - advertising 'rate' per thousand readers
(\$ per page per thousand readers)

D_0 - regression coefficient (pages per year)

D_1 - regression coefficient (pages per unit price)

D_0 and D_1 can be derived for a particular magazine company from an empirical study.

The advertising 'rate' per thousand readers is computed by:

$$\text{ARPTR.K} = \text{ADRTE.K} / (\text{TOTRDR.K} * 1\text{E-}3) \quad 25, A$$

ARPTR - advertising 'rate' per thousand readers
(\$ per page per thousand readers)

ADRTE - advertising 'rate' (\$ per page)

TOTRDR - total readers reported (number)

The symbol '1E-3' stands for 'one thousandth'.

Production Cost

The cost-volume relationship is envisaged as a long-run production cost equation linking the total production cost to the total number of pages printed and delivered. It is assumed to be determined by the technology of magazine publishing, which is stable. The form of this relationship is:

$$\text{EPDEX.K} = C_0 + C_1 * \text{MVPR.K} * \text{TOTRDS.K} \quad 26, A$$

- EPDEX - editing, printing and distributing expense (\$ per year)
 MVPR - magazine volume page rate (page per year)
 TOTRDS - total readers (number)
 C_0 - regression coefficient (\$ per year)
 C_1 - regression coefficient (\$ per page per reader)

C_0 and C_1 can be determined by an empirical study of a particular magazine company.

Trial Subscribers

A company's major promotional activity is directed towards acquiring trial readers. The overall result can be measured in terms of the number of trial readers acquired for a certain promotional expenditure. One might expect, also, that the volume of the magazine would influence the efficiency of selling trial subscriptions in that a thicker magazine is more likely to contain something of interest to the potential reader. This suggests the following regression model for determining the rate of selling trial subscriptions:

$$TSSR.KL = B_0 + B_1 * CNPEX.K + B_2 * MVPR.K \quad 27,R$$

- TSSR - trial subscription selling rate (number per year)
 CNPEX - circulation promotion expense (\$ per year)
 MVPR - magazine volume page rate (pages per year)
 B_0 - coefficient of regression (number per year)
 B_1 - coefficient of regression (number per \$)
 B_2 - coefficient of regression (number per page)

The regression coefficients can be obtained from an empirical study of a particular firm.

Regular Subscribers

The regular subscribers to a magazine are considered to be composed of a fraction of the regular readers from previous years who have renewed their subscriptions and a fraction of trial readers who transferred to

regular readership when their trial subscriptions expired. For example, a case study of one magazine suggests that about 75% of the regular subscribers renew their subscriptions and about 50% of the trial subscribers convert to regular readership (Harvard Business School, 1959, p. 10).

However, one would expect the readers whose subscriptions are expiring to be influenced in their decision to continue subscribing by the subscription 'rate' and the magazine volume. The former specifies the price they will be required to pay for the magazine and the latter contains the proposition that a thick magazine is more likely to contain something of interest to the reader than a thin magazine. This suggests the following regression equation for the rate of selling regular subscriptions:

$$\begin{aligned} \text{RSSR.KL} = & A_0 + (A_1 + A_2 * \text{SNRTE.K} + A_3 * \text{MVPR.K}) * \text{RSE.K} \\ & + (A_4 + A_5 * \text{SNRTE.K} + A_6 * \text{MVPR.K}) * \text{TSE.K} \quad 28, \text{R} \end{aligned}$$

$$^1 \text{RSSR} = \text{ITOTRDS} - \text{TSSR} \quad 28.1, \text{N}$$

RSSR - regular subscription selling rate (number per year)

RSE - regular subscriptions expiring (number per year)

TSE - trial subscriptions expiring (number per year)

SNRTE - subscription 'rate' (\$ per year)

MVPR - magazine volume page rate (pages per year)

A_0 - coefficient of regression (number per year)

A_1 & A_4 - coefficient of regression (dimensionless)

A_2 & A_5 - coefficient of regression (fraction of readers per
\$ - year)

A_3 & A_6 - coefficient of regression (fraction of readers per
page - year)

ITOTRDS - initial total readers (number)

TSSR - trial subscription selling rate (number per year)

All subscriptions are assumed to expire exactly one year after they are purchased. In reality the term of many subscriptions is for more

¹This equation initializes RSSR. It is required for technical reasons concerning the DYNAMO compiler in order to break the simultaneous equations arising between RSSR and RSE that prevent the simulation from starting.

than one year. However, we do not necessarily lose any precision in the model, for the purpose we have in hand, by assuming that such subscriptions are renewed on an annual basis. The number of subscriptions expiring can be modelled by storing the number of subscriptions sold for one simulated year. This is achieved with a DYNAMO user-defined macro function which we shall call PIPEOUT (see Appendix B.2 for a detailed description of this macro function). It models the subscription-expiration process as a pipeline into which subscribers are fed to emerge later. It, therefore, derives the number of subscribers emerging from a linear pipeline delay one simulated year after they entered the pipeline. In DYNAMO notation, the number of trial subscriptions expiring is given by the expression:

```
TSE.K = PIPEOUT (TSSR.JK)                29,A
TSE - trial subscriptions expiring (number per year)
TSSR - trail subscription selling rate (number per year)
PIPEOUT is a macro function defining the output of a one-
year linear pipeline delay (see Appendix B.2)
```

Similarly, the number of regular subscriptions expiring can be expressed as:

```
RSE.K = PIPEOUT (RSSR.JK)                30,A
RSE - regular subscriptions expiring (number per year)
RSSR - regular subscription selling rate (number per year)
PIPEOUT is a macro function defining the output of a one-
year linear pipeline delay (See Appendix B.2)
```

For the purpose of calculating the total readership level of the magazine, the expiration rate of subscriptions is defined by:

```
RSER.KL = RSE.K                        31,R
TSER.KL = TSE.K                        32,R
RSER - regular subscription expiration rate (number per year)
TSER - trial subscription expiration rate (number per year)
RSE - regular subscriptions expiring (number per year)
TSE - trial subscriptions expiring (number per year)
```

Total Readers

The total readers of the magazine is represented by a 'level' into which flow the trial and regular readers who have purchased subscriptions and out of which flow the readers whose subscriptions have expired.

$$\begin{aligned} \text{TOTRDS.K} &= \text{TOTRDS.J} + \text{DT} * (\text{TSSR.JK} + \text{RSSR.JK} - \text{TSER.JK} - \text{RSER.JK}) && 33, \text{L} \\ \text{TOTRDS} &= \text{ITOTRDS} && 33.1, \text{N} \\ \text{TOTRDS} &- \text{total readers (number)} \\ \text{ITOTRDS} &- \text{initial total readers (number)} \\ \text{TSSR} &- \text{trial subscription selling rate (number per year)} \\ \text{RSSR} &- \text{regular subscription selling rate (number per year)} \\ \text{TSER} &- \text{trial subscription expiration rate (number per year)} \\ \text{RSER} &- \text{regular subscription expiration rate (number per year)} \end{aligned}$$

The process of auditing and reporting the total readership of the magazine is simulated, in a similar manner to the accounting process, by sampling the end-of-period total readership and storing this number until the end of the next period. The DYNAMO equation for this process is:

$$\begin{aligned} \text{TOTRDR.K} &= \text{SAMPLE} (\text{TOTRDS.K}, \text{RAP}, \text{TOTRDS.K}) && 34, \text{A} \\ \text{RAP} &= 1 && 34.1, \text{C} \\ \text{TOTRDR} &- \text{total readers reported (number)} \\ \text{TOTRDS} &- \text{total readers (number)} \\ \text{RAP} &- \text{readership accounting period (years)} \end{aligned}$$

These 34 equation sets, constituting the basic model of a typical magazine publishing company, are listed in appendix A.1. Until we are able to test the assumptions implicit in these relationships, the model should be regarded as a working hypothesis of the system of publishing a magazine. Before we can use the model to simulate a magazine publishing company, the following parameters must be supplied: the coefficients of regression (for equations 16, 24, 26, 27 and 28), the fraction of revenue

to be charged to depreciation and general and administration (equations 5 and 6) and the initial values for the levels (equations 18.1, 20.1, 22.1, and 33.1). The next chapter describes an empirical study of a magazine firm to test the model's posited relationships and to obtain the parameters mentioned above. A late chapter describes experiments carried out on this model to find out how the magazine publishing system works.

CHAPTER IV

AN EMPIRICAL STUDY

This chapter describes an empirical study of a particular magazine publishing company to test the relationship posited for the model in Chapter III. The magazine chosen for this purpose was the Saturday Evening Post and its publishing firm, the Curtis Publishing Company. This company was chosen for a number of reasons. Firstly, its method of reporting its accounts, which were relatively detailed, had not changed over the two-decades 1940 to 1960. Secondly, since it was an old established periodical, audited and published industry data on its readership and advertising sales were also available over the same period. Thirdly, although the Curtis Publishing Company was engaged in publishing several magazines, the major portions of its revenues and expenses were derived from the Saturday Evening Post. And lastly, considerable interest was generated by the failure of the Saturday Evening Post in 1969 and there was considerable speculation as to the cause of its demise (Friedrich, 1970 and Culligan, 1970).

Data were collected and treated to facilitate testing the relationships of the model. The methodology of Regression Analysis was used for this purpose, since it offered the hope of simultaneously deriving the coefficients of the equations and assessing their reliability statistically (see Rao and Miller, 1971, Chapters 1 and 2). Regression Analysis is, perhaps, more akin to an art than to a science. As Rao and Miller state the problem is connection with econometric research (Rao and Miller, 1971, p. 13):

"After having obtained estimates of the parameters in a linear

regression equation, the researcher usually computes summary statistics to assess the usefulness of the estimates.Applied econometricians use a great deal of judgement at various stages of research by utilizing summary statistics to "feel the data."

It is difficult to set up definite rules concerning the uses and abuses of these summary statistics as econometric tools, since their proper selection requires skill and intuition on the part of the researcher."

The computed estimates of the parameters and the summary statistics are reported in this study in the conventional format usual for regression analyses, namely:

$$Y = a_0 + a_1 X_1 + \dots + a_i X_i + \dots + a_n X_n$$

$$(SE_0) \quad (SE_1) \qquad \qquad (SE_i) \qquad \qquad \qquad (SE_n)$$

$$R^2 = \text{a number between 0 and 1}$$

Y	-	the dependent variable
X _i	-	the i th independent variable
a _i	-	the 'regression coefficient' of the i th variable
SE _i	-	the 'standard error' of the i th coefficient estimate
R ²	-	the square of the 'multiple correlation coefficient'

The degree of reliance that one can put on a particular regression equation can be measured, to some extent, by the value of R² and the ratio of each 'regression coefficient' to its 'standard error'. R² measures the proportion of variation in the dependent variable that is explained by the independent variables; the value 1 suggests perfect explanation (see Rao and Miller, 1971, p. 13). The ratio of 'regression coefficient' to 'standard error', on the other hand, gives an indication of the precision of the estimated regression coefficients; the larger the ratio, then obviously, the better the precision of the estimates (see Rao and Miller, 1971, p. 22). In econometric studies a ratio of

1:1 is thought to be acceptable and a ratio of 10:1 or better is thought to be very good.

Estimating the coefficients in the regression equations and calculating their associated summary statistics using regression formulae is computationally arduous. Standard computer programs provide these statistics at an insignificant cost. The data collected for the purpose of testing the model were submitted to such a computerized program. A 'step-wise' multiple regression program was used for those equations with more than one independent variable. This program calculates the regression coefficients for those independent variables that, in combination, maximize the summary statistic \bar{R}^2 (for an explanation of this statistic see Rao and Miller, 1971, p. 21). The program was written by Professor Potluri Rao for the University of Washington's CDC 6400 computer. It was used as a means of excluding irrelevant variables from the regression equation.

The Data Base

The data base for testing the relationships was gathered from approximately twenty years (1940 to 1960) of the history of the Saturday Evening Post and the Curtis Publishing Company. The primary sources of the data were as follows:

- For the total number of advertising pages purchased annually and advertising revenues received: - the Publishers Information Bureau's Annual Report on "Total Advertising Revenue and Pages for Magazines" (Advertising Age, January issues).
- For magazine volume size: - a physical count of the magazine pages by the author.
- For other costs and revenues: - the financial reports in Moody's Industrial Manual.
- For circulation figures and subscription 'rates': - the Magazine Circulation and Rate Trends report (The Association of National Advertisers, 1961).

The data were processed to a form suitable for testing the model.

The operating statements of the company were reaggregated into a format to match the 'accounting relationships' of the model. All costs and revenues were converted from 'current dollars' to 'constant dollars' by dividing the 'current dollars' by the Consumer Price Index (obtained from Business Statistics, 1961) for the year in question. This rearrangement and conversion to 'constant dollars' of the annual financial operating statements of the Curtis Publishing Company for the period 1940 to 1960 is shown in Table 4.1.

The Regression Analysis

The relationships to be tested by regression analysis concern the firm's 'relationships with the environment' and those 'managed variables' that exhibit automatic adjustment to information flows from other parts of the model. These relationships have already been identified in Chapter III. In some instances, it was obvious that 'special events' had temporarily altered the relationships, such as the effect of war time paper rationing on the advertising pages purchased. Where such special events could be detected, the technique of adding a 'dummy variable' to the regression equation was used (see Rao and Miller, 1971, p. 88). The 'dummy variable' was given the value 1 during the time that the special event occurred, otherwise its value was 0. The 'dummy variable' is used to absorb the average effect of the special event. The computed regression coefficients and summary statistics for each of the posited regression equations are reported below. The equation numbers refer to the equations described in Chapter III and listed in the simulation model (Appendix A.1).

Magazine Volume Pages (equation 16). The data for the following regression equation are tabulated in Table 4.2 and plotted in Exhibit 4.1.

$$\begin{array}{llll} \text{Magazine Volume Pages} & = & 2065 & + & 1.3 * \text{Advertising Pages Sold} & 16, \text{ IV} \\ \text{\textit{R}}^2 & & \text{(pages per year)} & & \text{(148)} & \text{(0.05)} & \text{(pages per year)} \\ & & \text{\textit{R}}^2 & = & 0.974 \end{array}$$

TABLE 4.1

REVENUES AND EXPENSES
For the Curtis Publishing Company¹
(in millions of constant dollars)

For The Year (ending 31 Dec.)	Circulation Revenue	Advertising Revenue	Total Revenues ²	Editing, Printing & Distribution Expense	Selling Expense	Depreciation Charge	General & Administration Expense	Total Expenses ³	Gross Profit ⁴
1940	23.4	74.0	97.4	46.7	40.5	1.3	1.3	89.8	7.6
1941	24.8	75.0	99.8	51.0	41.0	1.0	1.0	94.0	5.8
1942	28.3	61.4	89.7	51.2	38.7	1.0	0.8	91.7	- 2.0
1943	30.4	72.8	103.2	48.2	41.8	0.7	0.8	91.5	11.7
1944	32.6	78.1	110.7	48.5	44.5	0.7	0.9	94.6	16.1
1945	33.3	81.8	115.1	52.7	46.1	0.7	1.1	100.6	14.5
1946	40.7	106.2	146.9	78.2	57.2	0.7	1.3	137.4	9.5
1947	43.3	119.0	162.3	86.7	55.7	1.2	1.4	145.0	17.3
1948	47.0	116.1	163.1	89.0	57.8	1.5	1.5	149.8	13.3
1949	52.0	112.1	164.1	88.4	58.8	1.6	1.6	150.4	13.7
1950	60.1	117.8	177.9	88.5	67.7	1.8	1.8	159.8	18.1
1951	56.6	113.0	169.6	85.0	67.6	1.6	1.9	156.1	13.5
1952	59.1	116.8	175.9	86.0	74.6	1.7	2.0	164.3	11.6
1953	65.1	122.0	187.1	88.8	79.4	1.8	2.0	172.0	15.1
1954	66.0	118.9	184.9	84.4	84.9	2.0	2.1	173.4	11.5
1955	65.8	125.4	191.2	84.1	93.4	2.2	2.1	181.8	9.4
1956	66.1	126.1	192.2	79.5	92.9	2.1	2.1	176.6	15.6
1957	69.4	132.4	201.8	85.9	98.5	2.1	2.4	188.9	12.9
1958	72.9	127.8	200.7	93.1	102.2	4.8	2.6	202.7	- 2.0
1959	76.4	145.2	221.6	104.5	111.1	5.1	2.9	223.6	- 2.0
1960	78.2	147.0	225.2	107.9	114.8	5.2	3.1	231.0	- 5.8

¹Source: Moody's Industrial Manual (1948, '55 & '61), converted to constant dollars by the formula: reported expenses or revenue in current dollars/ consumer price index.

²Excluding miscellaneous revenues and revenues from sales of paper.

³Excluding miscellaneous expenses and the estimated expenses from paper making.

⁴Total Revenues minus Total Expenses.

TABLE 4.2
MAGAZINE VOLUME PAGES VS ADVERTISING PAGES SOLD
For the Saturday Evening Post

For The Year (ending 31 Dec.)	Magazine Volume ¹ (pages per year)	Advertising Pages Sold ² (pages per year)
1940	5604	2796
1941	5666	2863
1942	5332	2372
1943	5628	2822
1944	5700	2932
1945	5822	3143
1946	7336	4033
1947	7920	4449
1948	7780	4351
1949	7568	4132
1950	7808	4425
1951	7664	4363
1952	7600	4194
1953	7644	4186
1954	6992	3686
1955	6896	3686
1956	6616	3507
1957	6490	3300
1958	6038	2892
1959	5932	2817
1960	5910	2788

¹Source: a physical count of the annual volume pages.

²Source: Advertising Age, (January issues).

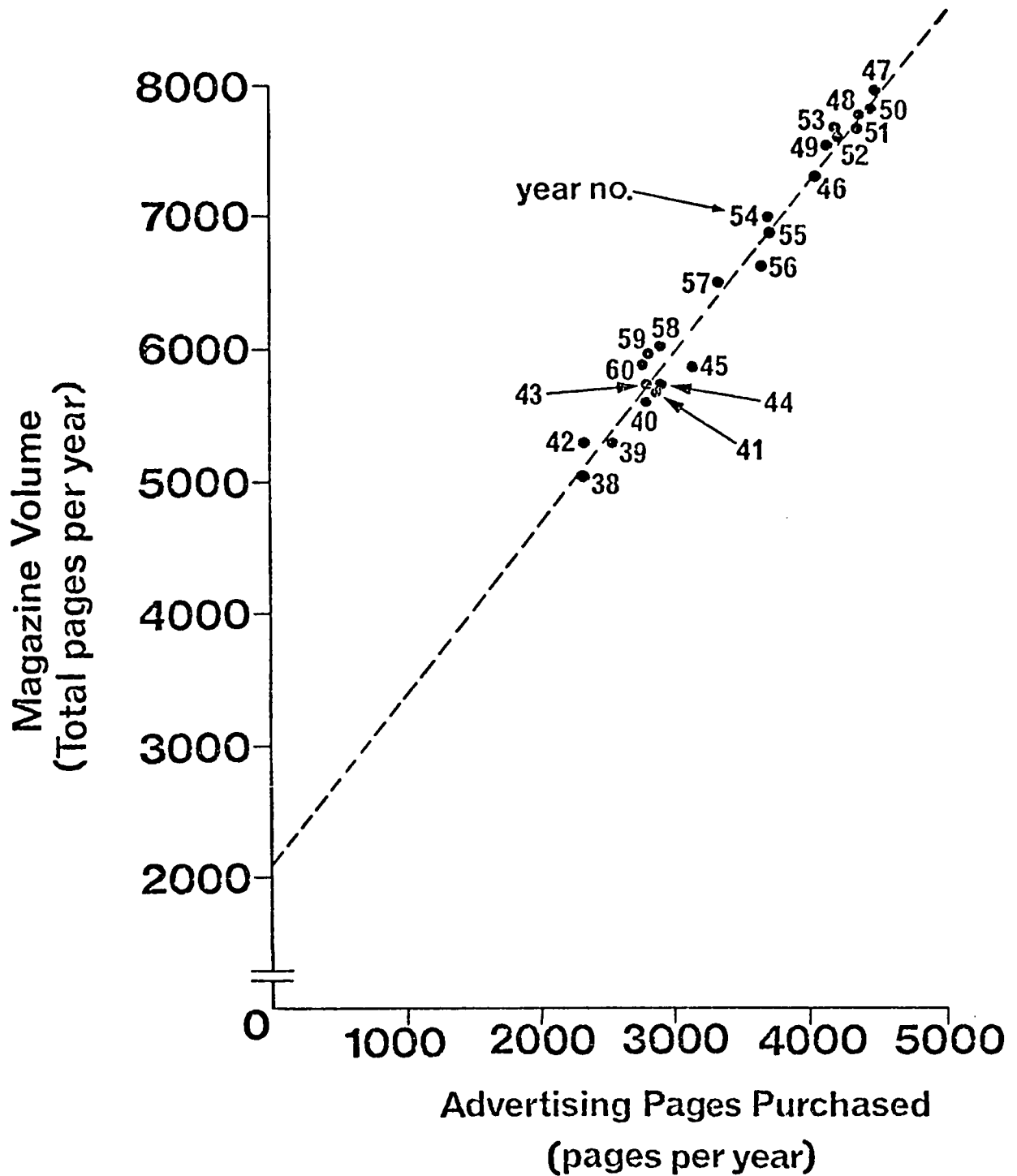


EXHIBIT 4.1 MAGAZINE VOLUME PAGES VS ADVERTISING PAGES PURCHASED
-the old Saturday Evening Post

Source: Table 4.2

Advertising Pages Selling Rate (equation 24). The data for the following regression equation are tabulated in Table 4.3 and plotted in Exhibit 4.2.

$$\begin{aligned} \text{Advertising Pages Sold} &= 8530 - 985 * \text{Advertising 'Rate' per Thousand Readers} \\ (\text{pages per year}) &\quad (209) \quad (84) \quad (\text{const. \$ per page per thousand readers}) \\ &\quad -1055 * \text{SPEVENT (1942,1942)} - 356 * \text{SPEVENT (1943, 1945)} \\ &\quad (216) \quad (134) \end{aligned}$$

$$R^2 = 0.960$$

24, IV

where, SPEVENT (1942, 1942) is a 'dummy variable' for a special event that occurred in 1942 when, in response to an anti-jewish article published in the Saturday Evening Post, the advertising industry withdrew a significant amount of advertising.

and SPEVENT (1943, 1945) is another 'dummy variable' for the effect of the war time reduction of advertising pages.

Editing, Printing and Distributing Expense (equation 26). The total number of magazine pages printed and delivered by the Curtis Publishing Company was estimated as follows. The annual volume size of each of the following major Curtis publications was physically counted: Saturday Evening Post, Ladies Home Journal, Holiday, Country Gentleman, American Home and Jack and Jill.

Each volume page count was multiplied by its reported total circulation for that year and summed to give an estimated grand total of pages printed and delivered by the company to its readers in that year. The data were gathered biannually for the years 1940 to 1966 to provide a representative sample of the company's output volume and yet reduce the very arduous data gathering task. In 1960, the company negotiated a new labour contract following a strike. This resulted in a significant increase in the cost of producing the magazines. A 'dummy variable' is introduced to estimate this effect. The data for this regression equation are tabulated in Table 4.4 and plotted in Exhibit 4.3.

TABLE 4.3
ADVERTISING SALES vs ADVERTISING PRICE
For the Saturday Evening Post

For The Year (ending 31 Dec.)	Advertising Pages Sold (pages per year)	Advertising Revenue (millions of constant dollars)	Average Circulation ² (millions of readers)	Average Advertising 'Rate' Per Page Per Thousand Readers ³ (constant dollars per page per thousand readers)
1940	2796	54.9	3.25	6.04
1941	2863	53.7	3.39	5.54
1942	2372	40.9	3.33	5.18
1943	2822	47.6	3.44	5.80
1944	2932	50.6	3.39	5.10
1945	3143	53.9	3.45	4.96
1946	4033	68.9	3.78	4.52
1947	4449	75.1	3.96	4.26
1948	4351	71.9	3.90	4.24
1949	4132	70.1	4.02	4.29
1950	4425	75.5	4.03	4.23
1951	4363	73.8	4.00	4.23
1952	4194	81.5	4.22	4.61
1953	4186	86.8	4.52	4.59
1954	3686	83.6	4.59	4.94
1955	3686	89.4	4.70	5.16
1956	3507	91.8	4.91	5.21
1957	3300	93.4	5.30	5.34
1958	2892	87.6	5.75	5.27
1959	2817	96.1	6.12	5.57
1960	2788	100.8	6.30	5.74

¹Source: Advertising Age (January issues).

²Source: Association of National Advertisers (1961).

³Computed by the formula: advertising revenues

(pages of advertising sold) X (average circulation X 10⁻³)

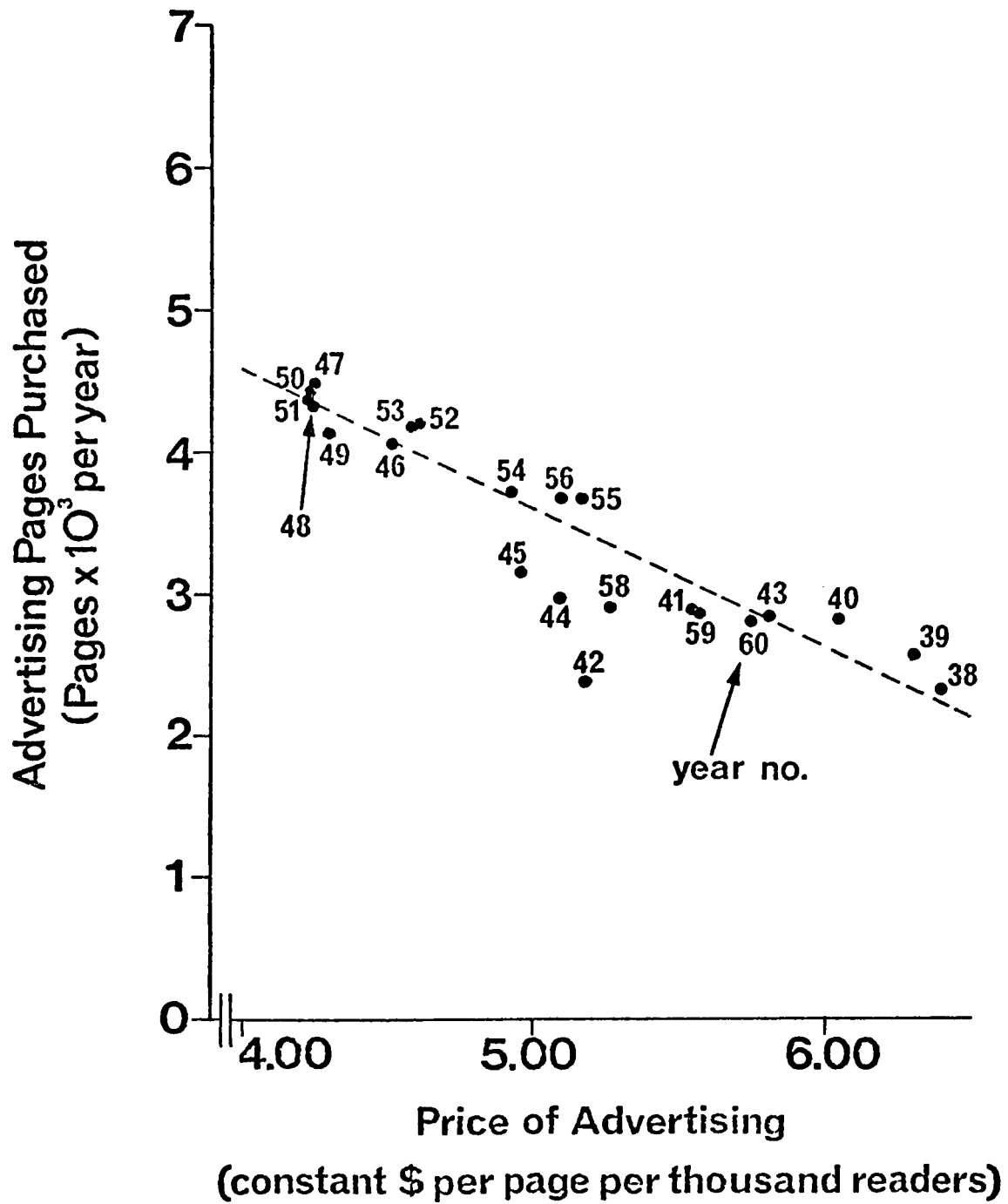


EXHIBIT 4.2 ADVERTISING PURCHASED VS PRICE OF ADVERTISING
- old Saturday Evening Post

Source: Table 4.3

TABLE 4.4
PRODUCTION EXPENSE VS VOLUME OF OUTPUT
For the Curtis Publishing Company

For The Year (ending 31 Dec.)	Editing, Printing And Distributing Expense ¹ (millions of constant dollars)	Volume of Output ² (billions of pages)
1940	46.7	26.1
1942	51.2	27.2
1944	48.5	30.1
1946	78.2	44.3
1948	89.0	49.7
1950	88.5	49.0
1952	86.0	47.8
1954	84.4	48.2
1956	79.5	46.3
1958	93.1	52.2
1960	107.9	55.9
1962	90.6	43.0
1964	80.4	42.2
1966	77.6	37.2

¹Source: Exhibit 4.1

²Source: Computed by summing (volume pages X average circulation) for the major Curtis magazines. The volume pages was found from a physical count of each magazine annual volume, and the average circulation from the Association of National Advertisers biannual report.

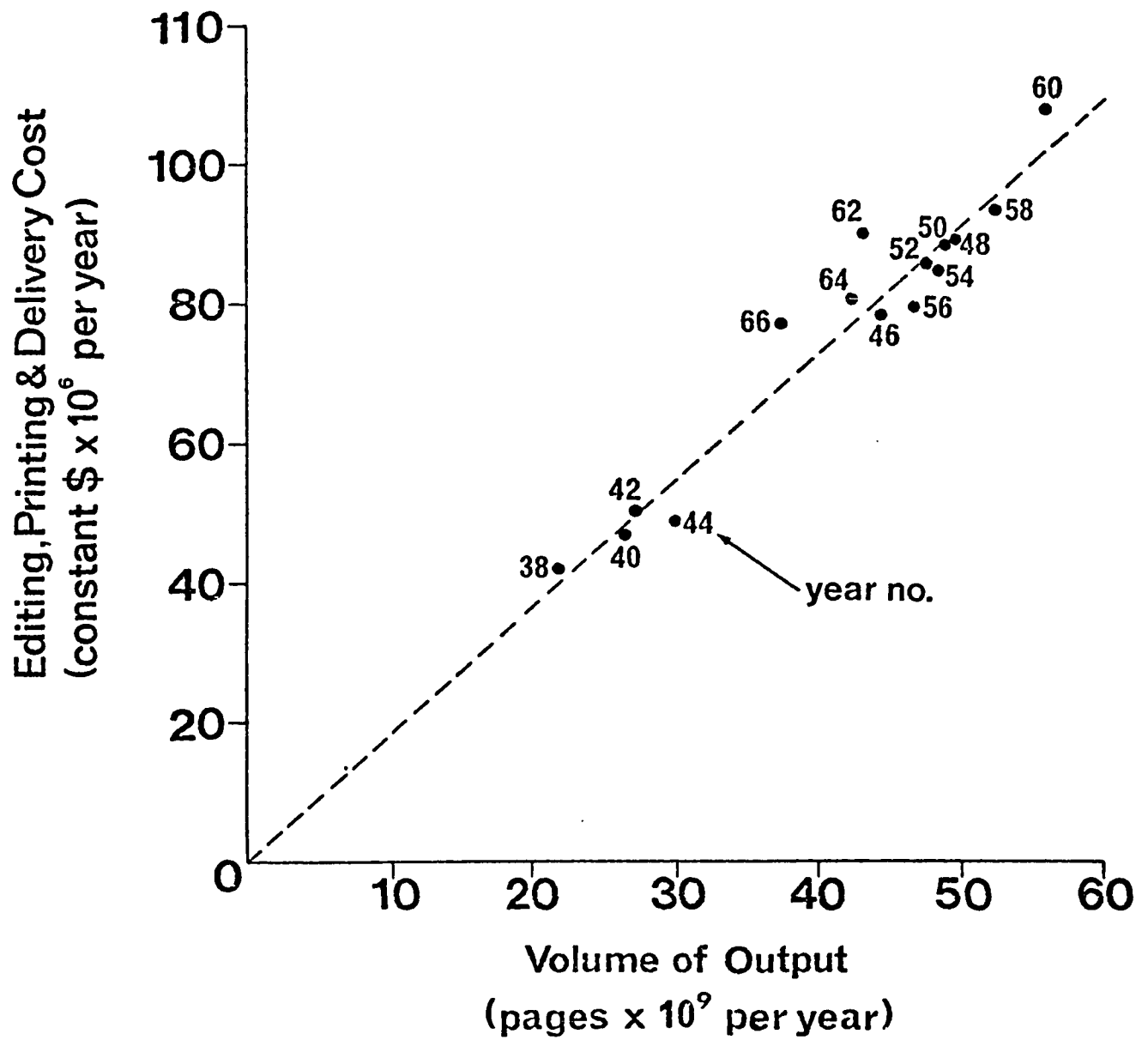


EXHIBIT 4.3 PRODUCTION EXPENSE VS VOLUME OF OUTPUT
-the Curtis Publishing Company

Source: Table 4.4

$$\begin{aligned}
 &\text{Editing, Printing and Distributing Expense} = -0.02 \times 10^{-3} \\
 &\quad (\text{constant dollars per year}) \quad (3.69) \\
 &+ 4.8 \times 10^{-3} * \text{Volume of Output} + 10.2 \times 10^6 * \text{SPEVENT (1960, 1966)} \\
 &\quad (0.09) \quad (\text{pages per year}) \quad (1.7) \\
 &R^2 = 0.979 \qquad \qquad \qquad 26, \text{ IV}
 \end{aligned}$$

where, SPEVENT (1960, 1966) is a 'dummy variable' for the effect of the strike and wage negotiation on production costs from 1960 and thereafter.

Note that the regression coefficient for the constant term in equation 26, IV is unreliable since its standard error is many times its value. It can be interpreted that the constant term is not significantly different from zero, which is as one would expect for a long-run cost equation. The economist's maxim, 'all costs are variable in the long-run' (which implies a cost curve passing through the origin of a cost-volume graph), applies to the Curtis Company's long-run production cost-volume relationship. The constant term, therefore, is given the value zero.

Subscription Selling Rate (equations 27 and 28). The data for these regression equations are tabulated in Table 4.5. These data were submitted to a step-wise regression program in an attempt to screen out irrelevant variables. As mentioned before, 'dummy variables' were added to represent special events.

Trial Subscriptions. In the absence of data concerning the actual expenditure on promoting the sales of the Saturday Evening Post, the trial subscriptions sold were regressed against the total circulation promotion expenditure of all Curtis magazines. Because the Saturday Evening Post was a weekly magazine as opposed to the monthly editions of the other Curtis publications, it accounted for about eighty percent of the

TABLE 4.5

THE DETERMINANTS OF READERSHIP
For the Saturday Evening Post

For The Year (ending 31 Dec.)	Total Readers ¹ (millions)	Trial Subscriptions Sold ² (millions per year)	Regular Subscriptions Sold ³ (millions per year)	Circulation Promotion Expense ⁴ (millions of constant dollars per year)	Average Subscription 'Rate' ⁵ (constant dollars per reader per year)	Magazine Volume ⁶ Pages (pages per year)
1940	3.25	1.16	2.09	29.4	3.08	5604
1941	3.39	1.25	2.14	29.8	2.93	5666
1942	3.33	1.14	2.19	29.5	3.52	5332
1943	3.44	1.32	2.12	30.9	4.15	5628
1944	3.39	1.60	1.79	32.8	4.50	5700
1945	3.45	1.75	1.70	33.7	4.79	5822
1946	3.78	1.81	1.97	41.3	4.86	7336
1947	3.96	1.81	2.15	37.9	5.21	7920
1948	3.90	1.75	2.15	40.4	6.02	7780
1949	4.02	1.75	2.27	42.0	5.97	7568
1950	4.03	1.71	2.32	50.0	5.97	7808
1951	4.00	1.70	2.30	50.6	5.52	7654
1952	4.22	1.88	2.34	57.1	5.40	7600
1953	4.52	1.98	2.54	61.1	5.36	7644
1954	4.59	1.93	2.66	67.1	5.34	6992
1955	4.70	1.88	2.82	74.6	5.36	6896
1956	4.91	1.96	2.95	74.0	5.28	6616
1957	5.30	2.48	2.82	78.6	5.10	6490
1958	5.75	2.51	3.24	83.0	5.00	6038
1959	6.12	2.54	2.58	89.3	4.93	5932
1960	6.30	2.69	3.61	92.8	4.85	5910

¹Source: Association of National Advertisers (1961). Average Paid Circulation.

²Source: Association of National Advertisers (1961), estimated by the formula: average weekly newsstand sales + subscriptions sold at less the basic price. Assumed to be equivalent to one-year subscriptions.

³Calculated by the formula: total readers (column 2) - estimated trial readers (column 3). Assumed to be equivalent to one-year subscribers.

⁴Source: Moody's Industrial Manual (1948, '55, '61), computed by the formula: commission on subscription sales + selling expense, where commission on subscription sales = total commissions - 15% of advertising revenue (assuming a 15% industry standard commission on advertising sales). (Costs expressed in total constant dollars for all Curtis magazines).

⁵Source: Association of National Advertisers (1961). The median subscription is approximately two years. Therefore half of a two-year subscription 'rate' was chosen as the annual subscription 'rate' to represent the range of 'rates' offered by the firm. (Expressed in constant dollars).

⁶Source: physical count of annual volumes.

company's total revenue. However, the readership of the Saturday Evening Post accounted for approximately fifty percent of the total readers of all Curtis magazines. Therefore, fifty percent of the total promotion expenditure is assumed to be spent on promoting the Saturday Evening Post. Although this is little more than an inspired guess, the critical assumption is whether the proportion remained the same over the twenty year period and not what the value of this proportion is. Any errors in the estimated proportion will effect the total expenses computed by the simulation model and hence the profit. Since we shall be concerned primarily with the relative movements of the profit rather than its absolute value, this kind of error is not important. Applying the proportion 0.5 to the total circulation promotion expenditure gives the following regression equation for trial subscriptions sold for the Saturday Evening Post (the final step of a 'stepwise' program):

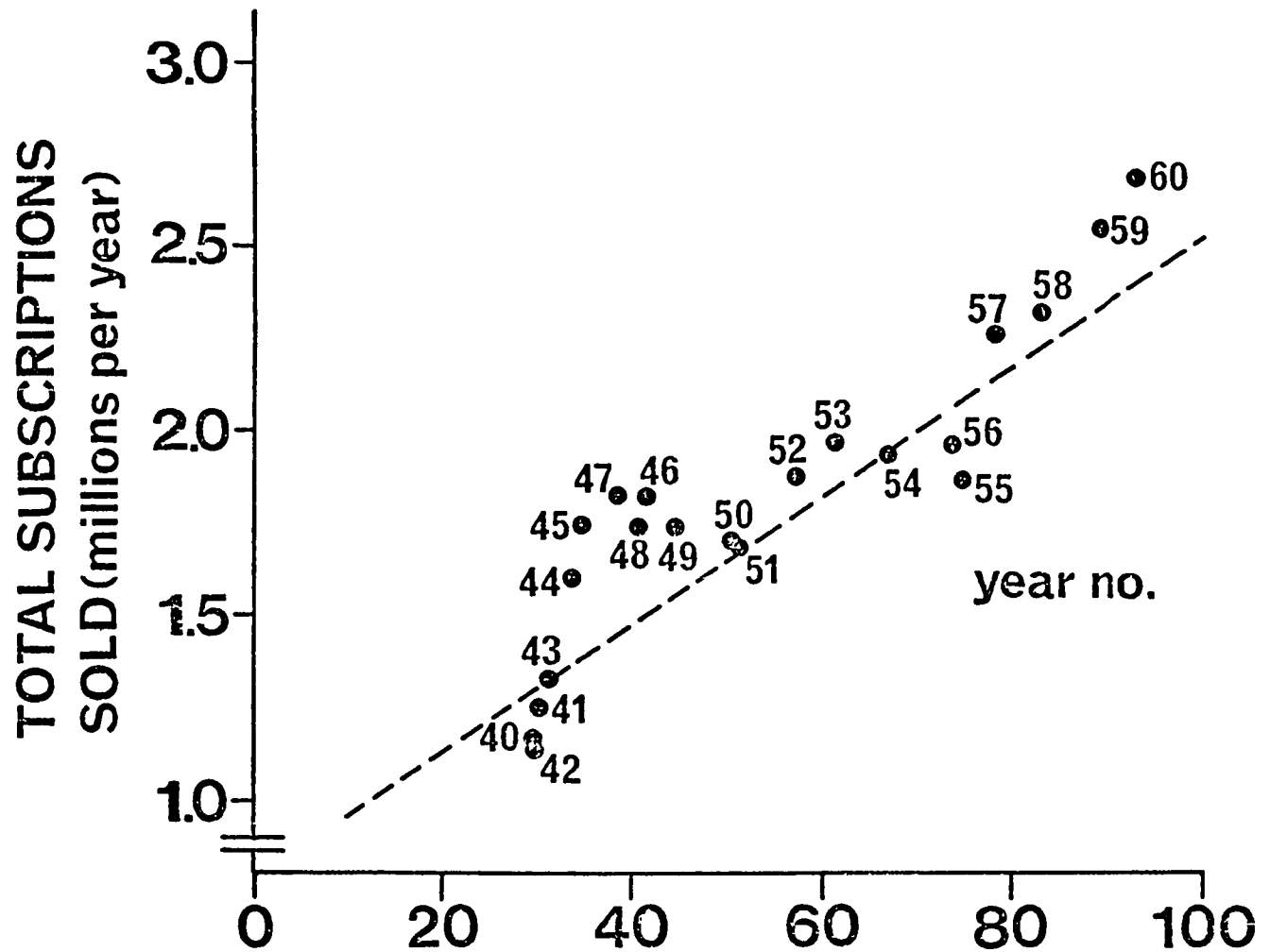
$$\begin{aligned} \text{Trial Subscriptions Sold} &= 0.79 \cdot 10^6 + (0.017/0.5) \cdot (0.5 \cdot \text{Total Circulation} \\ &\quad \text{(number per year)} \quad (0.09) \quad (0.0017) \quad \text{Promotion Expense}) \\ &\quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \text{(const. \$ per year)} \\ &+ 0.31 \cdot 10^6 \cdot \text{SPEVENT (1944,1949)} + 0.32 \cdot 10^6 \cdot \text{SPEVENT (1957,1960)} \\ &\quad (.05) \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad (0.08) \\ R^2 &= 0.959 \end{aligned}$$

The above relationship is illustrated by a plot of the number of trial subscriptions sold vs the total circulation promotion expenditure (see Exhibit 4.4).

This equation can be restated for use in the simulation model as:

$$\begin{aligned} \text{Trial Subscriptions Sold} &= 0.79 \cdot 10^6 + 0.034 \cdot \text{Circulation Promotion Expenditure} \\ &\quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \text{on the Saturday Evening Post} \\ &+ 0.31 \cdot 10^6 \cdot \text{SPEVENT (1944,1949)} + 0.32 \cdot 10^6 \cdot \text{SPEVENT (1957,1960)} \quad 27, \text{IV} \end{aligned}$$

where, SPEVENT (1944, 1949) is a 'dummy variable' representing the effect of promotional expenditures during the years 1944 to 1949, brought about by the increased popularity of the magazine. This is presumed to have been caused by the editorial policy that treated World War II as "the greatest war story of our time" (Friedrich, 1970, p. 12); and, SPEVENT (1958, 1960) is a 'dummy variable' representing an increase in the efficiency of promotional expen-



**CIRCULATION PROMOTION EXPENDITURE
of the CURTIS PUBLISHING COMPANY
(millions of constant dollars per year)**

EXHIBIT 4.4 TRIAL SUBSCRIPTIONS SOLD VS CIRCULATION EXPENDITURE
-the old Saturday Evening Post

Source: Table 4.5

diture due to technical reasons. It was during this period that the mass mailing of trial subscription offers became feasible due to the availability of lists of potential customers and the electro-mechanical and electronic devices for processing these lists.

Regular Subscriptions. The regression equation for regular subscriptions sold is (final step of a 'stepwise' program):

$$\begin{aligned} \text{Regular Subscriptions Sold} = & -0.60 \times 10^6 + \\ & (\text{number per year}) \quad (0.18 \times 10^6) \\ & (1.34 - 0.09 \times \text{Average Subscription 'Rate'}) \times \text{Regular Subscriptions Sold} \\ & \quad \quad \quad \text{last year}^1 \\ & (0.13)(0.03) (\text{const. \$ per reader per year}) \quad (\text{number per year}) \\ & + (8.0 \times 10^{-5} \times \text{Magazine Volume Pages}) \times \text{Trial Subscriptions Sold last} \\ & \quad \quad \quad \text{year}^1 \\ & (1.8 \times 10^{-5}) \quad (\text{pages per year}) \quad (\text{number per year}) \\ R^2 = & 0.960 \end{aligned} \quad 28, \text{IV}$$

Depreciation Charge and General and Administration Expense. The model presented in Chapter III assumes that the Depreciation Charge and the General and Administration Expense are proportional to the total revenue. These expenses are tabulated as proportions of the total revenue in Table 4.6. An inspection of this table shows that this is a reasonable assumption. Therefore, we may write the following approximate equations:

$$\begin{aligned} \text{Depreciation Charge} = & 0.01 \times \text{Total Revenue} \quad 5, \text{IV} \\ & (\text{const. \$ per year}) \quad (\text{const. \$ per year}) \end{aligned}$$

and

$$\begin{aligned} \text{General And Administration Expense} = & 0.01 \times \text{Total Revenue} \quad 6, \text{IV} \\ & (\text{const. \$ per year}) \quad (\text{const. \$ per year}) \end{aligned}$$

Validity of the Model

The model as described relies for its validation upon the regression equations computed in this chapter. The reader must judge for

¹Estimated as an equivalent number of one-year subscriptions. Hence, the number of subscriptions sold last year is a proxy variable for the number of subscriptions expiring.

TABLE 4.6
DEPRECIATION CHARGE AND GENERAL & ADMINISTRATION EXPENSE
AS A FUNCTION OF TOTAL REVENUE
For the Curtis Publishing Company

For The Year (ending 31 Dec.)	Depreciation Charge as a fraction of Total Revenue ¹ (dimensionless)	General And Administration Expense As A Fraction of Total Revenue ¹ (dimensionless)
1940	0.013	0.014
1941	0.010	0.010
1942	0.011	0.009
1943	0.007	0.008
1944	0.006	0.008
1945	0.006	0.010
1946	0.005	0.009
1947	0.007	0.009
1948	0.009	0.009
1949	0.010	0.010
1950	0.010	0.010
1951	0.009	0.011
1952	0.010	0.011
1953	0.010	0.011
1954	0.011	0.011
1955	0.011	0.011
1956	0.011	0.011
1957	0.010	0.012
1958	0.024	0.013
1959	0.023	0.013
1960	0.023	0.014
AVERAGE	0.011	0.011
STANDARD ERROR	(0.0012)	(0.0004)

¹Source: Table 3.1. Computed by the formula: (expense or charge)/total revenue.

himself the reliability of the above-reported regression equations, since there are no hard and fast rules for this purpose. In their favour can be offered the following:

1. The R^2 summary statistics are all greater than 0.95, which suggests quite strongly that the independent variables account for the major portion of the variations of the dependent variables.
2. The ratios of the regression coefficients to their standard errors varies from approximately 2.7 for the Advertising Pages Sold (equation 24,IV) to approximately 30 for Magazine Volume Pages (equation 16,IV). Ratios greater than one are thought to be acceptable for this kind of a study taking into account the number of observations (14 for the Production Cost equation 26,IV and 20 for all other equations).

The above-mentioned evidence, therefore, lends credence to the model of a publishing firm as representing reality for the purpose in hand. If the reader will accept this evidence, we can proceed to complete the simulation model to be used as an experimental vehicle for interpreting how the system of publishing works.

Alterations and Additions to the Simulation Model

Before the computer simulation version of the model (listed in Appendix A.1) can be made operational, the special events and regression coefficients derived from the empirical study must be incorporated. Also, the initial conditions prevailing at a certain time are required before the model can be made to run. These alterations and additions, necessary to complete the model, are:

Special Events. The relationships defining the Advertising Pages Selling

Rate, Editing, printing and distribution Expense, and Trial Subscription Selling Rate require the addition of special events. The regression equations for these variables can be restated in DYNAMO terminology as:

For advertising pages selling rate:-

$$\text{ADPSR.KL} = \text{DO} + \text{D1} * \text{ARPTR.K} + \text{D2} * \text{SPEVENT}(1942, 1942) + \text{D3} * \text{SPEVENT}(1943, 1945) \quad 24^*, \text{R}$$

ADPSR - advertising pages selling rate (pages per year)

ARPTR - advertising 'rate' per thousand readers (\$ per page per thousand readers)

SPEVENT(Y1,Y2) is a macro function defining a 'dummy variable'. It has the value zero except between the years Y1 and Y2, inclusively, when it assumes the value of 1. This macro function is listed and described in Appendix B.3.

DO, D1, D2 and D3 are regression coefficients that are defined below.

For editing, printing and distributing expense:-

$$\text{EPDEX.K} = \text{C0} + \text{C1} * \text{MVPR.K} * \text{TOTRDS.K} + \text{C2} * \text{SPEVENT}(1960, 1966) \quad 26^*, \text{A}$$

EPDEX - editing, printing and distributing expense (\$ per year)

MVPR - magazine volume pages rate (pages per year)

TOTRDS - total readers (number)

SPEVENT is a macro function defining a 'dummy variable' (see Appendix B.3).

C0, C1 and C2 are regression coefficients that are defined below,

and

for trial subscriptions selling rate:-

$$\text{TSSR.KL} = \text{B0} + \text{B1} * \text{CNPEX} + \text{B2} * \text{MVPR.K} + \text{B3} * \text{SPEVENT}(1944, 1949) + \text{B4} * \text{SPEVENT}(1957, 1960) \quad 27^*, \text{R}$$

TSSR - trial subscription selling rate (number per year)

CNPEX - circulation promotion expense (\$ per year)

MVPR - magazine volume pages rate (pages per year)

SPEVENT is a macro function defining a 'dummy variable' (see Appendix B.3).

B0, B1, B2, B3, B4 and B5 are regression coefficients defined below.

The macro function defining a Special Event (Appendix B.3) contains a parameter that can switch the effect of the special events on or off as desired. This facility enables us to experiment with the model

in a 'clinically clean form' (i.e. the effects of special events are excluded) and also to experiment with the effects of the special events included to see what effect, if any, these might have had on changing the destiny of the company. Therefore, an additional experimental parameter must be added to the model, namely (in Dynamo notation):

$$\text{SES} = 0 \qquad 35,C$$

SES - special event switch,
 when SES = 0 the effect of special events are excluded,
 and when SES = 1 the effect of special events are included.

Regression Coefficients. The coefficients of regression derived in Chapter IV can be added to the model in the form:

For Regular Subscription Sold:-

$$A0 = -0.60E6/A1 = 1.34/A2 = -0.09/A3 = 0/A4 = 0/A5 = 0/A6 = 8.0E-5 \qquad 28.1$$

For Trial Subscriptions Sold:-

$$B0 = 0.79E6/B1 = 0.034/B2 = 0/B3 = 0.31E6/B4 = 0.32E6 \qquad 27.1$$

For Production Costs:-

$$C0 = 0/C1 = 1.8E-3/ C2 = 10.2 E6 \qquad 26.1$$

For Advertising Pages Purchased:-

$$D0 = 8530/D1 = -985/D2 = -1055/D3 = -356 \qquad 24.1$$

and

For Magazine Volume Pages:-

$$G0 = 2065/G1 = 1.3 \qquad 16.1$$

Fraction of Revenue spent on Depreciation and General and Administration.

The constants of proportionality derived in Chapter IV can be stated as:

$$\text{FRCDN} = 0.01$$

5.1

FRCDN - fraction of revenue charged to depreciation (dimensionless)

and

$$\text{FRSGA} = 0.01$$

FRSGA - fraction of revenue spent on general and administration
(dimensionless)

Initial Conditions. The year 1940 was chosen as the starting year for the simulation. The appropriate initial conditions extracted from the Tables 5.1 to 5.5 are:

SYEAR	=	1940	starting year
ISNRTE	=	3.08	initial subscription 'rate' (\$ per reader per year)
IADRTE	=	19500	initial advertising 'rate' (\$ per page)
ICNPEX	=	15.0E6	initial circulation promotion expense (\$ per year)
ITOTRDS	=	3.25E6	initial total readers (number)

The amended model together with the printing, plotting and simulation run specifications (see Pugh, 1970) are listed in Appendix A.2. The model is now ready to run.

CHAPTER V

A SYSTEMS SIMULATION STUDY

This chapter describes a set of experiments carried out with the simulation model of the Saturday Evening Post and the interpretation of the results. The purpose of these experiments, as mentioned before, is to find out how the system of publishing works.

Experiments with the Model

The results of all the experiments are reported in Exhibits 5.1, 5.2, 5.3, 5.4, 5.5, 5.6 and 5.7. The top graph of each exhibit plots on a time scale the movement of the managed variables and the variable Advertising 'Rate' per Thousand Readers. The latter is an intervening variable between the managed variable Advertising 'Rate' and the number of pages of advertising purchased by the advertising industry. The center plot shows, similarly, the behavior of the readership and revenues and expenses in response to the changes to the variables in the first plot. The bottom plot reports the movements of the three performance measures, which are based in there turn, on the variables in the center plot. It is the intention of this method of reporting to facilitate the tracing of changes throughout the model system from the changes in the managed variables through their effects on readership, revenues and expenses, to the behavior of the measures of performance. The results are summarized in Table 5.1.

Experiment #1. The first experiment with the model entails allowing it to run freely for twenty simulated years, primed with the initial conditions apertaining to the Saturday Evening Post in 1940. The effects of special events are excluded and the initial values of the variables subject to

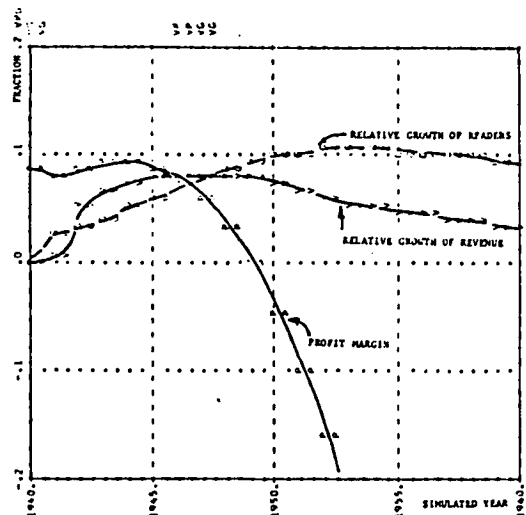
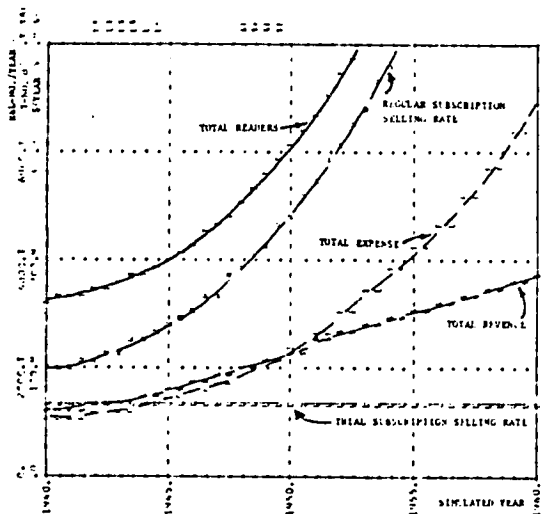
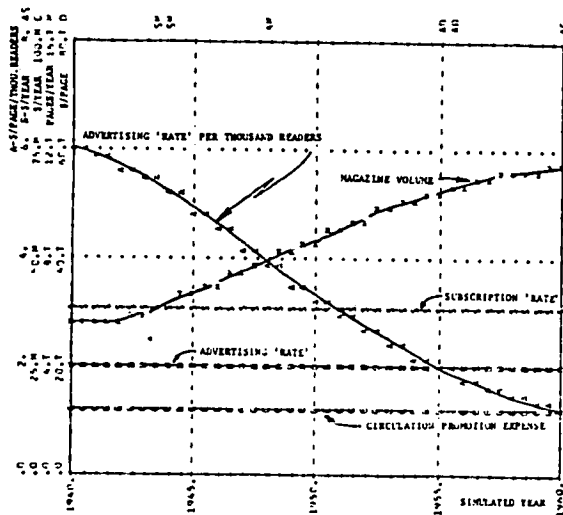


EXHIBIT 5.1 EXPERIMENT #1 RESPONSE OF FREE-RUNNING MODEL

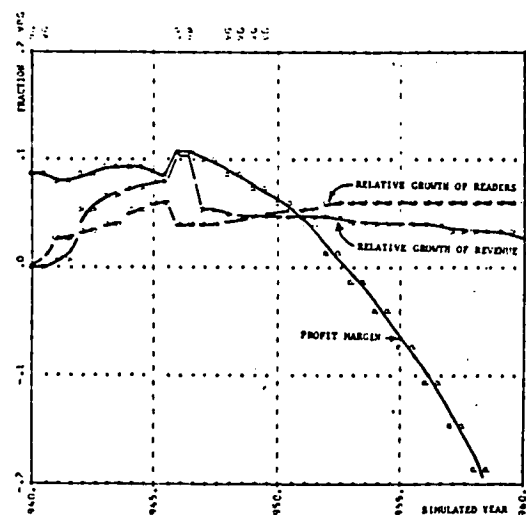
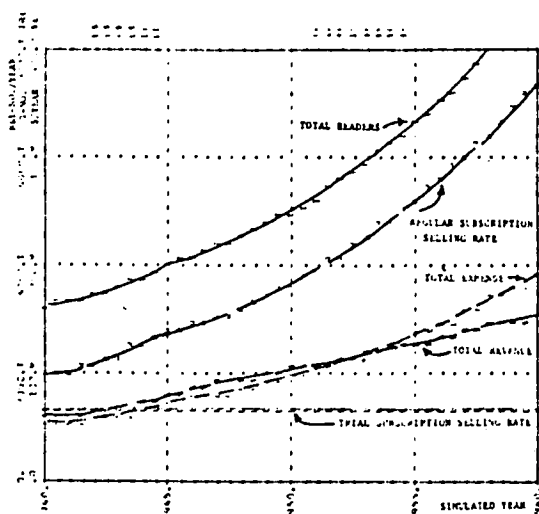
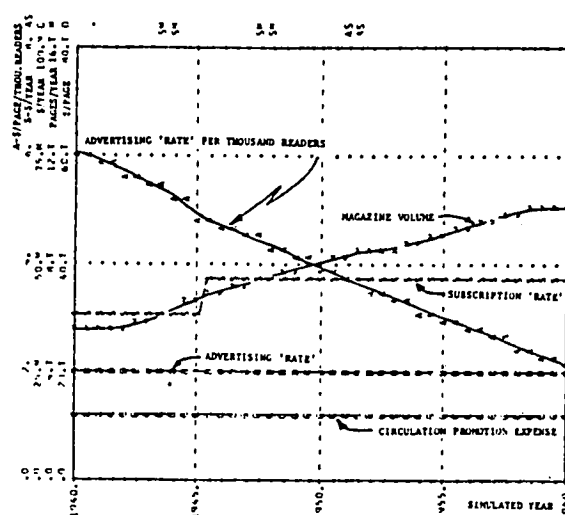


EXHIBIT 5.2 EXPERIMENT #2 RESPONSE TO A 20% INCREASE IN SUBSCRIPTION RATE

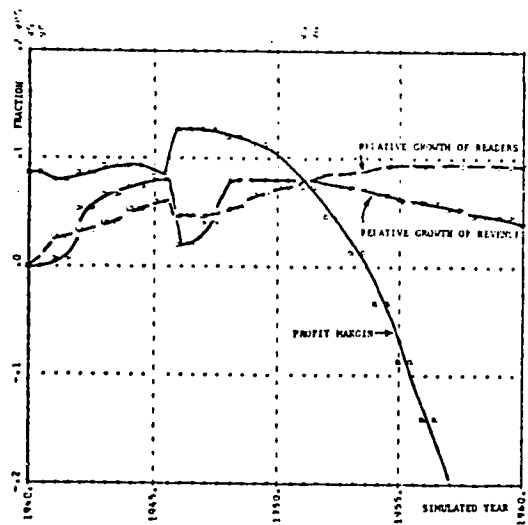
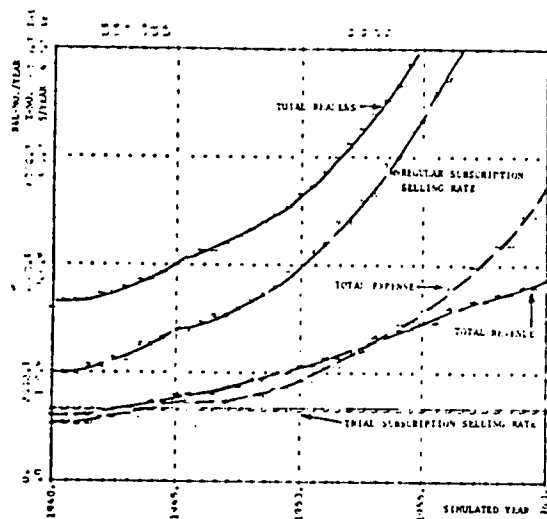
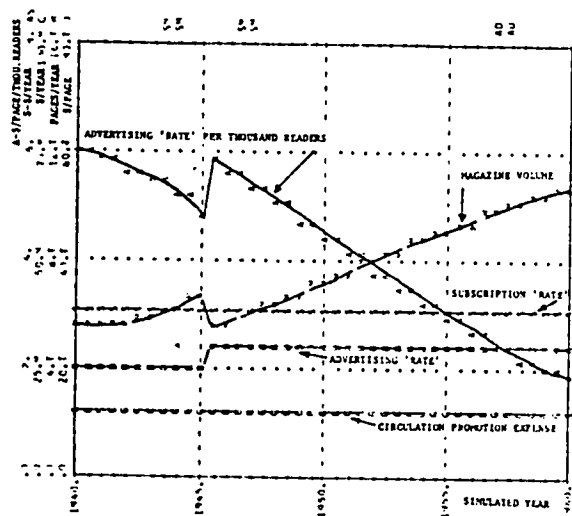


EXHIBIT 5.3 EXPERIMENT 73 RESPONSE TO A 20% INCREASE IN ADVERTISING 'RATE'

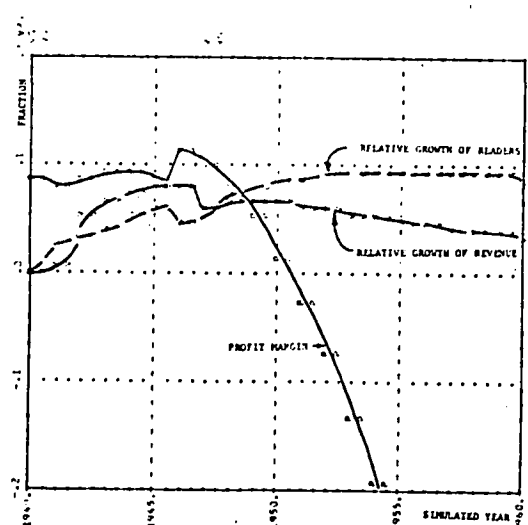
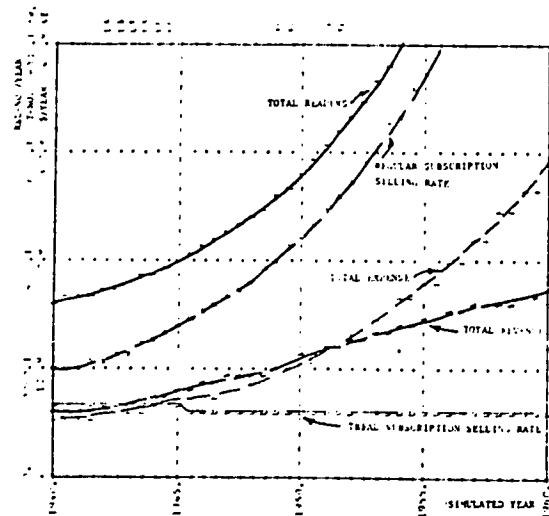
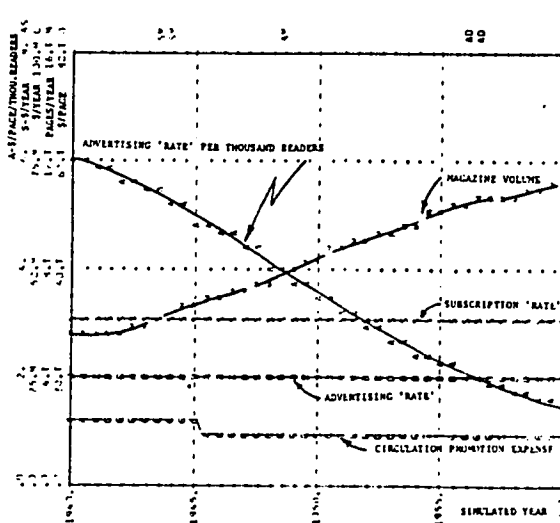


EXHIBIT 5.4 EXPERIMENT 74 RESPONSE TO A 20% DECREASE IN CIRCULATION PROMOTION EXPENDITURE

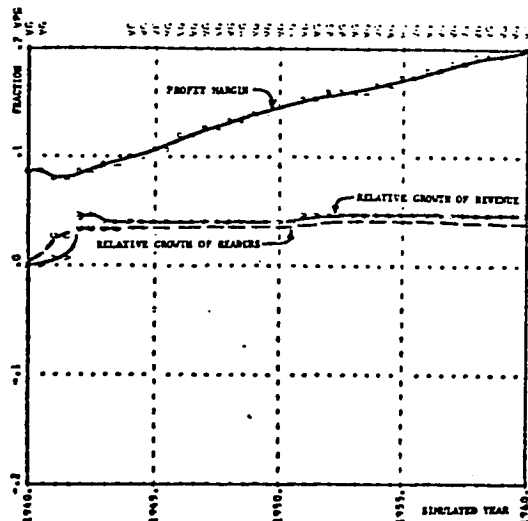
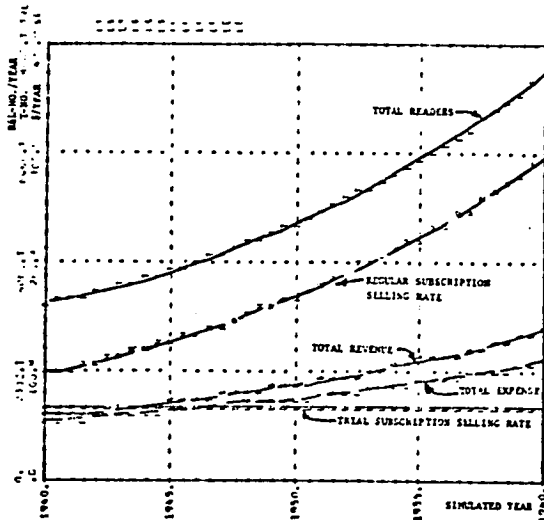
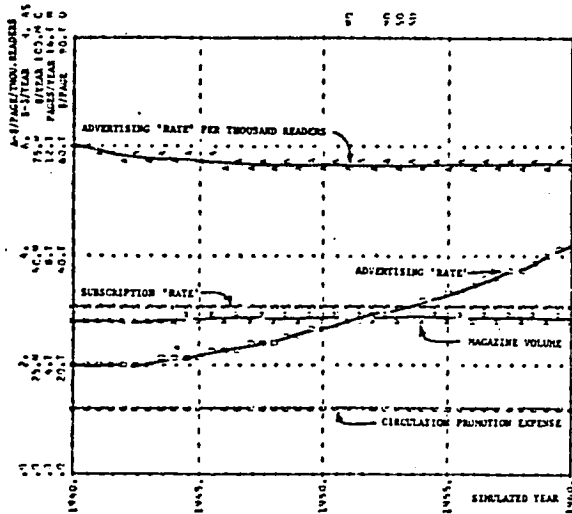


EXHIBIT 5.3 EXPERIMENT 35 RESPONSE TO A POLICY OF CONSTANT ADVERTISING 'RATE' PER THOUSAND READERS

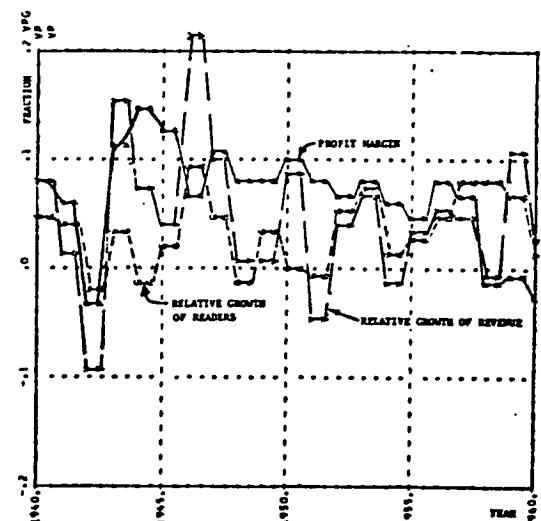
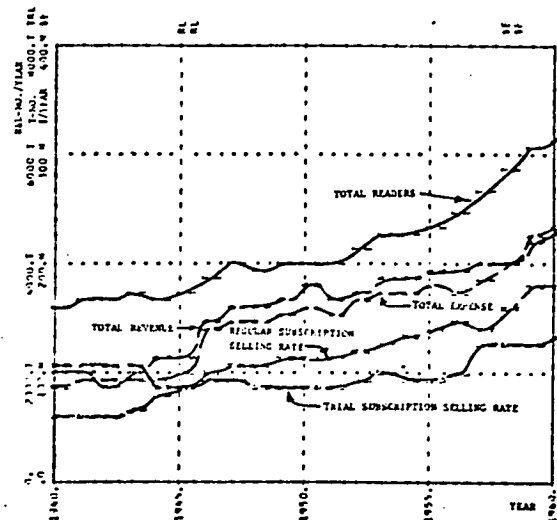
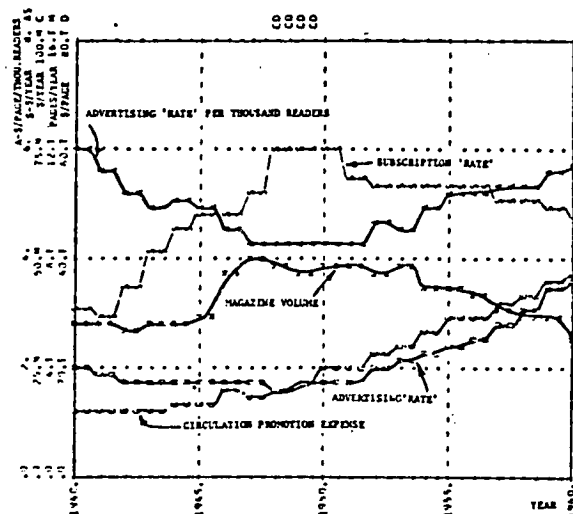


EXHIBIT 5.4 EXPERIMENT 36 ACTUAL COMPANY HISTORY (1946-1960)

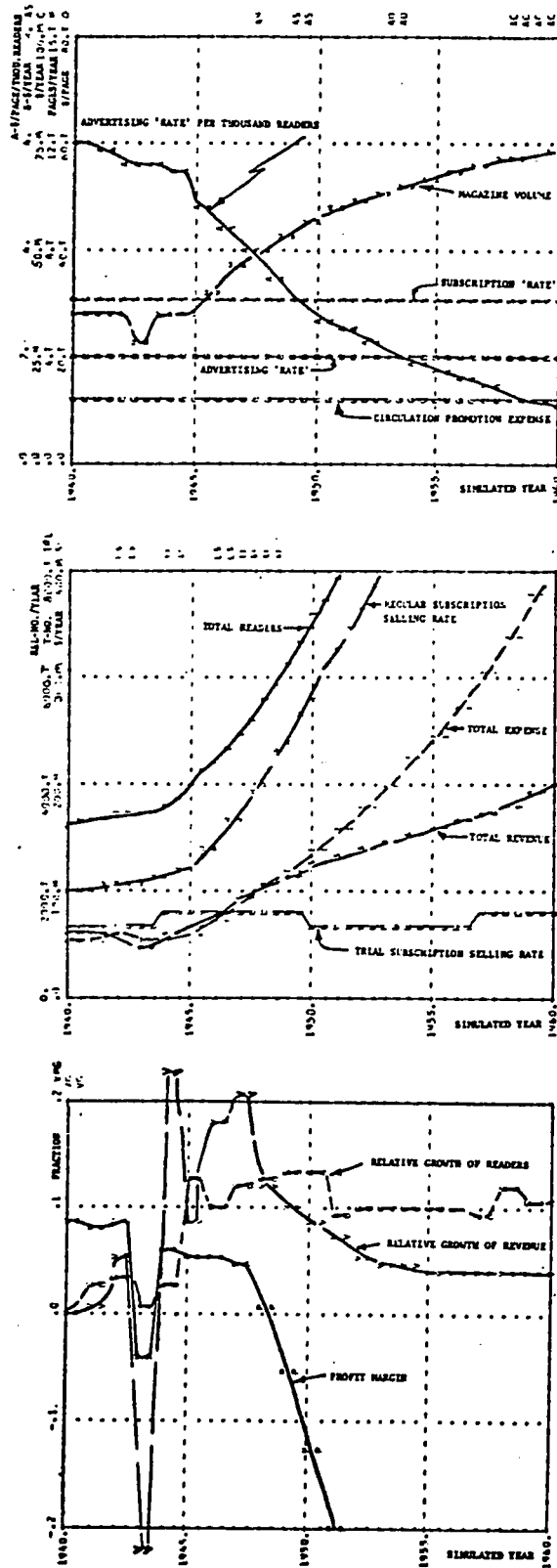


EXHIBIT 3.7 EXPERIMENT 97 RESPONSE OF FREE-RUNNING MODEL TO 'SPECIAL EVENTS'

TABLE 5.1 SUMMARY OF EXPERIMENTAL RESULTS

EXPERIMENT #	1	2	3	4	5	6	7
Experimental Parameter	Free Running	Subscription 'Rate' + 20% in 1945	Advertising 'Rate' + 20% in 1945	Promotion Expense 20% in 1945	Advertising 'Rate' per Thousand Readers Constant	Actual 1940-1960	Experiment #1 with special events included
Total Readers in 1950 (millions)	6.1	5.0	5.3	5.6	4.7	4.0	7.2
Total Revenue in 1950 (millions const. \$)	115.9	104.9	105.7	110.0	88.6	177.9	126.9
Relative Growth of Revenue (dimensionless)	Transient Effect Peak Value ¹ in year #	+0.03	-0.06	-0.02	-----	-----	-----
Profit Margin (dimensionless)	Transient Effect Peak Value ¹ in year #	0.05 1950	0.08 1950	0.07 1949	slowly increasing	0.15 1943	0.20 1947
Relative Growth of Readers (dimensionless)	Transient Effect Peak Value ¹ in year #	+0.02	+0.04	+0.02	-----	-----	-----
		Declines continuously from 1946	Declines continuously from 1947	Declines continuously from 1946	Increasing continuously	0.14 1944	0.09 1943
		-0.02	-0.01	-0.01	-----	-----	-----
		0.06 1957	0.10 1956	0.10 1955	slowly increasing	0.10 1946	0.14 1950

¹For experiments #2 through 6, this refers to the peak value reached after the transient effect has disappeared.

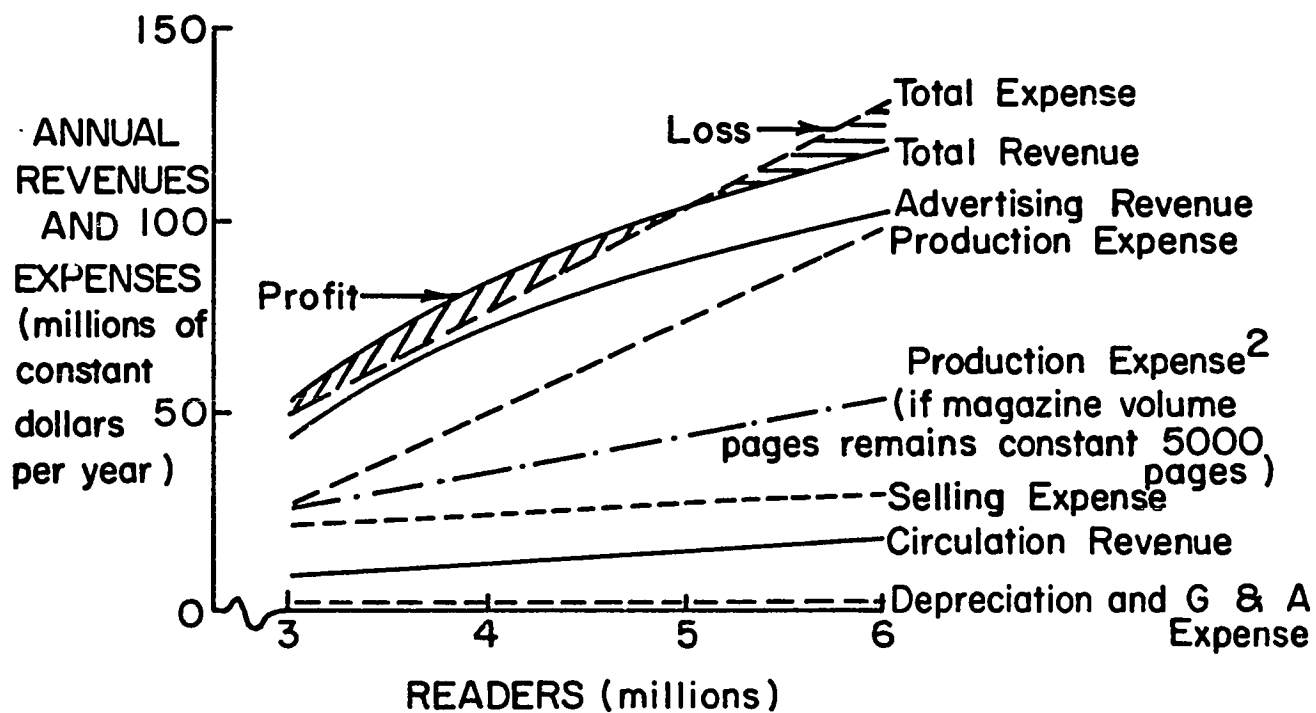
management fiat are left unchanged. It is as if, in an era of economic and technical stability (i.e. no wars, strikes or changes in promotion efficiency), the management takes an extended vacation, but before it departs, it fixes the subscription and advertising 'rates' and the annual expenditure on circulation promotion. From this experiment we should be able to determine whether the publishing system is stable or not. Obviously, if all the performance measures remain satisfactory during the period simulated, the system is easy to manage, but on the other hand, should some of the measures deteriorate, then the system is unstable, needs continual correction and, hence, might be considered more difficult to manage.

From Exhibit 5.1, we can see that the three variables subject to management decree (Subscription 'Rate', Advertising 'Rate' and Circulation Promotion Expense) are unchanged throughout the simulation run. The Advertising 'Rate' per thousand Readers, on the other hand, steadily declines throughout the experiment in response to the increasing number of readers of the magazine. Since this variable constitutes the price for advertising paid by the advertising industry, there results a steady increase in advertising pages purchased in the magazine. Through the firm's time-honoured formula relating the quantity of editorial and advertising content, the Magazine Volume Pages increase with the advertising. The resulting readership, revenues and expenses are plotted in the center graph. Note how the total readers grow rapidly from 3.25 million in 1940 to around 6 million in 1950. The revenues grow in the same period from 97 to 116 million constant dollars. The behavior of the performance measures resulting from this growth pattern is plotted in the bottom graph. It can

be seen that the Relative Growth of Revenues rises quite steeply to a peak of 0.08 in the simulated year 1947, the Relative Growth of Readers rises steadily to a peak of 0.10 in 1953, and the Profit Margin reaches a peak of 0.09 in 1944 before rapidly plummeting down. The behavior of the performance measures, therefore, suggests that the system of publishing this magazine is inherently self-destructive, in that the passage of time (four years to be precise) brings about a rapid decline in the Profit Margin. The question remains to be answered, why this occurs. We have seen how the magazine volume pages increase with increasing readership through the mechanism of the price of advertising and the number of advertising pages sold. This means that not only are more magazines being printed to supply the increase in readership but, also, each magazine has more pages in it. Thus, the production and distribution costs increase at a rate that is greater than would be incurred if the number of pages in the annual magazine volume remained constant. This phenomenon is illustrated in Exhibit 5.8, where the revenues and expenses derived from the model's equations are plotted as a function of the number of readers. The production expense for the situation where the annual magazine volume size is held constant at 5,000 pages, is shown in Exhibit 5.8, in comparison with the production expense when the volume size depends upon advertising sales. Note how the latter production expense increases with readership at about twice the rate for the former production expense. Also, the advertising revenue plotted in Exhibit 5.8, increases at a decreasing rate with the growth of readership. This relationship can be derived algebraically by substituting equation 25, III into 24, III, which restated gives:

EXHIBIT 5.8

A COMPARISON OF REVENUES AND EXPENSES AT DIFFERENT READERSHIP LEVELS¹



1 - derived from the equations of the model

2 - included for comparison only

$$\begin{array}{l} \text{Advertising Pages} = D_0 + D_1 * \text{Advertising 'Rate'} / (\text{Total Readers} * 10^3) \\ \text{Selling Rate} \\ \text{(pages/year)} \end{array}$$

where, D_0 and Advertising 'Rate' are positive and constant,

and, D_1 is negative and constant (from regression equation 24, IV).

The Advertising Pages Selling Rate will approach the value of D_0 as the divisor (Total Readers) increases. Hence, the advertising revenue, which depends directly upon this relationship, will also grow asymptotically to some limit with the growth of readers. We can state, therefore, that the system of publishing the Saturday Evening Post exhibits two unfortunate traits: one concerns the accelerated production expense and the other the deaccelerated advertising revenue with growth of readership. These two items in combination drive the company from a profit to a loss as the magazine's reading clientel grows if the advertising 'rate' remains unchanged.

Sources of Growth. Perhaps the most important asset of a magazine company is its readership. We have yet to explain the rapid growth of readers generated by the model company in this experiment (Exhibit 5.1). An examination of the regression equation for Trial Subscriptions sold (27, IV) reveals that the rate of selling trial subscriptions is entirely dependent upon the Circulation Promotion Expenditure. Since the latter is held constant in this experiment, the rate of selling trial subscriptions must also be constant. The regression equation for Regular Subscriptions (28, IV), on the other hand, contains a lot more independent variables and is more complex. It is restated here in a more comprehensible form:

Regular Subscriptions Sold = 600,000
(number per year)

+ Fraction of regular subscribers renewing their subscriptions * Regular
Subscriptions Expiring

+ Fraction of trial subscribers taking out regular subscriptions * Trial
Subscriptions Expiring
28A,V

where, the Fraction of regular subscribers renewing their subscriptions

= $1.34 - 0.09 * \text{Subscription 'Rate'}$ 28B,V

and the fraction of trial subscribers taking out regular subscriptions

= $8.0 * 10^{-5} * \text{Magazine Volume Pages}$ 28C,V

Several sources of potential readership growth can be identified from these relationships. Firstly, if the rate of selling regular subscriptions is greater in a particular year than in the previous year, then, if all the other variables remain constant, there will be an inherent growth of total readers. This will occur when the number of trial readers converting to regular readership exceeds the loss of regular subscribers who quit for one reason or another. For example, the Saturday Evening Post had the following conditions in 1940:

Trial readers	= 1.16 million
Regular readers	= 2.09 million
Subscription 'rate'	= 3.08 constant \$ per year
Magazine Volume pages	= 5600 per year

Substituting these values into equations 28A, B and C gives a selling rate of regular subscriptions for the subsequent year of 2.14 million (an increase of 0.05 million). The following year, these 2.14 million subscriptions

together with the trial subscriptions will be up for renewal with a consequent increase in regular subscriptions once again. The magazine's readership, therefore, will grow naturally from year to year.

A second potential source of growth stems from the relationship of the rate of selling trial subscriptions to the Circulation Promotion Expense as mentioned above. If the management of the firm chooses to increase this expense, the trial readers injected into the system will also increase. From equation 27,IV, we can calculate that each additional trial reader costs the firm roughly \$30 (const. \$). Moreover, the fraction of trial subscribers who eventually become regular readers is less than half the fraction of regular subscribers who renew their subscriptions. Therefore, the real cost of obtaining a regular reader is around \$60 to \$70 (const. \$). It is, therefore, an expensive way of boosting subscription sales. However, it does increase the regular subscription selling rate in subsequent years, and it does have a cumulative effect on the growth of readership.

Thirdly, the management may choose to alter the subscription 'rate'. Equation 28B,V indicates that a decrease in subscription 'rate' will stimulate regular subscription sales and an increase in the 'rate' will have the opposite effect. Roughly speaking, every dollar decrease in the subscription 'rate' results in a 9 percent increase in the fraction of regular subscribers renewing their subscription and visa-versa (from equation 28B,V). Assuming that two-thirds of the total readers are regular subscribers, it can be easily shown that an extra regular

subscriber obtained this way costs approximately \$17 (const. \$).¹ This would seem to be a cheaper form of stimulating readership growth than through increasing the promotion expenditure.

Finally, from equation 28C,V we see that an increase in the volume pages of the magazine will increase the fraction of trial subscribers who transfer to regular readership. This suggests that a thicker magazine is more attractive to the potential regular subscriber than a slim magazine. The relationship of equation 28C,V indicates that an increase of 1000 pages in the annual volume (approximately 20 pages per weekly issue) will increase by 8 percent the fraction of trial readers who convert to regular readership. Assuming that one-third of the total readers are trial readers (the situation pertaining to the Saturday Evening Post in 1940), and that a thousand pages cost an extra \$1.8 (const. \$) to produce and deliver to each reader (from the regression equation 26,IV), then it can be shown that each extra regular subscriber obtained in this way costs approximately \$67 (const. \$).² This is, also, an expensive way of acquiring a regular reading clientel.

¹ Computed by equating the loss of revenue to the potential increase in regular subscribers, where:

Cost of \$1 reduction in subscription 'rates' = 1 x Total Readers (\$ per year)

Increase in regular subscribers = .09 x (2/3) x Total Readers (subscribers)

² Computed by equating the cost of 1000 extra pages to the potential increase in regular subscribers, where:

Cost of 1000 extra pages = 1.8 x Total Readers (dollars per year)

Increase in Regular Subscribers = .08 x (1/3) x Total Readers (subscribers)

Interpreting the Results of Experiment #1.

Returning to the problem of interpreting the results of Experiment #1, it can be seen that two of the above mentioned growth factors account for the phenomenal growth rate of readers. Firstly, there is the natural growth brought about by the number of trial readers converting to regular readership overcompensating for the loss of regular subscribers, and secondly, there is the accelerating factor caused by the rapidly increasing pages in the annual volume. This is stimulated by the increase in advertising pages which is related to the drop in the price of advertising (the advertising 'rate' per thousand readers) which, in its turn, is caused by the increase in total readers. Referring to the diagram of the model (Exhibit 3.1), we can identify a closed loop pattern of components (which control engineers call a 'positive feedback loop') that accounts for this unrestrained growth situation. This 'positive feedback loop' passes through the following components of the model: total readers (33), advertising 'rate' per thousand readers (25), advertising pages selling rate (24), magazine volume page rate (16), regular subscription selling rate (28) and back to the total readers (33). Any change to one of these components will be feedback and reinforced through the system. It is both potentially explosive (i.e. an increase in the total readers will bring about a further increase) and potentially implosive (i.e. a decrease in total readers will be fed back and reinforced). This 'positive feedback loop' creates a managerial headache by driving up the number of pages in the magazine and, hence, its production costs faster than the revenues increase from advertising and circulation sales.

Since the Profit Margin in this experiment begins its rapid descent in the simulated year 1945, we would expect the management to take some action then. The model posits that the three major variables under their control are the subscription 'rate' the advertising 'rate' and the annual circulation promotion expense. Since the Profit Margin is the only measure to go out of control, we would expect the management of the firm to increase either of the 'rates' or decrease the promotion expenditure. This would increase revenues or decrease expenses. The impact of these changes on the model system of publishing the Saturday Evening Post is investigated next by carrying out experiments on the model with these variables. The results of Experiment #1 can be utilized as a 'benchmark' for comparing the relative movements of the performance measures.

Experiment #2. The effect of a change in subscription 'rate' was investigated by introducing an abrupt increase in this 'rate' in the year that the profit margin began to decrease, namely the simulated year 1945. Choosing this year also helps to circumvent a technical problem, often associated with simulation models, concerning the settling-down period due to the initializing procedure. The model has to be primed with initial conditions before it will run. For simplicity's sake, we assume a stable situation when initializing the pipe line delays representing the process of ageing subscriptions. However, this is a growth model, so that these assumptions, although they enable the model to run, actually introduce a small error. This error works its way out of the system in about two simulated years, so that choosing the fifth year of the simulation for the commencement of experiments avoids any confounding

of the effects of the experimental parameters on the model system with the transient effects generated by the initializing procedure.

A step change of twenty percent of the subscription 'rate' was imparted to the system. The results of this experiment are plotted in a similar fashion to experiment #1 in Exhibit 5.2, and summarized in Table 5.1. As it was predicted, the subscription price increase retards the growth of readership, so that, by the simulated year 1950, the total readership has grown to only 5 million (one million less than for experiment #1). The revenue, similarly, is checked, so that it reaches, in the same year, the value of 105 million constant dollars compared to 116 million constant dollars in experiment #1. The performance measures, it should be noted, exhibit two effects. Firstly, there is a transient effect induced by the experimental change that lasts for only a year or two, and secondly, there is a long term effect evidenced by the peak value that the measure attains once the transient effect has died away. The Profit Margin, for instance, increases temporarily by 0.02, returns to its previous value of 0.09 in 1948 and then declines rapidly. The Relative Growth of Revenue similarly exhibits a temporary increase of 0.03 before it settles to a value of 0.05 compared to 0.08 in experiment #1. Lastly, the Relative Growth of Readers decreases transiently by 0.02, then it increases to a maximum of 0.06 compared to 0.10 for experiment #1. To facilitate a comparison with experiment #1, the transient and long term experimental results are summarized in Table 5.1. The effect of the subscription 'rate' increase can be summed up as a transitory improvement in the profit margin, whose deterioration is forestalled

by four years. This temporary improvement of the profit margin is won at the expense of both the readership and revenue growth, so that by the simulated year 1950, one million fewer readers materialize and 11 million dollars per year in revenues are foregone. Increasing the subscription 'rate', therefore, as a tool of managerial control, serves to delay but temporarily the financial difficulties brought on by readership growth. It does this, however, at the expense of both the revenue and readership growth and, in particular, in the very sensitive area of regular subscribers who renew their subscriptions.

Experiment #3. The effect of a change in advertising 'rate' was investigated in a similar fashion to Experiment #2. An abrupt increase of 20% of the advertising 'rate' was induced in the model in the fifth simulated year. The results of this experiment are shown in Exhibits 5.3, and summarized in Table 5.1. From Exhibit 5.3, it can be seen that the increase in the advertising rate causes a temporary increase in the advertising 'rate' per thousand readers. This in its turn, through the mechanism of reducing the pages of advertising sold, temporarily halts the increase in the volume pages of the magazine. The effects of these variables on the performance measure can be observed in Exhibit 5.3. The Profit Margin is increased temporarily quite significantly. This occurs because the production costs have been held in check by the temporarily reduced magazine volume pages. One unexpected outcome from this experiment is that the regular subscription selling rate is reduced in comparison to the results of Experiment #1. This effect can be traced through the system from the increase in advertising 'rate' per thousand readers, to the decrease in advertising pages sold, to the

subsequent decrease in magazine volume pages, which reduces the fraction of trial readers who convert to regular readership, which reduces the regular subscription selling rate. However, this has a cumulative effect overtime on the total readers since there are now relatively fewer regular subscriptions expiring that are potentially renewable. Over the five year simulated period 1945 to 1950, this reduces the total readers by approximately 0.8 million in comparison with the first experiment.

From this experiment, the effect of increasing the advertising 'rate' can be discerned as significantly improving the profit margin, albeit temporarily and at the expense of both the long term revenue and readership growth. The detrimental effect of the change of advertising 'rate' on the growth of readership is, perhaps, a counter intuitive element of the system. One would not normally expect these components of the system to be related.

Experiment #4. The effect of a change in the annual Circulation Promotion Expense was investigated in a similar fashion. An abrupt decrease of 20% of the Circulation Promotion Expense was imparted to the model system in the fifth simulated year. The results of this experiment are shown in Exhibit 5.4, and summarized in Table 5.1. From Exhibit 5.4, it can be seen that the decrease in promotion expenditure effects the rate of selling trial subscribers, as we have already reasoned that it would. This in its turn has a cumulative effect on the total readers because fewer subscribers are now being inducted into the system, which brings about a deacceleration in the growth of readers through the mechanism of converting to regular readership in subsequent years.

The growth process is further attenuated by the positive feedback loop

described before. The reduced readership growth slows the rate of decrease in the price of advertising which affects the advertising sales so that the magazine volume grows less quickly. This, in its turn, affects the fraction of trial subscribers who convert to regular subscribers, and so on. The net effect of these changes to the readership on the company's measures of performance is to decrease significantly the relative growth of readership, and to increase temporarily the revenue growth and the profit margin. The inevitable decline in the profit margin is delayed for about 3 years.

The root cause of the sagging profit margin, as we have seen, lies in the positive feedback loop relating the number of pages in the magazine, and hence its cost, to the number of readers. To repeat the casual relationship: as the readership increases, the price of advertising decreases (advertising 'rate' per thousand readers), which stimulates advertising sales. The increased number of advertising pages leads to the addition of more pages of editorial content in keeping with the firm's advertising-editorial formula. The increased volume of pages attracts more trial subscribers to convert to regular readership which, through the mechanism of renewing subscriptions, leads to accelerated readership growth and a feeding back of the outcome to further reducing the price of advertising, and so on. The result of this feed-back effect is that costs rise more rapidly than revenues and the profit margin is reduced. If the management was aware of this process, then one might expect it to prevent the production costs from running away by controlling the number of pages in the magazine. As was explained earlier, the production costs of a magazine with a constant number of pages increases

with readership growth at a rate below that for the magazine whose pages are allowed to vary directly with the advertising content (see Exhibit 5.11). Obviously some relationship between advertising and editorial content must be maintained, otherwise the magazine will become all advertising as the readership grows and the price of advertising declines. An obvious way out of this dilemma is to fix the amount of advertising by controlling the price of advertising. Keeping the advertising 'rate' per thousand readers constant will achieve this. This is illustrated by another experiment with the model.

Experiment #5. In this experiment, whilst the subscription 'rate' and circulation promotion expense were held constant, the advertising 'rate' was adjusted every simulated year to effect a constant advertising 'rate' per thousand readers.³ The results of this experiment are shown in Exhibit 5.5, and summarized in Table 5.1. From Exhibit 5.5 it can be seen that the advertising 'Rate' is continually being revised in order to maintain a nearly constant advertising 'Rate' per thousand readers. Exhibit 5.5 shows that the readership and revenue growths are steady but less spectacular than for experiment #1. Lastly, the performance measures do not now deteriorate. The Relative Growth of Revenues and Relative Growth of Readers measures are nearly constant, albeit at a much smaller value than for experiment #1. The Profit Margin, on the

³This was achieved by replacing equation 21 (Chapter III and Appendix A.1) with the following (in DYNAMO terminology):

$$\text{ADRCH.KL} = (\text{IADRTE}/\text{ITOTRDS}) * \text{TOTRDR.K} - \text{ADRTE.K} \quad 21, \text{V}$$

where ADRCH, IADRTE, TOTRDR & ADRTE are defined in Chapter III and Appendix A.1.

the other hand, grows steadily throughout the experiment. The conclusion, therefore is that continually adjusting the advertising 'rate' in order to maintain a constant advertising 'rate' per thousand readers, leads to profit margin growth and constant revenue and readership growth. However, the growth of readers and revenues is at a considerably lower level than for experiment #1. The management strategy built into this experiment leads to a profit maximizing rather than to a revenue maximizing behavior of the system.

Comparison With Actual History

It has been suggested that a wise management will control the magazine publishing system by continually manipulating the advertising 'rate' so as to maintain the advertising 'rate' per thousand readers constant or nearly constant. In reality this means that the management must recalculate the advertising 'rate' every year to reflect both the change in total readers and the change in the value of money. One criterion, therefore, for judging the cleverness of a magazine's management is by its ability to maintain a constant or near constant advertising 'rate' per thousand readers. We might allow that the management pursue a more revenue maximizing course of action by controlling the variable under its control in such a way as to maintain a steady profit margin, whilst diverting the 'slack' in the system into activities that will maximize revenues (e.g. reduce the Advertising Rate per Thousand Readers, decrease the subscription 'Rate' or increase the Circulation Promotion Expense). Historical data for the Saturday Evening Post are plotted in the Exhibit 5.6, and summarized in Table 5.1. Note how the advertising 'rate' per thousand readers varies over the two decades 1940 to 1960 with its

consequent effect on the magazine volume pages. It exhibits no control at all. The conclusion is, then, that the management of the Saturday Evening Post, during this period, did not appreciate the interaction and long-run effects of the variables under its control and, in consequence, fails to meet our criterion of a wise management. However, they did achieve a much greater total revenue than in experiment #1 (178 vs 115 million constant dollars per year in 1950). We may conclude from this that the management collectively was revenue maximizing. The profit, on the other hand, exhibits considerable variation from an all time high of 0.15 in 1943 to a low of -0.03 in 1960. The question arises whether this variation can be accounted for by the decisions of the management or by the impact of the Special Events on the system. Another experiment was conducted with the model to investigate this question.

Experiment #7. For this experiment, Experiment #1 was repeated with the Special Event Switch (SES) switched on, so that the impact of the special events would be imparted to the model. It will be remembered that these events affected the efficiency of selling trial subscriptions, the rate of selling advertising pages and the production expense. The results of this experiment are shown in Exhibit 5.7, and the results are summarized in Table 5.1. It can be seen that the improvement in the efficiency of selling trial subscriptions during the years 1944 to 1949 increased the number of trial subscribers in the system which had the cumulative effect of increasing the total readership to over 7 million (compared to 6 million in experiment #1) by 1950. The reduced advertising during this same period held back the annual volume of pages which

reduced the production expense. The inevitable drop in the profit margin, as described in experiment #1, is delayed by about three years in consequence. The maximum revenue achieved was higher than for experiment #1 (123 compared to 116 million constant dollars per year). These experimental results bear very little resemblance to what actually occurred (compare Exhibits 5.6 with 5.7), so that we must search into the management's collective decision making behavior for an explanation.

Summary of Experimental Results

The behavior of the company's measures of performance in these experiments are summarized in Table 5.1. The main conclusions that can be drawn from these experiments are:

1. The system of publishing the Saturday Evening Post is potentially self destructive because the inherent and stimulated growth of readership drives up the production expenses at a rate in excess of the increase in revenues, so that, with increasing readership the profit margin declines very rapidly.
2. The variables under the control of management, namely, the subscription and advertising 'rates', and the annual circulation promotion expense, when changed to correct the sagging profit margin, have only a transitory effect. They improve the profit margin, as would be expected, but they only delay for a few years its inevitable fall.
3. Furthermore, changes to these variables have long-run effects that are sometimes deleterious. Increasing the subscription 'rate' has an adverse cumulative effect on the total readership. It strikes at the company's most valuable asset, its regular subscribers. Fewer subscribers means less revenue from circulation and advertising, so that the long-run

growth of revenue is affected adversely also. Decreasing the circulation promotion expenditure has similar deleterious effects. Perhaps the most unexpected relationship of all exists between the advertising 'rate' and the relative growth of readership. An increase in the advertising 'rate' has an adverse long-run effect on both the growth of readers and revenue. One would not normally expect these components of the system to be related. Therefore, it can be inferred that this magazine publishing system is difficult to manage.

4. One particular policy, namely controlling the size of the magazine through the mechanism of continually adjusting the advertising 'rate' to secure a constant advertising 'rate' per thousand readers, offers slow but stable growth of readership and revenues, longevity of the firm and increasing profits.

5. However, the actual behavior of the company exhibits considerable revenue maximizing. It does not seem that the management was aware either of the long-run effects of the variables under its control because of the wide range of values recorded for these variables, or of the policy mentioned in item 4 above.

If the management of the firm was not aware of the interrelationship of this complex system, it might easily be beguiled by the short-run, but transitory, corrective action of these variables under its control. As Forrester has written concerning the counter-intuitive behavior of complex systems (Forrester, 1969, p. 110):

'But the complex system is far more devious and diabolical than merely being different from simple systems with which we have experience. Although it is truly different, it appears to

be the same. The complex system presents an apparent cause that is close in time and space to the observed symptoms. But the relationship is usually not one of cause and effect. Instead both are coincident symptoms arising from the dynamics of the system structure. Almost all variables in the complex system are highly correlated, but time correlation means little in distinguishing cause from effect. Much statistical and correlation analysis is futilely pursuing this will-o'-the-wisp.

In a situation where coincident symptoms appear to be causes, a person acts to dispel the symptoms. But the underlying causes remain. The treatment is either ineffective or actually detrimental. With a high degree of confidence we can say that the intuitive solutions to the problems of complex social systems will be wrong most of the time. Here lies much of the explanation for the problems of faltering companies, disappointments in developing nations, foreign-exchange crises, and troubles of urban areas."

In the next chapter, an attempt will be made to explain the rise and fall of the old Saturday Evening Post by summarizing the managements' reactions to significant events in the magazine's life, and tracing the effect of these decisions through the system with our new found understanding of how the system works as a whole.

CHAPTER VI

MANAGEMENT DECISION MAKING IN A MAGAZINE PUBLISHING SYSTEM

- The rise and fall of the Saturday Evening Post

In this chapter we shall look at some of the more significant decisions made by the management of the Saturday Evening Post and try to trace their impact through the magazine publishing system using our new found knowledge of how the system functions. In this way it is hoped to explain the rise and fall of this illustrious magazine in terms of the dynamics of the entire system including the management decision processes.

Important Periods in the History of the Magazine between 1940 and 1960

Referring to Tables 6.1 and 6.2, we can discern four distinct periods in the developmental history of the Saturday Evening Post between the years 1940 and 1960. The first period, 1940 to 1945, spans the World War II years. During most of this period the expansion of the company was inhibited by paper rationing. The company raised the annual subscription 'rate' from an average of approximately 3.00 to 4.80 constant dollars per subscriber; presumably as a device for simultaneously rationing the magazine, which was in great demand, and compensating for the loss of war time advertising revenue (see Regression Equation 24, Chapter IV). The combined effects of limiting the volume of the magazine to around 5700 pages (thereby holding the production expenses in check), and increasing substantially the circulation revenue, resulted in an unprecedented profit margin of 14 per cent of revenues.

The second period spans the immediate post war years from 1945

TABLE 6.1
MAJOR REVENUES, MAJOR EXPENSES & TOTAL READERS¹
For the Curtis Publishing Co. & the Saturday Evening Post Magazine

Year Ending	Total Revenue (c\$m)	Circulation Revenue (c\$m)	Fraction of Total Revenue	Advertising Revenue (c\$m)	Fraction of Total Revenue	Production Costs ² (c\$m)	Fraction of Total Revenue	Promotion Costs ³ (c\$m)	Fraction of Total Revenue	Total Readers (millions)
1940	97.4	23.4	.240	74.0	.760	46.7	.480	29.4	.302	3.25
1941	99.8	24.8	.248	75.0	.752	51.0	.511	29.8	.299	3.39
1942	89.7	28.3	.316	61.4	.684	51.2	.571	29.5	.329	3.33
1943	103.2	30.4	.294	72.8	.706	48.2	.467	30.9	.299	3.44
1944	110.7	32.6	.294	78.1	.706	48.5	.438	32.8	.296	3.39
1945	115.1	33.3	.290	81.8	.710	52.7	.458	33.7	.293	3.45
1946	146.9	40.7	.277	106.2	.723	78.2	.534	41.3	.282	3.78
1947	162.3	43.3	.267	119.0	.733	86.7	.534	37.9	.234	3.96
1948	163.1	47.0	.288	116.1	.712	89.0	.545	40.4	.248	3.90
1949	164.1	52.0	.317	112.1	.684	88.4	.539	42.0	.256	4.02
1950	177.9	60.1	.338	117.8	.662	88.5	.498	50.0	.281	4.03
1951	169.6	56.6	.334	113.0	.616	85.0	.501	50.6	.299	4.00
1952	175.9	59.1	.336	116.8	.664	86.0	.489	57.1	.325	4.22
1953	187.1	65.1	.348	122.0	.652	88.8	.475	61.1	.326	4.52
1954	184.9	66.0	.358	118.9	.642	84.4	.457	67.1	.364	4.59
1955	191.2	65.8	.344	125.4	.656	84.1	.440	74.6	.390	4.70
1956	192.2	66.1	.344	126.1	.656	79.5	.414	74.0	.385	4.91
1957	201.8	69.4	.344	132.4	.656	85.9	.426	78.6	.390	5.30
1958	200.7	72.9	.363	127.8	.637	93.0	.464	83.0	.414	5.75
1959	221.6	76.4	.345	145.2	.655	104.5	.472	89.3	.404	6.12
1960	225.2	78.2	.347	147.0	.653	107.9	.479	92.8	.412	6.30

¹ Source: Tables 4.1 and 4.5, all money values are in millions of constant dollars (c\$m)

² Includes Editing, Printing & Distribution Expenses

³ Circulation Promotion Expense

TABLE 6.2
A SUMMARY OF PERFORMANCE MEASURES, MANAGED AND INTERVENING VARIABLES
For the Saturday Evening Post

Performance Measures ¹ (dimensionless)		Managed and Intervening Variables ³				
At Year Ending	Relative Growth of Revenue	Profit Margin	Relative Growth of Readers	(subject to management decree) Subscription-Advertising 'Rate' (10 ³ \$/year) (10 ³ \$/page)	Circulation Promotion Expense (10 ⁶ \$/year)	(Intervening) Advertising 'Rate' per Thousand Readers (\$/page/thou. Volume (pages/year)
1940	.08	.08	.05	2.93	18.7	5.54
1941	.01	.05	.04	3.52	17.3	5.18
1942	-.10	-.04	-.02	4.15	16.9	5.80
1943	.15	.11	.03	4.50	17.3	5.10
1944	.07	.14	-.01	4.79	17.1	4.96
1945	.04	.13	.02	4.86	17.1	4.52
1946	.28	.07	.10	5.21	16.9	4.26
1947	.10	.11	.05	6.02	16.5	4.24
1948	.01	.08	-.01	5.97	17.2	4.29
1949	.01	.08	.03	5.97	17.1	4.23
1950	.08	.10	.00	5.52	16.9	4.23
1951	-.05	.08	-.01	5.40	19.5	4.61
1952	.04	.07	.06	5.36	20.8	4.59
1953	.06	.08	.07	5.34	22.7	4.94
1954	-.01	.06	.02	5.36	24.2	5.16
1955	.03	.05	.02	5.28	25.6	5.21
1956	.01	.08	.05	5.10	27.4	5.34
1957	.05	.06	.08	5.00	30.3	5.27
1958	-.01	-.01	.08	4.93	34.1	5.57
1959	.10	-.01	.06	4.85	36.1	5.74
1960						5910

¹Source: Computed from Tables 4.1 and 4.5

²Assumes that the management took action to change the managed variables during the year following the report of unsatisfactory performance.

³Source: Tables 4.3 and 4.5, all money values in constant dollars.

to 1947 when the magazine underwent a phase of almost unrestrained growth. Its readership grew from 3.4 to almost 4 million, its revenues grew from 115 to 162 million constant dollars, and its profit margin fell from 14 in 1944 to 7 per cent of revenues in 1946. This phase of the magazine's history parallels the first experiment with the free-running simulation model described in the last chapter. The significant increase in readers lowered the price of advertising from 4.96 in 1944 to 4.24 constant dollars per page per thousand readers in 1947, which stimulated the advertisers to buy more pages of advertising in the magazine. This increase in advertising pages purchased was matched by an increase in editorial pages (see the advertising - editorial formula, Regression Equation 16, Chapter IV), which caused a significant increase in the volume of the magazine. As can be seen from Table 6.2, the annual volume grew from 5822 in 1944 to nearly 8000 pages in 1946. It has already been demonstrated that an increase in annual volume will improve the yield of regular readers converting from trial readers; thus accelerating the growth of total readers. The net result of the larger readership and more voluminous magazine supplied to each reader was a crippling increase in the production costs from around 46 to 53 per cent of annual revenues (see Table 6.1). Thus, the profit margin was depressed through the mechanism already uncovered and described in the previous chapter.

The management's action to counteract the drop in profit margin was to increase, quite substantially, the subscription 'rate' from an annual average of 4.79 in 1944 to over 6.00 constant dollars per subscriber.¹

¹Equivalent to about 12 (1970) dollars.

Why they should have adopted this policy is a matter for conjecture.

Cyert and March in their Behavioral Theory of the Firm make the following proposition concerning the way that organizations go about searching for a solution to a pressing problem (Cyert and March, 1963, p. 121).

'We assume that rules for search are simple minded in the sense that they reflect simple concepts of causality. Subject to learning..., search is based initially on two simple rules: (1) search in the neighbourhood of the problem symptom and (2) search in the neighbourhood of the current alternative. These two rules reflect different dimensions of the basic causal notions that a cause will be found 'hear' its effect and that a new solution will be found 'hear' an old one.'

Applying these rules to the present case leads to the conclusion that the management would indeed choose the alternative of increasing the subscription 'rate'. For example, referring to Table 6.1, we can see that one symptom of the problem is that the fraction of total revenue supplied by the circulation revenue fell during the years 1946-1947. This would suggest increasing the subscription 'rate'. Also, as has been stated previously, the company very successfully raised its profit margin during the war years by increasing the subscription 'rate'. Therefore, increasing the subscription 'rate' is a current alternative solution. This raises the exciting prospect, as will be elaborated on in the concluding chapter, that available theories of organizational decision making could be operationalized and pressed into service for simulating the collective intuitive decision processes in organizations. Returning to the saga of the Saturday Evening Post, the effect of increasing the subscription 'rate' has been shown to have a detrimental effect on the fraction of regular subscribers who resubscribe (see Exhibit 5.2, Chapter V). The growth of readers of the magazine, in consequence,

levelled off. In summary, this period of the magazine's history can be described as (1) unrestrained growth leading to a depressed profit margin, (2) management action based, presumably, on the symptoms of the problem and the most current alternative solution (namely, raising the subscription 'rate'), rather than being based on the underlying causal structure of the problem (namely, the loss of control of the annual volume and the consequent increase in production costs), and (3) stagnation in the growth of readers due to the drop in the renewal rate of regular subscribers.

The third phase in the magazine's life from 1948 to 1950 can best be described as 'stagnation'. In spite of an ever increasing expenditure of circulation promotion dollars (from 42.0 to 50.6 million constant dollars) the readership scarcely grew at all and in 1951 it actually declined. This can be explained in terms of the reduced renewal rate of regular subscriptions due to the high subscription 'rate' and the reduction in the efficiency of selling trial subscriptions as the market returned to normal after the high appeal of the magazine during the immediate post war period (see Regression Equation 27, Chapter IV). This drop in efficiency offset the increased promotional expenditure, so that the company was faced with a significant increase in promotional effort just to keep its total readership steady.

The fourth phase, spanning the years 1951 to 1960, was a period

of 'forced growth'. The decline in total circulation recorded in 1951 must have been of considerable concern to the management of the magazine. Also, during this period the Look magazine began to catch up with the Saturday Evening Post and a circulation war erupted (see Exhibit 6.1). There seems to have been a sudden realization that readership was the key to unlock future growth, because the management undertook to reduce the subscription 'rate' and to inject a massive quantity of promotional dollars (see Table 6.2). Circulation promotion expenditures increased over the period from around 57 to 93 million constant dollars per year and resulted in a 'forced' growth of readers from 4 to 6.3 million!

Since increasing the subscription 'rate' was no longer an acceptable means of raising extra revenue to pay for the ever increasing promotional expenditure, the only available alternative was to increase the advertising 'rate'. This 'rate' was consequently raised from an average of 19.5 to 36.1 thousand constant dollars per page (see Table 6.2). Unfortunately, the rate of increase in readers did not match the rate of increase in the advertising 'rate'. Hence, the real price of advertising rose from an average 4.61 to 5.74 constant dollars per page per thousand readers (see Table 6.2) and the advertisers purchased fewer pages in the magazine, (see Regression Equation 24, Chapter IV). Through the company standard practice of adjusting editorial pages to advertising pages (see Regression Equation 16, Chapter IV), the editor was limited to fewer editorial pages and the magazine's issues grew thinner, from an annual volume of around 7600 pages in 1951 to only 5910 pages in 1960. The yield of regular subscribers from trial subscribers, which has been shown to be dependent on the annual volume of

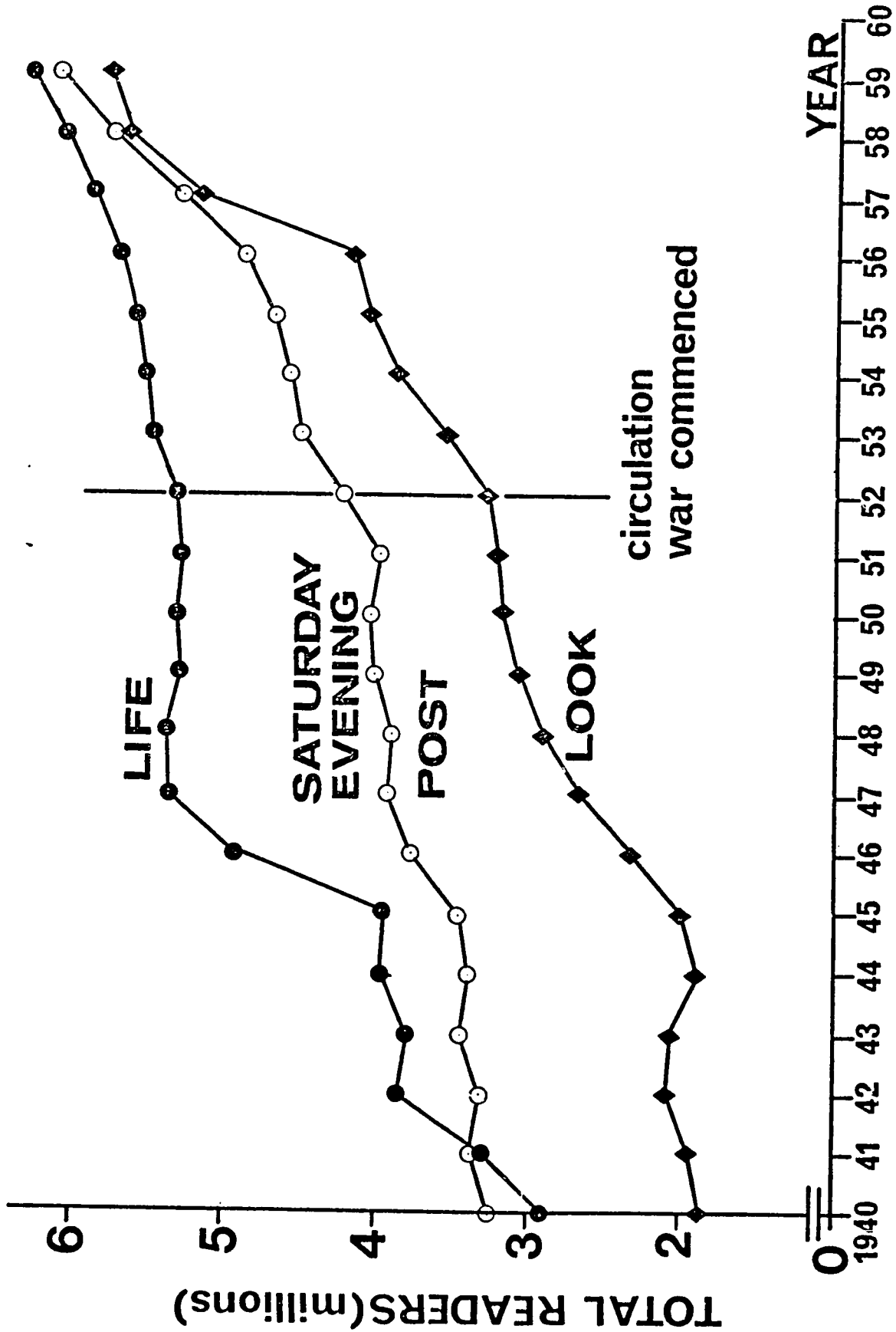


EXHIBIT 6.1 COMPARISON OF MAGAZINE READERSHIP TRENDS

- Life, Look and the old Saturday Evening Post

Source: Association of National Advertisers (1961)

the magazine, consequently dropped. This depressed the profit margin since it led to the dangerous situation that readership could only be maintained by an ever increasing level of promotional expenditure. By this time, almost one half of the total readers were trial readers and a smaller proportion of these readers was taking out regular subscriptions as the annual volume of the magazine declined in response to the ever increasing advertising 'rate'. During this period of its history, the magazine's readership grew from 4 to 6 million, the company's annual revenue grew from 170 to 225 million constant dollars and its profit margin fell from 8 percent of revenues to a loss position in 1958 and 1959. The company was on the brink of bankruptcy and never really recovered from this policy cul-de-sac of too high a subscription 'rate', too high an advertising 'rate', a declining annual volume and a too high promotional expenditure to solicit trial readers to replace the defecting readership.

The Death Throes

The final phase of the magazine's history is not covered by this study, but is mentioned here in passing because the dramatic events that unfolded appear to be a direct result of the weakened financial position brought about by the interaction of the management's previous decisions with the magazine publishing system, as described above. The death throes of the ailing Saturday Evening Post are well documented by one of the last presidents of the Curtis Publishing Company (Culligan, 1970) and the last editor of the magazine (Friedrich, 1970). The reduction in the volume of pages published necessitated a reduction in the company's printing plant capacity which led to a disastrous strike at the plant. Also, the change to biweekly and thence to monthly issues must have seemed

threatening to the editors, whose skills lay in the production of a weekly magazine, because they revolted and approached the Board of Directors directly about the matter. In consequence, the president of the company was forced to resign (Culligan, 1970). There was an attempt to reduce the circulation of the magazine, presumably to save production costs, but this seems to have failed to help its financial plight (Friedrich, 1970, p. 299). The company also changed its method of reporting its subscription income in the annual financial report to an accounting method that, in the short run, showed the company's operations in a better light (Friedrich, 1970, p. 65). The editors resorted to 'sensationalism' as a means of attracting and holding readers. Unfortunately, the company was successfully sued for libel and heavy damages were assessed in the favour of the parties defamed by the sensational disclosures published in the magazine (Friedrich, 1970, pp. 41 - 45). It would seem that the management never really understood the underlying causal structure of the problem besetting it and, hence, were never able to discover a satisfactory combination of the major variables under its control that would rescue the magazine. It was discontinued in 1969.

A Pathology of Magazines

The question naturally arises, whether the process that has been demonstrated to account for the decline of the old Saturday Evening Post is particular to that magazine only or is a more general description of a malaise that can effect other magazines. The basic assumptions built into this model of cause and effect concern (1) the demand function for advertising in a magazine, (2) the editorial-advertising formula for a maga-

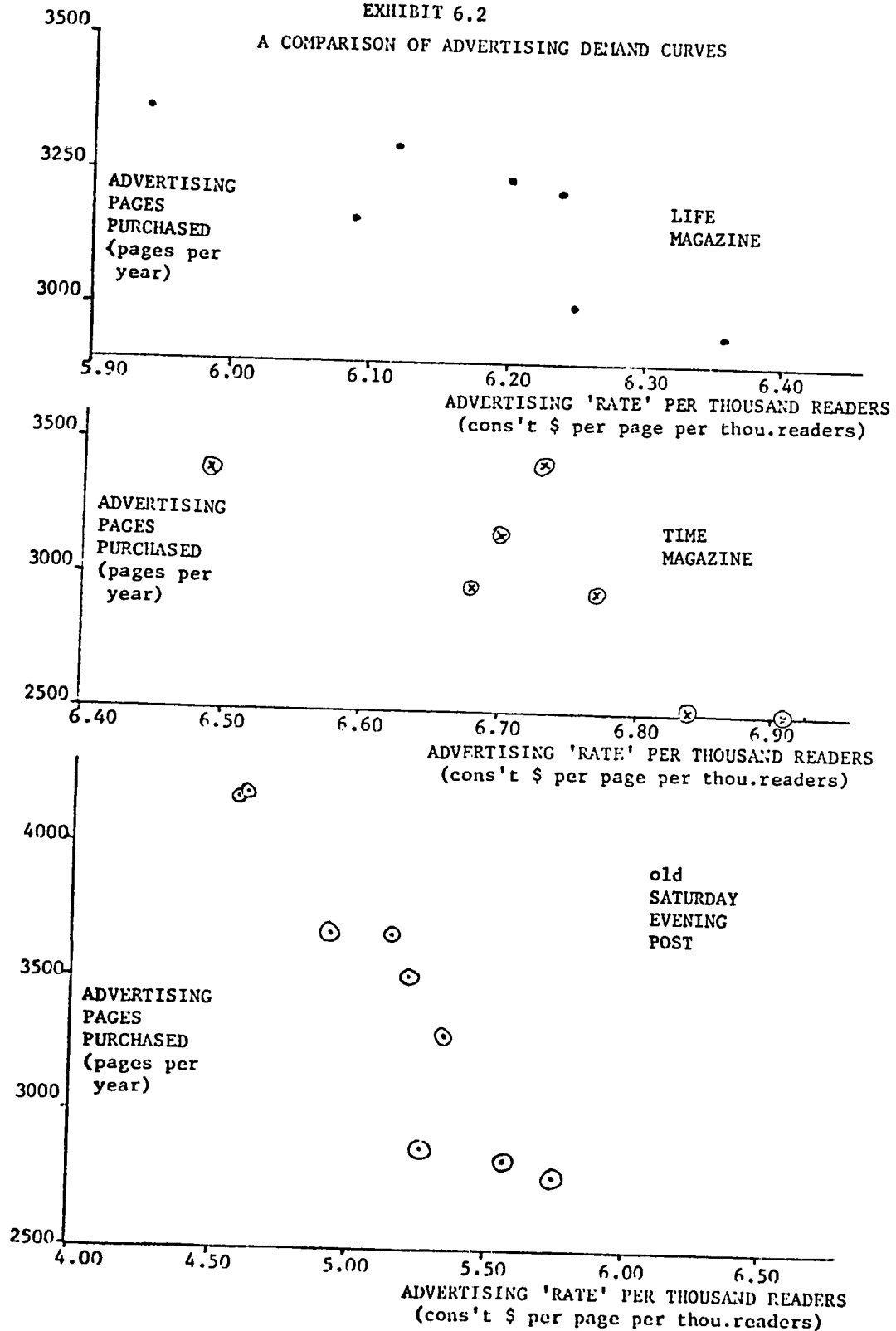
zine, and (3) the determinants of the readership from the magazine's annual volume size and subscription 'rate'. These assumptions are reviewed below, together with any evidence that has come to hand to compare these posited relationships for other magazines with those found for the old Saturday Evening Post.

The demand for advertising. The number of pages of advertising purchased in a magazine (pages per year) is posited to vary directly with the price of advertising charged by the magazine's publisher (advertising 'rate' per thousand readers). Exhibit 6.2 compares the plots of advertising pages purchased versus the advertising 'rate' per thousand readers for the old Saturday Evening Post and two other magazines. A visual inspection of this exhibit suggests that the posited relationship exists for all three magazines.

The editorial-advertising formula. A magazine's volume size (pages published per annual volume) is assumed to vary directly with the pages of advertising purchased (pages per year) in the magazine by the advertisers. The comparative plots of magazine volume size against advertising pages purchased are shown in Exhibit 6.3 for three magazines. An inspection of this exhibit also suggest quite strongly that the relationship holds for the other magazines as well as the old Saturday Evening Post.

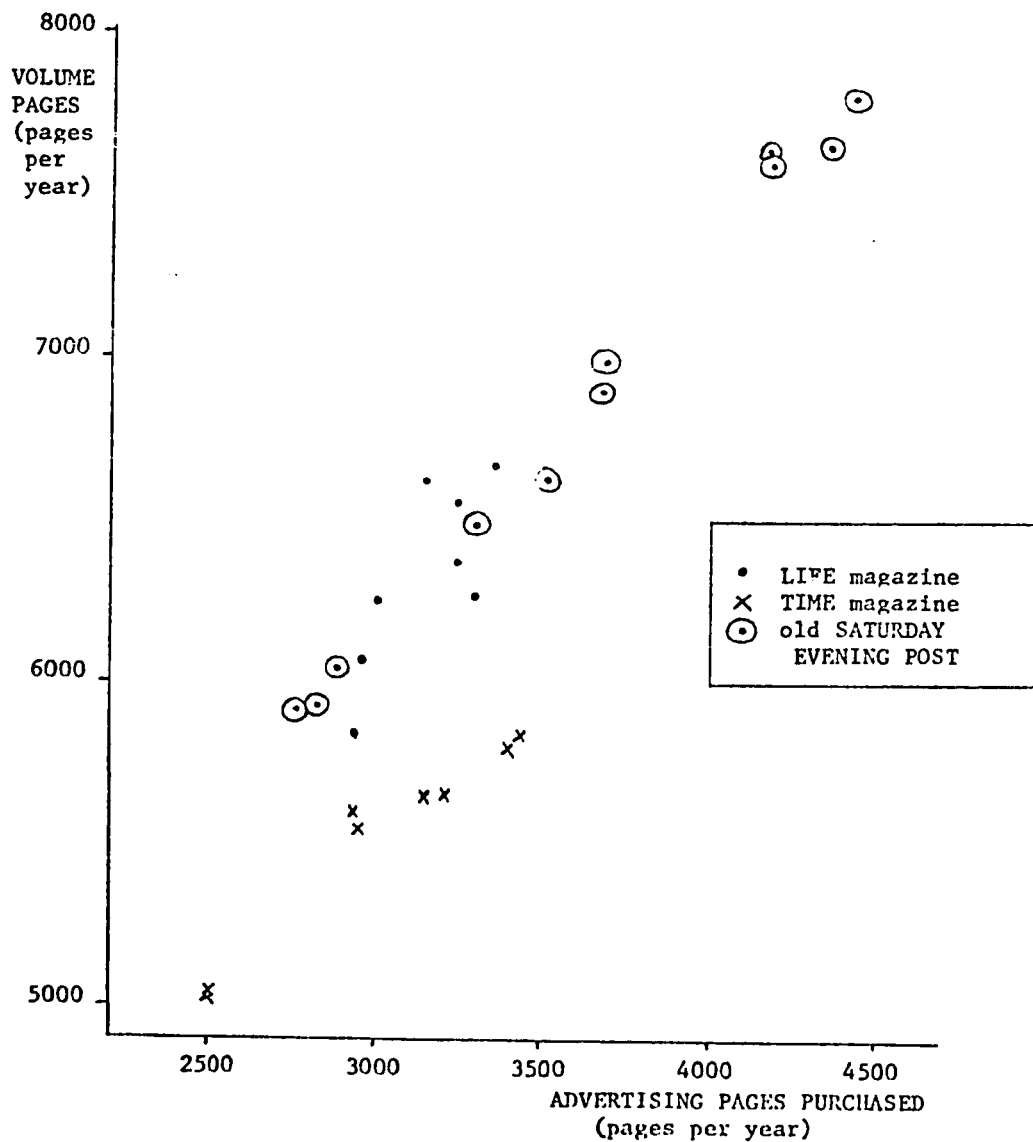
The determinants of the readership of the magazine. The fraction of regular readers who renew their subscriptions and the fraction of trial readers who convert to the regular readership of a magazine are both

EXHIBIT 6.2
A COMPARISON OF ADVERTISING DEMAND CURVES



Source: Advertising Age (January issues)

EXHIBIT 6.3
A COMPARISON OF ADVERTISING-EDITORIAL FORMULAE



Source: Advertising Pages Purchased - Advertising Age (January issues)
Volume Pages - physical count of magazine annual volumes

posited to be a function of the subscription 'rate' charged and its annual volume size. It will be recalled that the empirical study of the Saturday Evening Post indicated a strong relationship between the fraction of regular readers renewing their subscriptions and the subscription 'rate' charged. Also, the fraction of trial readers converting to regular readers was found to be markedly influenced by the annual volume size of the magazine. Unfortunately, data are not available in sufficient quantity to test these relationships on other magazines. It would be difficult to imagine, however, a magazine where at least the key relationship between subscription renewals and magazine volume size did not exist. It may not be a continuous variable, as the case of the Saturday Evening Post, but at least there must be a lower limit of magazine volume size at which point readers can no longer find enough editorial material of interest to them to make it worthwhile renewing their subscriptions. As long as such a relationship exists, and it would seem intuitively obvious that it would, then there is a possibility of a magazine's publisher getting caught up inadvertently in the downward spiral of events already discussed.

Summary

Using the understanding of how the system of publishing a magazine functions, and tracing the effects through the system of the management's decisions to change certain key variables, an explanation has been afforded of how the fortunes of the Saturday Evening Post and its publisher, the Curtis Publishing Company, rose and fell. This systems study of the magazine brings one to the conclusion that, had the management

acted appropriately to the underlying causal structure of the problem instead of reacting to the symptoms of the problem, the old Saturday Evening Post might still be in existence. Evidence and arguments have been furnished to suggest that the process may be common to other magazines besides the old Saturday Evening Post.

CHAPTER VII

SUMMARY AND CONCLUSIONS

In this chapter, the study and its major findings will be summarized. Some of the obvious omissions of the study, such as the effects of editorial policies, will be discussed. Finally, a commentary is offered on the wider implications of the methodology employed in this study.

A Summary of the Study and its Major Findings

The main objective of this study, as stated earlier, was to make a systems study of magazine publishing in order to find out how it works. The means for achieving this, in the first place, was by building a general simulation model of a magazine publishing firm using the methodology of Industrial Dynamics and drawing upon a variety of literature concerning the components of magazine publishing. This model was put forward as a working hypothesis of how the system of components interacted.

Next, the validation of the model was undertaken by testing the key assumptions built into it through an empirical study of a twenty-year period of the old Saturday Evening Post magazine. This study uncovered the following statistically tested relationships:

1. The total number of pages in the annual volume of the magazine was closely related to the pages of advertising sold during the year through the advertising-editorial formula (Regression Equation 16, IV).
2. There existed a well defined demand schedule for advertising pages in the magazine. In other words, given the price of advertising in the

magazine (in constant dollars per page per thousand readers), the number of pages of advertising purchased by the advertising industry in any year could have been predicted with reasonable accuracy. (see Regression Equation 24, Chapter IV).

3. The annual cost of producing the magazine (in constant dollars per year) was closely related to the annual volume of output measured by total pages printed and delivered to readers each year (see Regression Equation 26, Chapter IV). In particular, the cost per page for editing, printing and delivering the magazine remained remarkably constant over the period 1940 to 1959 which suggests that inflationary increase in production costs was not a root cause of the company's financial difficulties during this time.

4. The number of trial readers of the magazine (including news-stand sales) was directly related to the company's circulation promotion effort as measured by the expenditure in constant dollars per year (see Regression Equation 27, Chapter IV). No evidence could be found of a decline in the efficiency of selling trial subscriptions during the latter period of the study (1950 - 1960) when the magazine might have expected competition from a growing Television media. On the contrary, during this period, the marginal cost of selling trial subscriptions decreased due, presumably, to the improved technical efficiency of promoting subscription sales by the mass-mailing of reduced price subscription offers.

5. The subscription 'rate' (in constant dollars per subscription per year) charged for the magazine affected quite markedly the fraction of regular subscribers who renewed their subscriptions (see Regression Equation 28, Chapter IV).

6. The fraction of trial readers who converted to regular readership was directly related to the magazine's annual volume pages (pages per year), (see Regression Equation 28, Chapter IV).

These relationships were built into a simulation model of the Saturday Evening Post. The model was used to trace the impact through the system over time of the various management decisions, such as increasing the subscription 'rate'. These decisions were found to have both short run favorable and long run deleterious effects upon the key performance measures of profit margin, revenue growth and readership growth. For example, increasing the subscription 'rate' increased the circulation revenue and thus had a beneficial effect on the profit margin index of performance in the short run. However, it also reduced the fraction of regular readers who renewed their subscriptions, which led an unfortunate cumulative effect on the growth of readership. One unexpected discovery from experimenting with this model was that changes to the advertising 'rate' effected the growth of readers. This occurred through the following mechanism: an increase in advertising 'rate' decreased the demand for advertising which, in its turn, caused the magazine volume pages to decrease, which adversely effected the yield of regular subscribers from trial subscribers, with the consequence that the growth of readership was reduced over an extended period of time. Furthermore, during periods when the natural increase in readers reduced the advertising 'rate' per thousand readers, the purchase of advertising was stimulated, which increased the magazine volume pages so that the production costs increased at a rate in excess of the increases in revenues; thereby depressing the profit margin. This model of a magazine publishing firm suggests that the magazine

publishing system is potentially self-destructive in the long run, in that the growth of readers adversely effects the profit margin, and that the actions taken by the management to correct the situation by increasing subscription or advertising 'rates' can cause the growth of readers to decline.

The knowledge of how the magazine publishing system works was used to analyse the impact of the management of the old Saturday Evening Post during the period of 1940 - 1960. The conclusions drawn from this exercise are summarized as follows:

1. Paper rationing during World War II served to control the magazine volume pages. This, plus the management's policy of raising the subscription 'rate' as a means of rationing the magazine, resulted in an unprecedentedly high profit margin for the company.
2. After paper rationing was abolished, the increase in volume pages attracted more trial readers to become regular subscribers which, through the cause and effect chain of events described above, resulted in a depressed profit margin. This prompted the management to further increase subscription 'rates' until a stagnation in readership growth occurred through the mechanism also described above.
3. The management attempted to correct this unsatisfactory readership growth by increasing circulation promotion expenditure and funding this increase by raising the advertising 'rate'. However, this resulted, through the counter-intuitive element described before, in further stunting the readership growth, which the management tried to counter by increasing still more the circulation promotion expenditure and the advertising 'rate', and so on. The cumulative effect of this process over an extended period of

years drove the old Saturday Evening Post from a thick weekly magazine to a skinny biweekly and from a healthy growth based on a majority of regular subscribers to an unhealthy growth based on a large proportion of trial readers. This led subsequently to a revolt of the editors and a disastrous strike at the company's printing plant. It was suggested that, had the management treated the underlying causes of the problem, namely the uncontrolled magazine volume pages, instead of seemingly reacting to the symptoms of the problem, namely the depressed profit margin and unsatisfactory readership growth, the magazine might still be in business today.

Finally, it was argued that other magazines have similar characteristics to the old Saturday Evening Post and, therefore, might be susceptible to the same process that has been demonstrated to account for its decline. In other words, there is grounds to believe in a general pathology of magazines. If this be the case, then it leads to the conclusion that the failure of mass-circulation magazines, such as the old Saturday Evening Post (1969), Look (1970) and Life (1972), is not so much a matter of losing touch with the readership from an editorial quality point of view, or becoming unprofitable because of high postal rates or inflationary increases in printing costs, but more a matter of adopting the wrong tactics when adjusting advertising 'rates' and other management controls in response to the poor performance of such measures as profit margin on sales. That is, the decline in fortunes of some magazine companies is generated by internal management influences and not by external environmental ones. Due to the complexity of the magazine publishing system, we might very well expect the management of a magazine

to feel that it was being blown about by the winds of fortune rather than being master of its own destiny.

To use an analogy with human pathology, the patient might expire from an illness that would not normally be fatal if the patient's general physical condition had not been weakened by another more insidious and chronic illness. Similarly, a variety of events, such as higher postal charges, might bring about the demise of a magazine whose weakened financial situation has, nevertheless, resulted from the creeping pathological process already uncovered by this study. One might conjecture that the process that brought about the fall of the old Saturday Evening Post might well account for the failure of other magazines in recent times. This raises the interesting question whether magazines now enjoying high or rising popularity, such as Playboy, will be doomed in the long run by this same pathology concerning the management's intuitive decision making procedures within a complex system. As Forrester has written concerning the counter intuitive behavior of organizations in complex systems (Forrester, 1970, p. 55):

"Policies are being followed at the various points in the organization on the presumption that they will alleviate the difficulties. One can combine these policies into a computer model to show the consequences of how the policies interact with one another. In many instances it then emerges that the known policies describe a system which actually causes the troubles. In other words, the known and intended practices of the organization are fully sufficient to create the difficulty, regardless of

what happens outside the company or in the market-place. In fact, a downward spiral develops in which the presumed solution makes the difficulty worse and thereby causes redoubling of the presumed solution."

A Discussion of Some Omissions in the Study

Two assumptions implicit in this study, (1) that the quality of editorial content does not effect the sale of subscriptions and advertising, and (2) that the market for trial subscribers is limitless, are perhaps, difficult to accept. Let us deal with each of these items in turn.

The editorial direction of a magazine obviously must be of importance, particularly when a magazine is new. It is the editorial flavour of the magazine (its 'viceral' appeal as one editor put it) that enables it to be launched successfully on the newsstands in the first place. However, it was stated explicitly that this study does not cover the beginning or end events in the life of a magazine but rather the middle period when it enjoys stable relationship with its environment. These stable relationships assume a stable editorial quality of the magazine. If the editor incurs the ire of his readers or advertisers, he is replaced. For example, following the publication of an anti-jewish article in the old Saturday Evening Post in 1942, the editor was forced to resign. The editorial direction of the magazine also determines, to a large extent, the characteristics of its audience. This in turn effects the demand for advertising. The different slopes of the demand curves for advertising for, say, the old Saturday Evening Post and the Life magazine (Exhibit 6.2) exemplify this phenomenon. The old Saturday Evening Post was reputed to appeal to readers who lived in small towns

and rural communities, whereas the Life magazine appealed more to urban dwellers. The differences in the slopes of the advertising demand curves could be attributed to the desirability, on the part of the advertisers, to communicate their messages to one type of audience rather than to the other. Therefore, editorial direction and quality of content will effect indirectly the advertising sales, but this effect is a constant parameter embodied in the slope of demand curve as far as this study is concerned.

Surprisingly enough, no effect of editorial policy or quality of editorial content could be found on the subscription renewal behavior of readers of the old Saturday Evening Post. It will be recalled that regular readers were discovered to be sensitive to changes in the subscription 'rate' and trial readers to the annual volume size. This does not mean that the quality of the editorial content in the magazine was unimportant, but rather that, one way or another, it remained constant over the twenty-year period covered by the empirical study. Friedrich notes that any one of the diverse personalities who occupied the editorial chair of the old Saturday Evening Post was or could have been successful, but that no amount of editorial genius could have made up for, what he considered to be bad management (Friedrich, 1970, p. 478). Presumably, as long as the editorial 'flavour' of the magazine does not become out-of-date and the editor is able to keep more-or-less abreast of the changes in the tastes and social values of his readership, then he maintains a loyal or, at the very least, a satisfied clientele. As was previously noted, the yield of regular subscribers from trial readers was found to be sensitive to the magazine's annual volume size. This

suggests that the breadth of the editorial content of the magazine might be a key influence on resubscription behavior. That is, the more articles published covering a broader range of subject matter, the greater the chance that the trial reader will find something of interest to him personally that will influence his decision to become a regular subscriber. Once he becomes a regular subscriber, it seems that he acts as a 'satisfier' who renews his subscriptions more-or-less indefinitely until he becomes dissatisfied by the raising of the subscription 'rate'.

The assumption concerning a limitless supply of trial readers is justified because, over the twenty-year period of the study of the old Saturday Evening Post, no sign of a saturating market could be discovered. In spite of references to the increasing cost of acquiring additional readers (see for example: "Editorial", Saturday Review, November 7, 1970), the exact opposite was found to apply to the old Saturday Evening Post. This was attributed to the increased technical efficiency of selling trial subscriptions by mass mailing reduced-price subscriptions offers. If the magazine is becoming slimmer with the passage of time, for reasons that have already been given, then it might become harder to retain readers. The management of the magazine must now spend more on circulation promotion to maintain the level of readers. It might easily be beguiled into thinking that the cost of acquiring each additional reader had increased, whereas in actual fact the cost remained constant and the yield of regular subscribers from trial subscribers had declined. The market for a magazine obviously cannot be limitless and must saturate some day, but by broadening its appeal and by bringing out foreign editions, mass-circulation magazines seem to find ways of

putting off that day.

Some Implications Concerning the Methodology Used

The methodology employed by this study can be briefly summarized as: (1) constructing a systems simulation model of a magazine publishing firm using the meta-modelling techniques of System Dynamics, and (2) experimenting with the model system to find out how it works. The framework for constructing the model consists of identifying groups of parts of the system within the broad categories of 'accounting information flows', 'measures of performance', 'managed variables' and 'relationships of the organization with its environment'. If this can be performed successfully for a moribund magazine publishing firm, why cannot it be done for other magazine firms that are still in business? And if it can be done for magazine publishing firms, why cannot it be performed on other firms in other industries? There would seem to be no reason for suggesting that this approach could not be applied more generally. This study might, therefore, point the way to systematizing the construction of corporate simulation models.

The experiments conducted with such a constructed corporate simulation model might yield useful information about the long-run viability of the organization. One might ask of it such questions as, is the enterprise going to be difficult to manage? How robust is the system to sudden changes in business conditions? How will it grow--steadily or boom followed by bust? Are there any counter-intuitive elements in the system that might beguile the management into, unknowingly, pursuing a path to destruction? The management of the company and its investors would surely find the answers to these questions useful. If this be so,

then we have the beginning of a tool for the financial analysis of companies.

Lastly, it might be worth noting that the missing link in corporate simulation models is the management decision making processes. Without this link, we cannot expect the model to generate realistic predictions of how a corporation will grow. Although the model gives us useful insights into how the system works and allows us to predict what will happen when certain management decisions are enacted, without a realistic model of management decision making we cannot validate the entire system model through its ability to predict outcomes reliably.

If a submodel of the management's collective and intuitive decision making behavior could ever be developed and plugged into a systems model of the organization, then reliable simulations and predictions of the organizations future growth could be made. Developments in the theory of management decision making in an organizational context, within the last decade, have brought this within the bounds of possibility. It was demonstrated in the last chapter that Cyert and March's theory (Cyert and March, 1963) would have predicted correctly the raising of subscription 'rates' by the management of the old Saturday Evening Post at a time when, as we have seen, they would have been better advised to follow another course of action. The construction of a simulation model of intuitive management decision making would constitute a significant breakthrough in corporate simulation modelling.

APPENDIX A

MODEL EQUATIONS

A.1 The Equations of the General Model of a Magazine Publishing Company

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*      A MODEL OF A MAGAZINE PUBLISHING COMPANY
NOTE
NOTE  MACRO FUNCTIONS.....
NOTE  MACRO DEFINITION OF THE RELATIVE GROWTH OF A QUANTITY OVER
NOTE  A ONE-YEAR PERIOD.
MACRO RELGROW(Q)
L  $DQ.K=$DQ.J+DT*(PULSE((Q.J-$DQ.J)/DT,TIME+1-DT,1)
N  $DQ=Q
A  RELGROW.K=(Q.K-$DQ.K)/$DQ.K
MEND
NOTE  MACRO DEFINITION OF ONE-YEAR PIPELINE DELAY.
MACRO PIPEOUT(IN)
L  $B1.K=$B1.J+DT*(IN.JK-$R1.JK)
N  $B1=0
R  $R1.KL=$B1.K*$PL.K
L  $B2.K=$B2.J+DT*($R1.JK-$R2.JK)
N  $B2=IN/5
R  $R2.KL=$B2.K*$PL.K
L  $B3.K=$B3.J+DT*($R2.JK-$R3.JK)
N  $B3=IN/5
R  $R3.KL=$B3.K*$PL.K
L  $B4.K=$B4.J+DT*($R3.JK-$R4.JK)
N  $B4=IN/5
R  $R4.KL=$B4.K*$PL.K
L  $B5.K=$B5.J+DT*($R4.JK-$R5.JK)
N  $B5=IN/5
R  $R5.KL=$B5.K*$PL.K
L  $B6.K=$B6.J+DT*($R5.JK-$CUT.JK)
N  $B6=IN/5
R  $CUT.KL=$B6.K*$PL.K
A  $PL.K=PULSE(1/DT,TIME+0.20,0.20)
A  PIPEOUT.K=$B6.K*5
MEND
NOTE  MACRO DEFINITION OF A SPECIAL EVENT
MACRO SPEVENT(STYEAR,SPYEAR)
A  SPEVENT.K=SES*(STEP(1,$STTIM)+STEP(-1,$SPTIM))
N  $STTIM=STYEAR-1
N  $SPTIM=SPYEAR
MEND .....
NOTE
NOTE  *** A MODEL OF A MAGAZINE PUBLISHING COMPANY ***
NOTE
NOTE  -----
NOTE  PART 1. ACCOUNTING INFORMATION FLOWS, MEASURES OF PERFORMANCE,
NOTE  MANAGED VARIABLES AND RELATIONSHIPS WITH THE ENVIRONMENT
NOTE  -----
NOTE
NOTE  ACCOUNTING INFORMATION FLOWS
NOTE  (ALL MONEY VALUES ARE EXPRESSED IN CONSTANT DOLLARS)
NOTE

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R	CNRER.KL=(TSSR.JK+RSSR.JK)*SNRTE.K	1	CIRCULATION REVENUE
NOTE			RATE (\$/YEAR)
R	ADRER.KL=ADPSR.JK*ADRTE.K	2	ADVERTISING REVENUE
NOTE			RATE (\$/YEAR)
R	PREXR.KL=EPDEX.K	3	PRODUCTION EXPENSE
NOTE			RATE (\$/YEAR)
R	SGEXR.KL=CMPEX.K+ADSEX.K	4	SELLING EXPENSE
NOTE			RATE (\$/YEAR)
R	DNCHR.KL=FRCON*(TREVR.K/AP)	5	DEPRECIATION CHARGE
NOTE			RATE (\$/YEAR)
R	GAEXR.KL=FRSGA*(TREVR.K/AP)	6	GENERAL & ADMIN EXPENSE
NOTE			RATE (\$/YEAR)
L	TREV.K=TREV.J+DT*(CNRER.JK+ADRER.JK-RCB.JK)	7	TOTAL REVENUE (\$)
N	TREV=(CNRER+ADRER)*AP	7.1	INITIAL TOTAL REV (\$)
R	RCB.KL=PULSE(TREV.K/DT,SYEAR,AP)	8	REVENUE CLOSING BALANCE
NOTE			(\$/YEAR)
A	TREVR.K=SAMPLE(TREV.K,AP,TREV.K)	9	TOTAL REVENUE REPORTED
NOTE			(\$)
L	TEXP.K=TEXP.J+DT*(PREXR.JK+SGEXR.JK+DNCHR.JK+GAEXR.JK-ECB.JK)	10	TOTAL EXPENSE (\$)
NOTE			
N	TEXP=(PREXR+SGEXR+DNCHR+GAEXR)*AP	10.1	INITIAL TOTAL EXP (\$)
R	ECB.KL=PULSE(TEXP.K/DT,SYEAR,AP)	11	EXPENSE CLOSING BALANCE
NOTE			(\$/YEAR)
A	TEXPR.K=SAMPLE(TEXP.K,AP,TEXP.K)	12	TOTAL EXPENSE REPORTED
NOTE			(\$)
C	AP=1	7.2,8.1,9.1,10.2,11.1,12.1	ACCOUNTING PERIOD (YRS)
NOTE			
NOTE	MEASURES OF PERFORMANCE		
NOTE			
A	RGRV.K=RELGRW(TREVR.K)	13	RELATIVE GROWTH OF
NOTE			REVENUE (DL)
A	PMARG.K=(TREVR.K-TEXPR.K)/TREVR.K	14	PROFIT MARGIN (DL)
A	RGR.K=RELGRW(TOTRDR.K)	15	RELATIVE GROWTH OF
NOTE			TOTAL READERS (DL)
NOTE			
NOTE	MANAGED VARIABLES		
NOTE			
NOTE	VARIABLES DETERMINED BY STANDARD PRACTICES		
A	MVPR.K=G0+G1*ADPSR.JK	16	MAGAZINE VOLUME PAGE
NOTE			RATE (PAGES/YEAR)
A	ADSEX.K=COADS*ADRER.JK	17	ADVERTISING SELLING
NOTE			EXPENSE RATE (\$/YEAR)
C	COADS=0.15	17.1	COMMISSION ON
NOTE			ADVERTISING SALES (DL)
NOTE	VARIABLES CHANGED BY MANAGEMENT FIAT		
L	SNRTE.K=SNRTE.J+DT*SNRCH.JK	18	SUBSCRIPTION [RATE]
N	SNRTE=ISNRTE	18.1	INITIAL SUBSN [RATE]
NOTE			(\$/READER/YEAR)
L	ADRTE.K=ADRTE.J+DT*ADRCH.JK	20	ADVERTISING [RATE]
N	ADRTE=IADRTE	20.1	INITIAL AD [RATE]

L	CNPEX.K=CNPEX.J+DT*CPECH.JK	22	CIRCULATION PROMOTION
NOTE			EXPENSE RATE (\$/YEAR)
N	CNPEX=ICNPEX	22.1	INITIAL CIRC PMN EXP
NOTE			(\$/PAGE)
NOTE	EXPERIMENTAL PARAMETERS		
NOTE			
R	SNRCH.KL=PULSE(A*SNRTE.K/DT,ST,SYEAR+50)	19	SUBSN [RATE] CHANGE
NOTE			(\$/READER/YEAR/YEAR)
NOTE			
R	ADRCH.KL=PULSE(B*ADRTE.K/DT,ST,SYEAR+ST)	21	ADVTG [RATE] CHANGE
NOTE			(\$/PAGE/YEAR)
NOTE			
R	CPECH.KL=PULSE(C*CNPEX.K/DT,ST,ST+SYEAR)	23	CIRN PMN EXP CHANGE
NOTE			(\$/YEAR/YEAR)
NOTE			
C	A=0/B=0/C=0	19.1,21.1,23.1	STEP HEIGHT (DL)
C	ST=1945	19.2,21.2,23.2	STEP TIME (YEAR #)
C	SES=0 0=OFF/1=ON	35	SPECIAL EVENTS SWITCH
NOTE			
NOTE	RELATIONSHIPS WITH THE ENVIRONMENT		
NOTE			
R	ADPSR.KL=D0+D1*ARPTR.K	24	ADVERTISING PAGES
NOTE			SELLING RATE (PAGES/Y)
A	ARPTR.K=ADRTE.K/(TOTRDR.K*1E-3)	25	AD [RATE] PER THOUSAND
NOTE			READERS (\$/PAGE/TH-RD)
A	EPDEX.K=C0+C1*MVPR.K*TOTRDS.K	26	EDITING, PRINTING &
NOTE			DISTRIBUTING EXPENSE
NOTE			(\$/YEAR)
R	TSSR.KL=B0+B1*CNPEX.K+B2*MVPR.K	27	TRIAL SUBSCRIPTIONS
NOTE			SELLING RATE (NO/YEAR)
R	RSSR.KL=A0+		
X	(A1+A2*SNRTE.K+A3*MVPR.K)*RSE.K+	28	REGULAR SUBSCRIPTIONS
X	(A4+A5*SNRTE.K+A6*MVPR.K)*TSE.K		SELLING RATE (NO/YEAR)
NOTE		28.1	INITIAL REGR SUBSN
N	RSSR=ITOTRDS-TSSR		SELLING RATE (NO/YEAR)
NOTE		29	TRIAL SUBSCRIPTIONS
A	TSE.K=PIPEDUT(TSSR.JK)		EXPIRING (NO/YEAR)
NOTE		30	REGULAR SUBSCRIPTIONS
A	RSE.K=PIPEDUT(RSSR.JK)		EXPIRING (NO/YEAR)
NOTE		30.1	INITIAL REGR SUBSN
N	RSE=TOTRDS-TSE		EXPIRING (NO/YEAR)
NOTE		31	TRIAL SUBSCRIPTION
R	TSER.KL=TSE.K		EXPIRATION RATE (NO/Y)
NOTE		32	REGULAR SUBSCRIPTION
R	RSER.KL=RSE.K		EXPIRATION RATE (NO/Y)
NOTE		33	TOTAL READERS (NO)
L	TOTRDS.K=TOTRDS.J+DT*(TSSR.JK+RSSR.JK-TSER.JK-RSER.JK)	33.1	INITIAL TOT RDS (NO)
NOTE			
N	TOTRDS=ITOTRDS	34	TOTAL READERS REPORTED
A	TOTRDR.K=SAMPLE(TOTRDS.K,CAP,TOTRDS.K)		

```

NOTE
C      CAP=1
NOTE
NOTE
NOTE      INITIAL CONDITIONS AND REGRESSION COEFFICIENTS SPECIFIC TO -
NOTE      A PARTICULAR COMPANY
NOTE
C      SYEAR=          8.2,11.2,19.3,21.3,23.3 STARTING YEAR (#)
C      FRCDN=          5.1 FRACTION OF REVENUE
NOTE                                CHARGED TO DEPRECIATION
NOTE                                (DL)
C      FRSGA=          6.1 FRACTION OF REVENUE
NOTE                                SPENT ON GEN. & ADMIN.
NOTE                                (DL)
C      ISNRTE=         18.2 INITIAL SUBSCRIPTION
NOTE                                RATE ($/READER/YEAR)
C      IADRTE=         20.2 INITIAL ADVERTISING
NOTE                                RATE ($/PAGE)
C      ICNPEX=         22.2 INITIAL CIRCULATION PROMOTION
NOTE                                EXPENSE RATE ($/YEAR)
C      ITOTRDS=        33.2 INITIAL TOTAL READERS
NOTE                                (NO)
NOTE      REGRESSION COEFFICIENTS
C      A0= /A1= /A2= /A4= /A5= /A6=
NOTE                                30.1 FOR REGULAR SUBSCRIPTIONS SOLD
C      B0= /B1= /B2=
NOTE                                27.1 FOR TRIAL SUBSCRIPTIONS SOLD
C      C0= /C1=
NOTE                                25.1 FOR PRODUCTION COSTS
C      D0= /D1=
NOTE                                24.1 FOR ADVERTISING PAGES PURCHASED
C      G0= /G1=
NOTE                                16.1 FOR MAGAZINE VOLUME PAGES
NOTE
NOTE      END OF PART 1
NOTE
NOTE      PRINTING, PLOTTING & SIMULATION RUN SPECIFICATIONS
NOTE
PRINT 1)(6.2)TSSR,RSSR,TOTRDS/2)(6.2)TSER,RSER
X      /3)ARPTR(0.2),ADPSR(0.0),MVPR(0.0)
X      /4)SNRTE(0.2),CNPEX(6.2),ADRTE(3.1)
X      /5)SNRCH(0.2),CPECH(6.2),ADRCH(3.1)
X      /7)(6.2)ADKER,CNRER,TREVR/8)(6.2)PREXR,SGEXR,TEXPR
X      /9)(0.3)RGRV,PMARG,RGR
NOTE      PLOT DECISION VARIABLES
PLOT  ARPTR=A,SNRTE=S(0,8.0)/CNPEX=C(0,01E8)/MVPR=M(0,16E3)/ADRTE=D(0,8E
X      4)
NOTE      PLOT READERS, REVENUES AND EXPENSES
PLOT  TOTRDS=T,RSSR=R,TSSR=L(0,8E6)/TREVR=$,TEXPR=E(0,400E6)
NOTE      PLOT PERFORMANCE MEASURES
PLOT  RGRV=V,PMARG=P,RGR=G(-0.2,0.2)
N      TIME=SYEAR
SPEC  PRTPER=1/PLTPER=0.50/LENGTH=1960/DT=0.1
RUN

```

INITIAL YEAR #

A.2 The Equations used for the Simulation of the Saturday Evening Post

```

*      A MODEL OF THE SATURDAY EVENING POST
NOTE
NOTE  MACRO FUNCTIONS.....
NOTE  MACRO DEFINITION OF THE RELATIVE GROWTH OF A QUANTITY OVER
NOTE  A ONE-YEAR PERIOD.
MACRO RELGROW(Q)                                APP B.1
L  $DQ.K=$DQ.J+DT*PULSE((Q.J-$DQ.J)/DT,TIME+1-DT,1)
N  $DQ=Q
A  RELGROW.K=(Q.K-$DQ.K)/$DQ.K
MEND
NOTE  MACRO DEFINITION OF ONE-YEAR PIPELINE DELAY.
MACRO PIPEOUT(IN)                                APP B.2
L  $B1.K=$B1.J+DT*(IN.JK-$R1.JK)
N  $B1=0
R  $R1.KL=$B1.K*$PL.K
L  $B2.K=$B2.J+DT*($R1.JK-$R2.JK)
N  $B2=IN/5
R  $R2.KL=$B2.K*$PL.K
L  $B3.K=$B3.J+DT*($R2.JK-$R3.JK)
N  $B3=IN/5
R  $R3.KL=$B3.K*$PL.K
L  $B4.K=$B4.J+DT*($R3.JK-$R4.JK)
N  $B4=IN/5
R  $R4.KL=$B4.K*$PL.K
L  $B5.K=$B5.J+DT*($R4.JK-$R5.JK)
N  $B5=IN/5
R  $R5.KL=$B5.K*$PL.K
L  $B6.K=$B6.J+DT*($R5.JK-$CUT.JK)
N  $B6=IN/5
R  $CUT.KL=$B6.K*$PL.K
A  $PL.K=PULSE(1/DT,TIME+0.20,0.20)
A  PIPEOUT.K=$B6.K*5
MEND
NOTE  MACRO DEFINITION OF A SPECIAL EVENT
MACRO SPEVENT(STYEAR,SPYEAR)                    APP B.3
A  SPEVENT.K=SES*(STEP(1,$STTIM)+STEP(-1,$SPTIM))
N  $STTIM=STYEAR-1
N  $SPTIM=SPYEAR
MEND .....
NOTE
NOTE  *** A MODEL OF A MAGAZINE PUBLISHING COMPANY ***
NOTE
NOTE  -----
NOTE  PART 1. ACCOUNTING INFORMATION FLOWS, MEASURES OF PERFORMANCE,
NOTE  MANAGED VARIABLES AND RELATIONSHIPS WITH THE ENVIRONMENT
NOTE  -----
NOTE
NOTE  ACCOUNTING INFORMATION FLOWS
NOTE  (ALL MONEY VALUES ARE EXPRESSED IN CONSTANT DOLLARS)
NOTE

```

R	CNRER.KL=(TSSR.JK+RSSR.JK)*SNRTE.K	1	CIRCULATION REVENUE
NOTE			RATE (\$/YEAR)
R	ADRER.KL=ADPSR.JK*ADRTE.K	2	ADVERTISING REVENUE
NOTE			RATE (\$/YEAR)
R	PREXR.KL=EPDEX.K	3	PRODUCTION EXPENSE
NOTE			RATE (\$/YEAR)
R	SGEXR.KL=CNPEX.K+ADSEX.K	4	SELLING EXPENSE
NOTE			RATE (\$/YEAR)
R	DNCHR.KL=FRCDN*(TREVR.K/AP)	5	DEPRECIATION CHARGE
NOTE			RATE (\$/YEAR)
R	GAEXR.KL=FRSGA*(TREVR.K/AP)	6	GENERAL & ADMIN EXPENSE
NOTE			RATE (\$/YEAR)
L	TREV.K=TREV.J+DT*(CNRER.JK+ADRER.JK-RCB.JK)	7	TOTAL REVENUE (\$)
N	TREV=(CNRER+ADRER)*AP	7.1	INITIAL TOTAL REV (\$)
R	RCB.KL=PULSE(TREV.K/DT,SYEAR,AP)	8	REVENUE CLOSING BALANCE
NOTE			(\$/YEAR)
A	TREVR.K=SAMPLE(TREV.K,AP,TREV.K)	9	TOTAL REVENUE REPORTED
NOTE			(\$)
L	TEXP.K=TEXP.J+DT*(PREXR.JK+SGEXR.JK+DNCHR.JK+GAEXR.JK-ECB.JK)	10	TOTAL EXPENSE (\$)
NOTE			
N	TEXP=(PREXR+SGEXR+DNCHR+GAEXR)*AP	10.1	INITIAL TOTAL EXP (\$)
R	ECB.KL=PULSE(TEXP.K/DT,SYEAR,AP)	11	EXPENSE CLOSING BALANCE
NOTE			(\$/YEAR)
A	TEXPR.K=SAMPLE(TEXP.K,AP,TEXP.K)	12	TOTAL EXPENSE REPORTED
NOTE			(\$)
C	AP=1	7.2,8.1,9.1,10.2,11.1,12.1	ACCOUNTING PERIOD (YRS)
NOTE			
NOTE	MEASURES OF PERFORMANCE		
NOTE			
A	RGRV.K=RELGROW(TREVR.K)	13	RELATIVE GROWTH OF
NOTE			REVENUE (DL)
A	PMARG.K=(TREVR.K-TEXPR.K)/TREVR.K	14	PROFIT MARGIN (DL)
A	RGR.K=RELGROW(TOTRDR.K)	15	RELATIVE GROWTH OF
NOTE			TOTAL READERS (DL)
NOTE			
NOTE	MANAGED VARIABLES		
NOTE			
NOTE	VARIABLES DETERMINED BY STANDARD PRACTICES		
A	MVPR.K=GO+Q1*ADPSR.JK	16	MAGAZINE VOLUME PAGE
NOTE			RATE (PAGES/YEAR)
A	ADSEX.K=CJADS*ADRER.JK	17	ADVERTISING SELLING
NOTE			EXPENSE RATE (\$/YEAR)
C	CJADS=0.15	17.1	COMMISSION ON
NOTE			ADVERTISING SALES (DL)
NOTE	VARIABLES CHANGED BY MANAGEMENT FIAT		
L	SNRTE.K=SNRTE.J+DT*SNRCH.JK	18	SUBSCRIPTION RATE
N	SNRTE=ISNRTE	18.1	INITIAL SUBSN RATE
NOTE			(\$/READER/YEAR)
L	ADRTE.K=ADRTE.J+DT*ADRCH.JK	20	ADVERTISING RATE
N	ADRTE=IADRTE	20.1	INITIAL AD RATE

L	CNPEX.K=CNPEX.J+DT*CPECH.JK	22	CIRCULATION PROMOTION
NOTE			EXPENSE RATE (\$/YEAR)
N	CNPEX=ICNPEX	22.1	INITIAL CIRC PRMN EXP
NOTE			(\$/PAGE)
NOTE	EXPERIMENTAL PARAMETERS		
R	SNRCH.KL=PULSE(A*SNRTE.K/DT,ST,SYEAR+50)		
NOTE		19	SUBSN [RATE] CHANGE
NOTE			(\$/READER/YEAR/YEAR)
R	ADRCH.KL=PULSE(B*ADRTE.K/DT,ST,SYEAR+ST)		
NOTE		21	ADVTG [RATE] CHANGE
NOTE			(\$/PAGE/YEAR)
R	CPECH.KL=PULSE(C*CNPEX.K/DT,ST,ST+SYEAR)		
NOTE		23	CIRN PMN EXP CHANGE
NOTE			(\$/YEAR/YEAR)
C	A=0/B=0/C=0	19.1,21.1,23.1	STEP HEIGHT (DL)
C	ST=1945	19.2,21.2,23.2	STEP TIME (YEAR #)
C	SES=0 0=OFF/1=ON	35	SPECIAL EVENTS SWITCH
NOTE			
NOTE	RELATIONSHIPS WITH THE ENVIRONMENT		
NOTE			
R	ADPSR.KL=D0+D1*ARPTR.K+D2*SPEVENT(1942,1942)+D3*SPEVENT(1943,1945)		
NOTE		24*	ADVERTISING PAGES
NOTE			SELLING RATE (PAGES/Y)
A	ARPTR.K=ADRTE.K/(TCTRDR.K*1E-3)	25	AD [RATE] PER THOUSAND
NOTE			READERS (\$/PAGE/TH-RD)
A	EPDEX.K=C0+C1*MVPR.K*TOTRDS.K+C2*SPEVENT(1950,1965)		
NOTE		26*	EDITING, PRINTING &
NOTE			DISTRIBUTING EXPENSE
NOTE			(\$/YEAR)
R	TSSR.KL=B0+B1*CNPEX.K+B2*MVPR.K+B3*SPEVENT(1944,1949)+		
X	B4*SPEVENT(1957,1950)	27*	TRIAL SUBSCRIPTIONS
NOTE			SELLING RATE (NO/YEAR)
R	RSSR.KL=A0+		
X	(A1+A2*SNRTE.K+A3*MVPR.K)*RSE.K+		
X	(A4+A5*SNRTE.K+A6*MVPR.K)*TSE.K	28	REGULAR SUBSCRIPTIONS
NOTE			SELLING RATE (NO/YEAR)
N	RSSR=ITOTRDS-TSSR	28.1	INITIAL REGR SUBSN
NOTE			SELLING RATE (NO/YEAR)
A	TSE.K=PI PEDOUT(TSSR.JK)	29	TRIAL SUBSCRIPTIONS
NOTE			EXPIRING (NO/YEAR)
A	RSE.K=PI PEDOUT(RSSR.JK)	30	REGULAR SUBSCRIPTIONS
NOTE			EXPIRING (NO/YEAR)
N	RSE=TOTRDS-TSE	30.1	INITIAL REGR SUBSN
NOTE			EXPIRING (NO/YEAR)
R	TSER.KL=TSE.K	31	TRIAL SUBSCRIPTION
NOTE			EXPIRATION RATE (NO/Y)
R	RSER.KL=RSE.K	32	REGULAR SUBSCRIPTION
NOTE			EXPIRATION RATE (NO/Y)
L	TOTRDS.K=TOTRDS.J+DT*(TSSR.JK+RSSR.JK-TSER.JK-RSER.JK)		

```

NOTE
N      TOTRDS=ITOTRDS
A      TOTRDR.K=SAMPLE(TOTRDS.K,CAP,TOTRDS.K)
NOTE
C      CAP=1
NOTE
NOTE
NOTE
NOTE
NOTE
NOTE
C      SYEAR=1940      8.2,11.2,19.3,21.3,23.3 STARTING YEAR (#)
C      FRCON=0.01      5.1 FRACTION OF REVENUE
NOTE                                CHARGED TO DEPRECIATN.
NOTE                                (DL)
C      FRSGA=0.01      6.1 FRACTION OF REVENUE
NOTE                                SPENT ON GEN & ADMIN
NOTE                                (DL)
NOTE
C      ISNRTE=3.08      18.2 INITIAL SUBSCRIPTION
NOTE                                IRATE1 ($/READER/YEAR)
C      IADRTE=19500      20.2 INITIAL ADVERTISING
NOTE                                IRATE1 ($/PAGE)
C      ICNPEX=15.0E6      22.2 INITIAL CIRC PROMOTION
NOTE                                EXPENSE RATE ($/YEAR)
C      ITOTRDS=3.25E6      33.2 INITIAL TOTAL READERS
NOTE                                (NO)
NOTE
NOTE
C      REGRESSION COEFFICIENTS
C      A0=-0.60E6/A1=1.34/A2=-0.09/A3=0/A4=0/A5=0/A6=8.0E-5
NOTE                                23.2 FOR REGULAR SUBSCRIPTIONS SOLD
C      B0=0.79E6/B1=0.034/B2=0/B3=0.31E6/B4=0.32E6
NOTE                                27.1 FOR TRIAL SUBSCRIPTIONS SOLD
C      C0=0/C1=1.8E-3/C2=10.2E6      25.1 FOR PRODUCTION COSTS
C      D0=8530/D1=-985/D2=-1055/D3=-356
NOTE                                24.1 FOR ADVERTISING PAGES PURCHASED
C      G0=2065/G1=1.3      16.1 FOR MAGAZINE VOLUME PAGES
NOTE
NOTE
NOTE
NOTE
NOTE
PRINT 1)(6.2)TSSR,RSSR,TOTRDS/2)(6.2)TSER,RSER
X      /3)ARPTR(0.2),ADPSR(0.0),MVPR(0.0)
X      /4)SNRTE(0.2),CNPEX(6.2),ADRTE(3.1)
X      /5)SNRCH(0.2),CPECH(6.2),ADRCH(3.1)
X      /7)(6.2)ADRLR,CNRER,TREVR/3)(6.2)PREXR,SGEXR,TEXPR
X      /9)(0.3)RGRV,PMARG,RGR
NOTE
NOTE
PLT   PLOT DECISION VARIABLES
X      AKPTR=A,SNRTE=S(0,3.0)/CNPEX=C(0,01E3)/MVPR=M(0,15E3)/ADRTE=D(0,8E
NOTE
NOTE
PLT   PLOT READERS, REVENUES AND EXPENSES
PLT   TOTRDS=T,RSSR=R,TSSR=L(0,3E6)/TREVR=S,TEXPR=E(0,400E6)

```

```
NOTE  PLOT PERFORMANCE MEASURES
PLOT  RGRV=V,PMARG=P,RGR=G(-0.2,0.2)
N      TIME=SYEAR
SPEC  PRTPER=1/PLTPER=0.50/LENGTH=1950/DT=0.1
RUN   RESPONSE OF FREE RUNNING MODEL
```

INITIAL YEAR #

APPENDIX B

MACRO FUNCTIONS

B.1 Macrofunction RELGROW (Q)

The macro function RELGROW (Q) computes the relative growth of a quantity Q over a one year period. It performs this by storing the value of Q for one simulated year in a level equation so that it can be compared with the current value of Q to find the relative difference between them. At the end of the simulated year, the stored value of Q is jettisoned and replaced so that a new value of the relative growth $(Q_t - Q_{t-1})/Q_{t-1}$ can be computed. The following DYNAMO equations perform this calculation:

MACRO RELGROW(Q)

```

L   $DQ.K = $DQ.J + DT*PULSE ( (Q.J-$DQ.J)/DT, TIME + 1-DT,1)
N   $DQ = Q
A   RELGROW.K = (Q.K - $DQ.K)/$DQ.K
MEND

```

B.2 Macrofunction PIPEOUT(IN)

The macrofunction PIPEOUT (IN) creates a one-year pipeline delay for the purpose of simulating the ageing of subscriptions. The value of the input IN is progressively moved every fifth of a simulated year through the pipeline and emerges in the sixth period. The DYNAMO equations for performing this function are:

MACRO PIPEOUT (IN)

```

L   $B1.K = $B1.J + DT*(IN.JK - $R1.JK)
N   $B1 = 0
R   $R1.KL = $B1.K*$PL.K
L   $B2.K = $B2.J + DT*($R1.JK - $R2.JK)
N   $B2 = IN/5
R   $R2.KL = $B2.K*$PL.K
L   $B3.K = $B3.J + DT*($R2.JK - $R3.JK)
N   $B3 = IN/5
R   $R3.KL = $B3.K*$PL.K
L   $B4.K = $B4.J + DT*($R3.JK - $R4.JK)
N   $B4 = IN/5
R   $R4.KL = $B4.K*$PL.K
L   $B5.K = $B5.J + DT*($R4.JK - $R5.JK)
N   $B5 = IN/5
R   $R5.KL = $B5.K*$PL.K
L   $B6.K = $B6.J + DT*($R5.JK - $OUT.JK)
N   $B6 = IN/5
R   $OUT.KL = $B6.K*$PL.K
A   $PL.K = PULSE(1/DT, TIME + 0.20, 0.20)
A   PIPEOUT.K = $B6.K*5
MEND

```

B.3 Macrofunction SPEVENT (STYEAR, SPYEAR)

The macrofunction SPEVENT (STYEAR, SPYEAR) creates a 'dummy' variable of value 1 during the period commencing at the beginning of the 'start year' (STYEAR) and finishing at the end of the 'stop year' (SPYEAR). At all other times it has the value zero. It also contains a 'special event switch' (SES) that can be given the value 1 or zero depending on whether one wants to include or exclude the effects of special events on the relationship of the model as uncovered by the empirical study of the Saturday Evening Post magazine. The following DYNAMO equations achieve this effect:

MACRO SPEVENT (STYEAR, SPYEAR)

```

A    SPEVENT.K = SES*(STEP(1, $STTIM) + STEP (-1, $SPTIM) )
N    $STTIM = STYEAR - 1
N    $SPTIM = SPYEAR
MEND

```

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