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This study investigated the feasibility of applying economic demand analysis (especially elasticity of demand) in marketing George Washington University off-campus degree programs. In the case under study, a supplemental budget request had to be submitted to meet expenses incurred by an unforeseen increase in demand for graduate and undergraduate credit courses in the College of General Studies. Accordingly, a written and graphic analysis was made of the budget justification in terms of the total contribution profit concept, break-even analysis, and the multiple functional relations affecting the demand for credit courses. A framework or model was also sought for an intelligent approach in other off-campus departments to planning, prediction, and control of functions. The resulting tuition increase was accompanied, not by the expected drop in demand, but by an increase. This apparent paradox was attributed to factors other than elasticity of demand (curriculums, total tuition, tuition assistance, promotion) which entered into the final determination of demand. Implications for budgeting and program planning were noted, together with suggestions for further research. (ly)

APPLICATION OF DEMAND ANALYSIS IN MARKETING CONTINUING EDUCATION

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CHAPTER I

INTRODUCTION

A. Purpose of the Study

The purpose of this study is to determine the feasibility of applying economic demand analysis in marketing off-campus degree programs by The George Washington University (GWU).

In predicting demand, elasticity is one factor, an important factor, but still only one factor. In many cases other variables may outweigh the elasticity of demand factor. Thus, an increase in price would normally be expected to result in a drop in demand--that is, a negative elasticity. In the case studied here, however, a raise in tuition was followed by an increase in demand--that is, elasticity was positive.

This paper analyzes this paradox and shows that is has a rational basis consistent with the concept of a negative elasticity of demand.

The market situation in which GWU functions is oligopolistic in nature--a few local institutions with off-campus programs, and many students seeking the courses. Demand analysis should assist GWU in gaining insight int factors involving the increase or

decrease of off-campus students.

The phenomenal growth of the demand for off-campus programs in the Washington Metropolitan area has forced GWU to optimize its academic resources, keep abreast of the needs of the community it serves, and the operations of its local academic competitors. Market prediction is essential, if the University is to continue its growth.

GWU is a p ivate non-profit institution. It does not realize a profit, only a growth income. However, growth income which represents total cost less expenses is referred to in this paper as profit so as to be synonamous with the terminology of the economic theory employed.

B. Background of the Problem

The College of General Studies (CGS) was established in 1950 as the off-campus division of The George Washington University. Its role was to extend the educational facilities of the University into the community. Since 1950, the "community" has grown to encompass the District of Columbia, Maryland, Virginia, Delaware, Alabama, Pennsylvania, and Rhode Island. However, during the last three years, programs offered in Alabama and Pennsylvania have been phased out.

The College works closely with education directors, school officials, military agencies, personnel administrators in government, business and industry, and others interested in developing in-service programs. The uniqueness of the program is that students may earn a degree without physically registering for courses on

campus. In essence, the courses are taken to the student off campus, a reverse of the traditional approach. The College also conducts conferences, seminars, and non-credit programs; however, this paper is concerned only with programs offered for credit, i.e., undergeaduate and graduate courses leading to a degree. Currently, there are approximately 8,500 students enrolled in undergraduate and graduate courses off campus. The majority of enrollments are graduate students. During this academic year, it is anticipated that 1,200 courses will be offered.

The Staff of Instruction includes full-time faculty members of the University and a part-time faculty numbering 500 drawn from government, industry and business.

The Comptroller of the University allocates an expense budget to each School for the fiscal year commencing July 1. The expense budget of CGS is estimated from projected revenue using the preceeding fiscal year as a base. Credit Programs, a department within CGS, offers credit courses leading to undergraduate and graduate degrees. It has exhausted its 12-month expense budget after the first five months of the fiscal year 1968-69, as a result of an erroneous projection. A supplemental, budget request with justification must be submitted to the budget officer, in order to meet increased expenses incurred by an unforeseen increase in demand for credit courses.

The objective of this study is twofold: (1) a written and

graphic analysis of the budget justification employing the following economic concepts: total contribution profit concept; break-even analysis; elasticity of demand; and, the multiple functional relationships relative to the demand for credit courses; (2) to provide a framework or model for other off-campus departments for an intelligent approach to planning, predicting, and controlling their functions.

C. Limitations of the Study

The mathematical model of multiple functional relationships relative to the demand for credit courses, as used here, is based on Bayesian analysis.

The diverse conditions under which decisions are made in our real world of imperfection and inequality of knowledge and capability include: certainty, risk and uncertainty. It is the last under which most decisions are made and upon which the model was constructed; for the probabilities of the outcomes are unknown.

Essentially, Bayesian analysis is based on a subjective probability of each outcome or occurrence under conditions of uncertainty. It assumes, in the absence of a better basis, that human feelings or hunches about things are more likely to be right than wrong. The key factor is what subsets or analogues of past experience are selected for the predictive model; each such variable must then be weighted or arrayed ordinally or, if possible and preferably, cardinally. The weighting becomes the coefficient (or parameter)

of its variable.

Bayesian analysis, as compared with conventional statistical analysis, provides a formal method of integrating subjective and objective probabilities for decision making. The selected analogues and weights may be adjusted in terms of expected outcomes. If more data or greater certainty are needed, they may be purchased if available. However, one must weigh the cost against th gain from the better forecast.

This is a study of the entire off-campus student body participating in credit programs. It is not analyzed separately by graduate or undergraduate students, or by students who do or do not receive tuition assistance from their employers.

D. Organization of the Study

Chapter I states the purpose and background of the problem studied.

Chapter II reviews the total contribution profit concept and break-even analysis in terms of the significant findings.

Chapter III applies the elasticity of demand concept to off-campus courses, and introduces other factors which must be evaluated jointly with it.

Chapter IV presents a mathematical model incorporating the principal variables in the demand for credit courses. The selection of analogues, their weighting, and the derivation of an equation

applicable to the real world, are tested for validity and reliability.

Chapter V concludes the analysis by a review of the various concepts employed in the study.

Chapter VI indicates where additional research might be useful for extending knowledge along the lines of the theory (i.e., model) developed in this study.

CHAPTER II

THE TOTAL CONTRIBUTION PROFIT CONCEPT AND BREAK EVEN ANALYSIS: A COMPARISON

A. Total Contribution Profit

The total contribution profit concept may be described very briefly. It is the difference between total revenue less variable expenses. For example, if tuition for a course is $132.00 and the variable expenses are $45.00 the remaining $87.00 is contribution profit. It "contributes" to the recovery of fixed expenses, depreciation and some return on investment. The concept is well adapted to CCS in that a portion of its capital is already a "sunk" investment and hence immobile.

Why this concept? There are many individuals who are not economically oriented and have a tendency to think of profit in the above terms only. This does not imply that their approach is wrong, only different from those who think of profit in the fuller economic sense as total revenue less total cost. This latter approach may be referred to as a break-even analysis. As may be seen graphically in Figures I and II, the basic structure and use of these two approaches are essentially the same. Figure I is shown as a generalized model--figures were excluded--since Figure II

was selected as a better graphic presentation of the problems of Credit Programs.

B. Break-Even Analysis

As noted above, the break-even technique of profit control is viewed as total revenue less total cost, including all fixed and variable costs. When graphed, the curves show total costs, and total income, as the scale of operations increases. The intersection of the two curves represents the point where Credit Programs breaks even, and beyond which profit begins. It is not all clear profit beyond this point, since variable costs continue to expand with scale. However, profit beyond this point grows faster than expenses, chiefly because fixed costs (overhead) grow more slowly.

C. Comparison

In principle, both charts are based on essentially the same structure, but with different emphasis. They display all data used by break-even analysis in profit planning and control.

Figure II represents the break-even chart of Credit Programs, as approved by the GWU Comptroller. It was an erroneous projection. Ratios of variables and fixed costs were based on last academic year's registrations, without consideration for changing weights of factors that contribute to the demand for credit courses.

The overlay in Figure II represents graphically a marginal analysis of expenses versus income. It demonstrates that an increase in expenses will produce a disproportionately greater increase in revenue.

CHAPTER III

ELASTICITY OF DEMAND FOR OFF-CAMPUS COURSES

A. Elasticity of Demand

The concept of elasticity of demand indicates the relative degree of responsiveness of quantity demanded to changes in market price. It depends primarily upon percentage changes and is independent of the units used to measure quantity and price. Elasticity is conventionally described in one of the three following categories: (1) elastic demand--when a percentage price cut yields a larger percentage rise in quantity, so as to increase total revenue; (2) unitary elasticity--when a price cut results in an exact compensating rise in quantity so as to leave total revenue exactly unchanged; (3) inelastic demand--when a percentage cut in price evokes a smaller percentage increase in quantity, and total revenues fall. In all these cases, the elasticity is negative--an increase divided by a decrease. Total revenue is defined as price times quantity. For example, if tuition were $132.00 per credit course and there were 100 registrations, total revenue would be $13,000.00

B. Applicability of Demand Analysis to Off-Campus Courses

The College of General Studies increased its tuition in academic

year 1968-69 by six dollars per course, or 5%. In accordance with the above discussion, the elasticity of demand should be negative. The data here, however, reveals a positive elasticity, a paradox which must be explained.

This positive elasticity may be calculated by applying the formula for arc elasticity of demand:

$$E_D = \frac{Q_2 - Q_1}{Q_2 + Q_1} \div \frac{P_2 - P_1}{P_2 + P_1}$$

where E_D = arc elasticity of demand; Q_1 and Q_2 represent the quantity demanded before and after the price change, respectively; and P_1 and P_2 are the prices that correspond with these quantity figures.

Applying the formula to the demand curves in Figure I, we find that:

D_1:

$$E_{D_1} = \frac{\frac{1,809 - 2,927}{1,809 + 2,927}}{\frac{126 - 132}{126 + 132}}$$

$$E_{D_1} = 10.15$$

D_2:

$$E_{D_2} = \frac{\frac{4,237 - 5,900}{4,327 + 5,900}}{\frac{126 - 132}{126 + 132}}$$

$$E_{D_2} = 7.06$$

D_3:

$$E_{D_3} = \frac{\frac{5,990 - 8,582}{5,990 + 8,582}}{\frac{126 - 132}{126 + 132}}$$

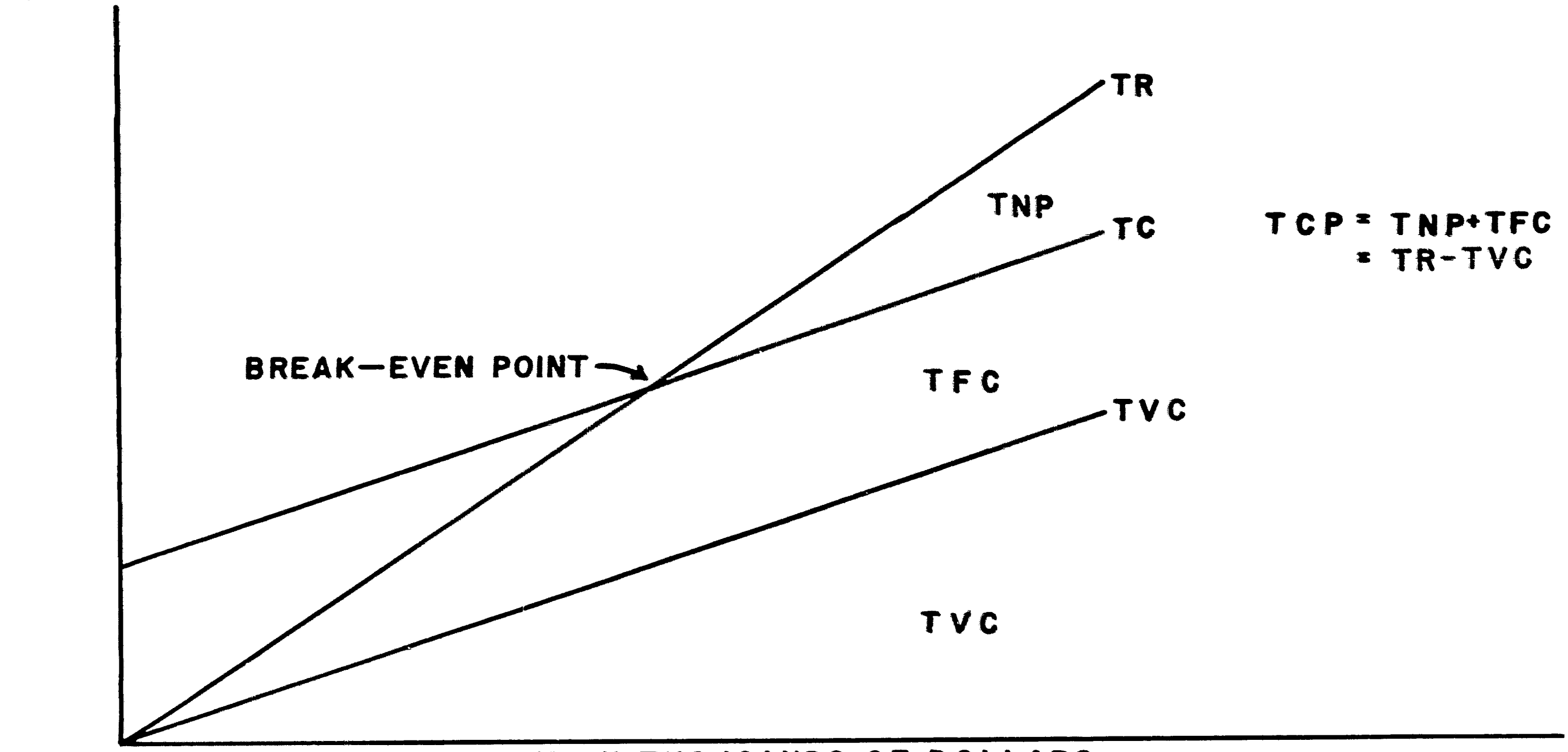
$$E_{D_3} = 7.65$$

From the above formula, the elasticities for D_1, D_2, and D_3 are 10.15, 7.06, and 7.65 which means that the demand for each is elastic and positive in sign.

What appears to be an exception to the law of demand, however, is only a paradox. Elasticity in this study is only one factor entering into the final determination of demand. Other factors were curricula offered, tuition charged, tuition assistance, and promotion. These factors and their cardinal arrangements are discussed more fully in the following chapter in which a mathematical model is constructed. With different weights (coefficients) assigned to each variable, a rise in price could be accompanied by an increase in demand. This actually occurred.

FIGURE 1

CONTRIBUTION PROFIT CHART



LEGEND

TR : TOTAL REVENUE	TFC: TOTAL FIXED COST
TNP: TOTAL NET PROFIT	TVC: TOTAL VARIABLE COST
TC : TOTAL COST	TCP: TOTAL CONTRIBUTION PROFIT

CHAPTER IV

THE DEMAND FUNCTION

A. A Mathematical Model--Multiple Functional Relationships

The limitations of this study were discussed in Chapter I. Briefly, Bayesian analysis was the basis for construction of the mathematical model. To reiterate, the use of a model in decision making under conditions of uncertainty involves selecting a set of analogues, weighting them subjectively, and summing the subjectively weighted outcomes to obtain the expected value. The expected value may deviate from the actual results, due to the particular selection of analogues and the weights assigned.

At first glance, these restrictions may seem an insurmountable handicap. However, in researching historical data for selected analogues as shown in Table I, it was possible to carry on vicarious experimentation, by varying some properties of the system and holding others constant. This approach allowed manipulation and adjustment of functional weights by comparison with prior academic years to obtain desired results.

B. Selection of Analogues

The demand for off-campus courses is a result of a multitude

TABLE I

Analogue Data for Academic Years 1963-70

Academic Year	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70
Curricula Offered (C)	13	14	13	9	11	15	17
Tuition Cost Per Credit Course (T_c)	$72.00	$81.00	$90.00	$120.00	$126.00	$132.00	$141.00
Tuition Assistance; Maximum Per Credit Course (T_a)	$40.50	$40.50	$42.75	$42.75	$42.75	$99.00	$106.00
Promotion of Programs (P)	$2,000	$3,000	$8,000	$12,000	$20,000	$30,000	$50,000

Source: George Washington University, College of General Studies, Budget Office, December 1968

of factors. Analogues selected for this model were a result of extensive primary research of historical data maintained by this institution over the past four years. After a thorough analysis of the data, four functions were selected which traditionally appeared to have had the greatest impact on demand for credit courses: (1) curricula--number of degree programs offered; (2) tuition charged by the University; (3) tuition assistance received by the student from his employer; and (4) promotion of the program, e.g., newspaper advertisements, publications, counseling by staff members, etc. The rationale for selection will be discussed in the analysis.

III. Application of the Model

Selection of the four major analogues or independent variables which were believed to determine the dependent variable, i.e., demand for credit courses, may be expressed by the formula:

$$D = aC + bT_c + cT_a + dP$$

where D = demand for credit courses; C = curricula offered; T_c = tuition charged; T_a = tuition assistance; P = promotion; and a, b, c, d = weights assigned to the specific analogue.

By use of the data researched, using the past four academic years as a base, and applying the above analogues, the four unknowns, a, b, c, and d were found by simultaneously solving the following four equations as shown in Table II:

TABLE II

Academic Year	C	T_c	T_a	P		Credit Course Registrations
1963-64	13_a	+ 72_b	+ 40.5_c	+ 2_d	=	11,122
1964-65	14_a	+ 81_b	+ 40.5_c	+ 3_d	=	12,250
1965-66	13_a	+ 90_b	+ 42.75_c	+ 8_d	=	12, 954
1966-67	9_a	+ 120_b	+ 42.75_c	+ 12_d	=	13,555

Thus, the four unknowns were solved as: a = 397; b = 58; c = 42; and d = 103.

In the above analysis four equations were needed, one for each unknown. One equation with the known enrollment--academic year 1967-68, Table III, was reserved to check the validity of the new model: $D = 397C + 58T_c + 42T_a + 103P$.

TABLE III

Academic Year	C	T_c	T_a	P'		Credit Course Registrations
1967-68	11_a	+ 126_b	+ 42.75_c	+ 20_d	=	X
	11(397)	+ 126(58)	+ 42.75(42)	+ 20(103)	=	15,414*

*Actual credit course registrations were 14,900

Table III reveals a difference of 514 registrations or approximately 3.4% between the actual and estimated registration figures. It appears that the model is a reasonable predictor in

the real world of registrations.

Currently, CGS is two-thirds of its way through academic year 1968-69 which has 12,000 registrations to date. Table IV estimates total registrations for the remaining academic year, as well as for the forthcoming academic year 1969-70.

TABLE IV

Academic Year	C	T_c	T_a	P		Credit Course Registrations
1968-69	15_a	+ 132_b	+ 99_a	+ 30_d	=	X
	15(397)	+ 132(58)	+ 99(42)	+ 30(103)	=	20,998
1969-70	17_a	+ 141_b	+ 106_b	+ 50_d	=	X
	17(397)	+ 141(58)	+ 106(42)	+ 50(103)	=	24,379

We shall be able to test the validity of the predicted 20,998 registrations within the next 60 days. From all indications, it appears that this is a realistic figure; however, the academic year 1969-70 can not be tested for at least 14 months.

It will be within these two time frames that the validity of the model will be tested--the degree to which it explains and predicts in the real world.

CHAPTER V

OVERALL ANALYSIS OF THE DATA

The break-even chart, Figure II, shows the total cost and total revenue relationships of output or registrations. The break-even point of $855,000, as projected, served as a yardstick for CGS profit or growth fund contribution to the University. Thus, the growth fund contribution dictates the expense budget allocation. The forecast of the upcoming year has always been taken as identical to the current year's off-campus registration figures. However, in the real world, this may not prove valid. There is always the possibility of an increase or decrease; fortunately, CGS had a bull market this year.

If the program had remained relatively static, the projection might have proven reasonable. There are three assumptions which may account for the erroneous forecasts: (1) historically, off-campus registrations have been relatively consistent, with an average variation of only 945 registrations or 8% during the past four years; (2) the on-campus population is fairly stable -- The Comptroller budgets for both areas; (3) therefore, assumptions

FIGURE II

ADJUSTED FORECAST
20,998 REGISTRATIONS

OVERLAY

BREAK EVEN CHART
ACADEMIC YEAR 1968-69

ORIGINAL FORECAST
THIRD SPRING REGISTRATION: 16,000

INCREASED GROWTH

ACTUAL REGISTRATIONS: 12,000

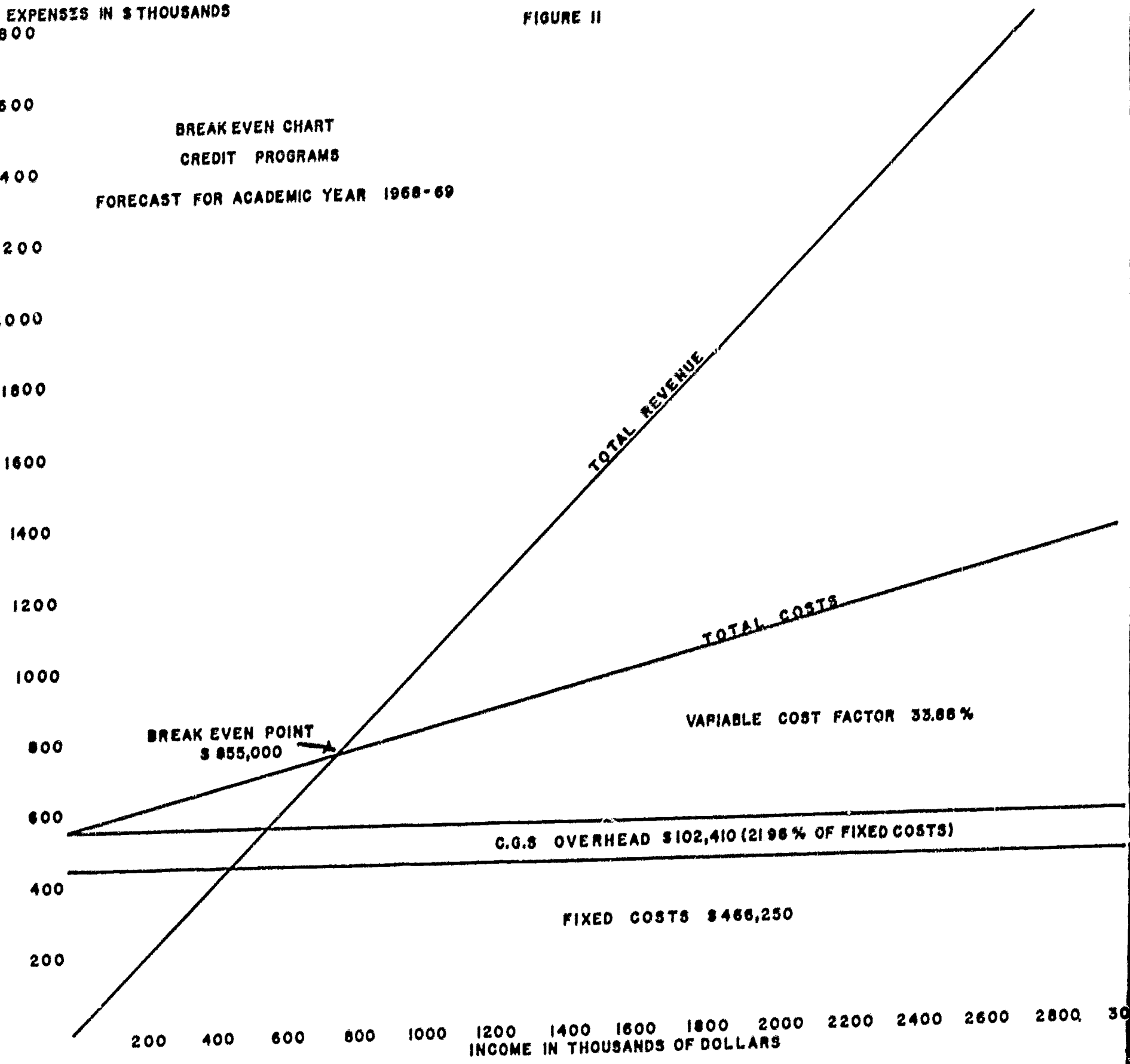
ORIGINAL FORECAST THIRD
FALL REGISTRATION: 9,000

INCREASED GROWTH

INCREASED EXPENSES

INCREASED EXPENSES

FIGURE II


EXPENSES IN $ THOUSANDS
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
BREAK EVEN CHART
CREDIT PROGRAMS
FORECAST FOR ACADEMIC YEAR 1968-69
TOTAL REVENUE
TOTAL COSTS
VARIABLE COST FACTOR 33.66 %
BREAK EVEN POINT
$ 855,000
C.G.S OVERHEAD $102,410 (21.96 % OF FIXED COSTS)
FIXED COSTS $466,250
200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3C
INCOME IN THOUSANDS OF DOLLARS

one and two were rationalized by the Comptroller as a general pattern or trend on which to base the current allocations.

The current and estimated registration figures for the Spring 1969 semester far exceed the projected forecast. It was necessary to make a supplemental request for funds in order to meet increased expenses due to higher registrations. However, the corresponding increase in expenses will result in a disproportionate increase in revenue as shown in the overlay to Figure II. In summation, CGS expects increased income will generate increased expenses, but the end result will be a larger growth fund, or profit.

Based on the forecast of the mathematical model, a new break-even chart will be necessary for next academic year to reflect changed percentages for variable, overhead, and fixed costs.

It should be noted that the break-even chart is only one form of analytical tool. It was found useful for Credit Programs, since it makes its position visible in one quick glance. It does not serve as a basis for control. Cost control, increased registrations, competition, etc., must be achieved individually within the total concept, objectives and available resources. Essentially, it was this type of approach which has led to the bull market.

The elasticity of demand for credit courses discussed in Chapter III and shown graphically in Figure I shows the inverse relation between price and quantity. Figure I leads one to believe

that there are exceptions to the law of demand. A notable exception was noted by Sir Robert Giffen (1837-1910)--a rise in the price of bread caused low-paid British wage earners to buy more bread, not less. They had to compensate by buying less of higher cost meat and correspondingly more calories of bread.

However, the inverse relation in Figure I does not necessarily mean that we have discovered another exception. It is rather a paradox--apparent, not real. Two examples will be given to illustrate this paradox. CGS has published its projected increased tuition rates for the next three academic years. It is possible that the higher tuition rates with expectation of further rises caused the inverse shift in the demand curve. This is analogous to inventory build-up against inflation. That is, students may have increased their academic load to complete their programs in order to avoid higher tuition fees for forthcoming semesters. The second possibility is that of image. Local institutions offering similar programs for the same tuition may be selected by students for various reasons, i.e., snob appeal, parental alumni, etc. The above examples are by no means exhaustive. The research conducted for development of the mathematical model of the demand for credit courses however, lends supporting evidence that there is no actual contradiction of the law of demand.

The analogues selected for the mathematical model of demand were a result of extensive research and Bayesian judgment. Of

the many analogues considered, only four were chosen. They were chosen on the basis of the objectives of Credit Programs--to offer credit courses off campus that will assist government, business, industry and the general public in meeting their academic needs.

Although GWU is a non-profit institution, it is imperative that Credit Programs optimize its resources, in order to offer quality programs. The department strives to accomplish this each semester by presenting a total program that will accomplish the following: minimum course cancellations; an optimum class size, small enough not to jeopardize the quality of the course; and, an optimum mix of courses so as to increase total registrations. The increase in total registrations will generate additional income, permitting acquisition of additional resources to meet the ever increasing demands of the community served. The planning, coordinating, and control of scheduling, cancelling and optmizing class size will not be discussed, as it is beyond the scope of this paper.

The above factors dictated the selection of curricula as one of the four analogues. It should be noted that curricula and programs are used interchangeably; credit courses are the spokes of the curricula wheel.

The number of curricula offered over past academic years has not varied significantly, as may be seen in Table I. The key concept is to offer the optimum combination of what is needed, not what the institution wants to offer, or what others are offering.

This same principle applies to any organization that has a product to market. Curricula was therefore considered as a prime function.

The second and third variables selected were tuition cost per credit course, and tuition assistance per credit course received by the student from his employer. As stated earlier, the bulk of the students are predominantly graduate. Referring again to Table I, it may be seen that these two variables have been on the rise since 1963. However, the difference, or actual net cost to the student, has increased at a greater ratio, until the current academic year, when the cost to the student dropped approximately 60%. This drop has raised undergraduate registrations faster than graduate registrations. This difference may be due to the fact that several local State institutions have been offering undergraduate programs at tuitions lower by an average of 32%. CGS accepts up to 90 semester hours of undergraduate work from local accredited institutions. It is therefore assumed that the increased tuition assistance, which has resulted in 60% reduction of cost to the CGS student, has been largely responsible for the increase in undergraduate registrations as well as the entire program.

Considering curricula as a prime variable, its natural complement was promotion. In addition to the traditional brochures, fliers, catalogues, and counseling, Credit Programs employed a different promotion technique--newspaper advertising. Referring again to Table I, we see the dollar scale of promotion of programs, starting

with $2,000 in academic year 1963-64. Key questions have been how to advertise and what media to use. Newspaper advertising had been taboo until the last month of academic year 1967-68. At this time, full page advertisements in the three major Washington newspapers were approved by the administration. The initial cost was absorbed during 1967-68, but the results were not realized until the commencement of academic year 1968-69. Special telephone numbers were used as a control device for incoming calls. The newspaper advertisements generated approximately 700 inquiries. Collection and analysis of this data will assist in determining the contribution of newspaper advertising, as well as the point of diminishing returns for each medium As of this date, CGS is aware that X number of inquiries have been received. If 8% of the inquirers registered each semester, it would place CGS beyond the break-even point relative to expenses incurred for advertising. However, the system was implemented so rapidly that adequate control procedures were not feasible. This situation is being corrected. Control techniques are being established to determine how many callers actually register for courses who would not have registered otherwise. This data should assist in constructing a model showing the relationship between registrations and advertising, which, ultimately, should afford a basis for deciding the total size of the newspaper advertising budget and a point of diminishing returns for each medium. Unfortunately, until sufficient data are collected, the department

must operate on a trial and error basis; keeping in mind the short and long-run ramifications. It is interesting to note that other local institutions have begun to follow the advertising concept of CGS by using the same media.

In Chapter V, we discussed the cardinal arrangement of each analogue. Theoretically, each variable may be manipulated by varying the weight of one while holding the others constant. In all probability, however, the functional weights would require periodic adjustments, since we in the academic community live in a dynamic environment. In the last fifty years, we have experienced more technological and managerial advancement than in all history. Change has its effects on every facet of our society--social, political and economic. All organizations must continuously reassess their role in view of change and public attitude. CGS, in particular, must keep abreast of change, as we serve and depend upon organizations which are intensely involved in change. These dynamics, relative to the type of mathematical model in this study, mean not only cardinal changes but functional changes as well. The variables must be looked at independently, interdependently, and from a short and long-range view. They must be reviewed continuously.

In summary, one must look ahead, and be aware of the total concept within the increasing compaction of time. It is the inequality of knowledge and managerial capability in our real world of imperfection that separates the "men from the boys" in the decision making process.

Bayesian analysis? It is only as valid as the knowledge and vision of the individual who employs it.

CHAPTER IV

SUGGESTIONS FOR ADDITIONAL RESEARCH

A great deal can be learned about how much reliance to place on any one predictor among others used in forecasting the demand for credit courses. Best weights to use when combining predictors may vary from semester to semester, school to school, and geographically. The compaction of time and change, today, are crucial factors in the job of managers, whether academic administrators or business entreprenneurs. Managers must look ahead, and stop looking back at what others are doing; they must look into the future and be aware of the total concept.

The different variables involving various categories of the off-campus student body suggest that additional research is needed for each component in order to refine the prediction of demand for credit courses: for example, a distinct and separate study for graduate and undergraduate students, further categorized by those who do and do not receive tuition assistance.

A useful research project might be developed by studying other local institutions with similar curricula, tuition, and promotion policies.

Further research might incorporate the use of additional analogues into the model presented in this study.

If feasible, it would be desirable to have other directorates within the College of General Studies conduct similar research; that is, departments involving programs other than credit courses. It may force each department head to: discipline his staff by developing a system of ideas for a mathematical model--a shorthand summary for his component relationships; to quantify his functions or know why he can not quantify them; and to manipulate the variables of the model for maximum output. The net effect may result in far-reaching changes and insight into the various elements of planning, predicting, and control.

While the results of this study suggest a possible basis for action, it must be viewed with caution. This study is presented for the interest of knowledgeable administrators who may find that it confirms or denies the teachings (analogues) of their own experience but who will, in any case, want to reflect on them. Each department may be a unique case and should be evaluated accordingly. The danger lies in using the same yardstick for each department blindly, or without continuous updating and review.

This study, moreover, should be evaluated from two separate viewpoints; the generalized model, and the specific values assigned to the variables and their coefficients. The model is proposed as a prototype idea. Variables may be added or subtracted as each

observer feels warranted, without invalidating the basic idea. As to the specific values, again they can be varied by the observer according to his own Bayesian predictions and experiences, without invalidating the generalized model.

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