



RETURNING MATERIALS:

Place in book drop to
remove this checkout from
your record. FINES will
be charged if book is
returned after the date
stamped below.

--	--	--

10/12

Copyright by
THOMAS LEE POWERS
1985

ABSTRACT

AN EXAMINATION OF THE EFFECTS OF TRADE INCENTIVES ON LOGISTICAL PERFORMANCE IN THE GROCERY PRODUCTS INDUSTRY

By

Thomas L. Powers

Trade incentives are commonly utilized within distribution channels, however their impact on logistical performance has not previously been identified. Without this information a determination cannot be made as to the desirability of trade incentive usage. The purpose of this research was to determine those logistical impacts and cost ramifications over a wide range of environmental conditions.

The Simulated Product Sales Forecasting Model was utilized to generate information on logistical performance impacts. This was accomplished utilizing a wide range of input variables associated with incentive activity.

The major conclusion of the research were:

1. Incentive activity had a substantial positive impact on inventory levels. These inventory levels once increased due to the presence of the incentive were relatively insensitive to other input parameters.

2. Incentive activity caused customer service levels to increase overall. These levels were sensitive to other

input variables within the incentive scenarios tested.

3. Incentive activity caused the pattern of shipments by size to vary from the non-incentive pattern. A greater number of larger shipments occurred, at the same time that the number of smaller shipments was reduced. Within the incentive scenarios, the pattern was on occasion significantly different as levels of the other input parameters were varied.

4. The presence of an incentive did not significantly change the total number of shipments. Despite the relatively large change in the pattern of shipments, their total remained relatively constant.

5. When cost assignments were made to the measures of logistical performance, a wide range of results occurred. In the instance of an incentive price discount not being passed on to the final customer, the use of an incentive resulted in improved profitability for the distribution center/retail network. When this price discount was passed along, reduced profitability occurred in the majority on incentive scenarios tested.

The results of this research project would indicate that incentives have substantial impacts on logistical performance, and that in many cases these impacts result in reduced financial performance when a price discount is passed along through the channel and less than optimal market response occurs.

ACKNOWLEDGMENTS

I wish to express my appreciation to the following members of my dissertation committee who made this project possible:

Dr. David J. Closs, who chaired the dissertation committee. Dr. Closs provided a tremendous amount of input both on the overview of the entire project and on the specific aspects of the research design.

Dr. M. Bixby Cooper, whose expertise in the area of retailing was instrumental in the conception and execution of this research.

Dr. Donald J. Bowersox, whose vast experience in simulation modeling gave a sense of balance and background to the project.

I would also like to express thanks to the following individuals for their intellectual and financial support during my doctoral program:

Dr. Charles Hoitash, Eastern Michigan University.

Dr. Floyd Patrick, Eastern Michigan University.

Dr. Donald Taylor, Michigan State University.

TABLE OF CONTENTS

Page

Chapter I

Introduction	1
Background	3
Reasons for the Existance of Trade Incentives	4
Calls for Research	7
Market Response to Trade Incentives	9
Research Questions and General Hypotheses	10
Methodology	14
Model and Structure Utilized	15
Justifications and Limitations	19
Footnotes	22

Chapter II

Review of the Literature	25
Price Theory Applied to Channels	26
Division of Labor-Channel Structure	31
Importance of Distribution Efficiency	35
Single Echelon Models	37
Multiple Echelon Models	39
Market Response to Promotions and Incentives	45
Contributions of the Present Research	51
Footnotes	53

Chapter III

Research Methodology	56
Introduction	56
Development of Hypotheses	56

Model Development	61
Research Design	68
Model Validation	76
Summary	77
Footnotes	79
 <u>Chapter IV</u>	
Results and Conclusions	81
Hypothesis One	81
Hypothesis Two	108
Hypothesis Three	132
Hypothesis Four	149
Hypothesis Five	165
Footnotes	210
 <u>Chapter V</u>	
Implications of the Research	211
Review of Hypothesis	211
Implications of the Research	222
Limitations of the Research	226
Future Research	227
Footnotes	229
 <u>Appendices</u>	
Appendix A	230
Appendix B	235
Appendix C	239
Appendix D	244
<u>Bibliography</u>	245

LIST OF TABLES

	Page
Table 2.1 Competitive Market Structure	29
Table 3.1 Testing Environment Variables	69
Table 3.2 Testing Environment Simulation Run Combinations	73
Table 4.1 Analysis of Variance of Inventory Level by Incentive Level at Low Level of Uncertainty	84
Table 4.2 Analysis of Variance of Inventory Level by Incentive Level at High Level of Uncertainty	85
Table 4.3 Analysis of Variance of Inventory Level by 20% Incentive with Different Sales Increases at Low Level of Uncertainty	88
Table 4.4 Analysis of Variance of Inventory Level by 20% incentive with Different Sales Increases at High Level of Uncertainty	89
Table 4.5 Analysis of Variance of Inventory Level by 40% Incentive with Different Sales Increases at Low Level of Uncertainty	91
Table 4.6 Analysis of Variance of Inventory Level by 40% Incentive with Different Sales Increases at High Level of Uncertainty	92
Table 4.7 Analysis of Variance of Inventory Level by 20% Incentive with 20% Sales Response Increase with Different Payback Levels at Low Level of Uncertainty	95
Table 4.8 Analysis of Variance of Inventory Level by 20% Incentive with 20% Sales Response Increase with Different Payback Levels at High Levels of Uncertainty	96

Table 4.9	Analysis of Variance of Inventory Level by 20% Incentive with Different Payback Levels at Low Level of Uncertainty	98
Table 4.10	Analysis of Variance of Inventory Level by 20% Incentive with Differnt Payback Levels at High Levels of Uncertainty	99
Table 4.11	Analysis of Variance of Inventory Level by 40% Incentive with 20% Sales Increase with Different Payback Levels at Low Level of Uncertainty	101
Table 4.12	Analysis of Variance of Inventory Level by 40% Incentive with 20% Sales Increase with Different Payback Levels at High Level of Uncertainty	102
Table 4.13	Analysis of Variance of Inventory Level by 40% Incentive with 40% Incentive with Different Payback Levels at Low Level of Uncertainty	105
Table 4.14	Analysis of Variance of Inventory Level by 40% Incentive with 40% Sales Increase with Different Payback Levels at High Level of Uncertainty	106
Table 4.15	Testing Environment Output, Hypothesis One, All Testing Conditions	107
Table 4.16	Analysis of Variance of Customer Service Level by Incentive Level at Low Level of Uncertainty	110
Table 4.17	Analysis of Variance of Customer Service Level by Incentive Level at High Level of Uncertainty	111
Table 4.18	Analysis of Variance of Customer Service Level for 20% Incentive with Different Sales Increases at Low Level of Uncertainty	114
Table 4.19	Analysis of Variance of Customer Service Level for 20% Incentive with Different Sales Increases at High Level of Uncertainty	115

Table 4.20	Analysis of Variance of Customer Service Level for 40% Incentive with Different Sales Increases at Low Level of Uncertainty	116
Table 4.21	Analysis of Variance of Customer Service Level for 40% Incentive with Different Sales Increases at High Level of Uncertainty	117
Table 4.22	Analysis of Variance of Customer Service Level by 20% Incentive with 20% Sales Response Increase with Different Payback Levels at Low Level of Uncertainty	121
Table 4.23	Analysis of Variance of Customer Service Level by 20% Incentive with 20% Sales Response Increase with Different Payback Levels at High Level of Uncertainty	122
Table 4.24	Analysis of Variance of Customer Service Level by 20% Incentive with 40% Sales Response Increase with Different Payback Levels at Low Level of Uncertainty	123
Table 4.25	Analysis of Variance of Customer Service Level by 20% Incentive with 40% Sales Response Increase with Different Payback Levels at High Level of Uncertainty	124
Table 4.26	Analysis of Variance of Customer Service Level by 40% Incentive with 20% Sales Response Increase with Different Payback Levels at High Level of Uncertainty	127
Table 4.27	Analysis of Variance of Customer Service Level by 40% Incentive with 20% Sales Response Increase with Different Payback Levels at High Level of Uncertainty	128
Table 4.28	Analysis of Variance of Customer Service Level by 40% Incentive with 40% Sales Response Increase at Different Payback Levels at Low Level of Uncertainty	129
Table 4.29	Analysis of Variance of Customer Service Level by 40% Incentive with 40% Sales Response Increase at Different Payback Levels at High Level of Uncertainty	130

Table 4.30	Testing Environment Output, Hypothesis Two, All Testing Conditions	133
Table 4.31	Shipment Summary for Different Incentive Levels at Low Level of Uncertainty	134
Table 4.32	Shipment Summary for Different Incentive Levels at High Level of Uncertainty	135
Table 4.33	Shipment Summary for 20% Incentive with Different Sales Increases at Low Level of Uncertainty	137
Table 4.34	Shipment Summary for 20% Incentive with Different Sales Increases at High Level of Uncertainty	138
Table 4.35	Shipment Summary for 40% Incentive with Different Sales Increases at Low Level of Uncertainty	139
Table 4.36	Shipment Summary for 40% Incentive with Different Sales Increases at High Level of Uncertainty	140
Table 4.37	Shipment Summary for 20% Incentive with 20% Sales Response Increase with Different Payback Levels at Low Level of Uncertainty ..	141
Table 4.38	Shipment Summary for 20% Incentive with 20% Sales Response Increase with Different Payback Levels at High Level of Uncertainty .	143
Table 4.39	Shipment Summary for 20% Incentive with 40% Sales Response Increase with Different Payback Levels at Low Level of Uncertainty ..	144
Table 4.40	Shipment Summary for 20% Incentive with 40% Sales Response Increase with Different Payback Levels at High Level of Uncertainty .	145
Table 4.41	Shipment Summary for 40% Incentive with 20% Sales Response Increase with Different Payback Levels at Low Level of Uncertainty ..	146
Table 4.42	Shipment Summary for 40% Incentive with 20% Sales Increase with Different Payback Levels at High Level of Uncertainty	147

Table 4.43	Shipment Summary for 40% Incentive with 40% Sales Increase with Different Payback Levels at Low Level of Uncertainty	148
Table 4.44	Shipment Summary for 40% Incentive with 40% Sales Increase with Different Payback Levels at High Level of Uncertainty	150
Table 4.45	Total Shipments for Different Incentive Levels at Low Level of Uncertainty	151
Table 4.46	Total Shipments for Different Incentive Levels at High Level of Uncertainty	152
Table 4.47	Total Shipments for 20% Incentive with Differnet Sales Increases at Low Level of Uncertainty	153
Table 4.48	Total Shipments for 20% Incentive with Different Sales Increases at High Level of Uncertainty	154
Table 4.49	Total Shipments for 40% Incentive with Different Sales Increases at Low Level of Uncertainty	155
Table 4.50	Total Shipments for 40% Incentive with Different Sales Increases at High Level of Uncertainty	156
Table 4.51	Total Shipments for 20% Incentive with 20% Sales Increase with Different Payback Levels at Low Level of Uncertainty	157
Table 4.52	Total Shipments for 20% Incentive with 20% Sales Response Increase with Different Payback Levels at High Level of Uncertainty .	158
Table 4.53	Total Shipments for 20% Incentive with 40% Sales Response Increase with Different Payback Levels at Low Level of Uncertainty ..	159
Table 4.54	Total Shipments for 20% Incentive with 40% Sales Response Increase with Different Payback Levels at High Level of Uncertainty..	160
Table 4.55	Total Shipments for 40% Incentive with 20% Sales Response Increase with Different Payback Levels at Low Level of Uncertainty...	161

Table 4.56	Total Shipments for 40% Incentive with 20% Sales Response Increase with Different Payback Levels at High Level of Uncertainty.	162
Table 4.57	Total shipments for 40% Incentive with 40% Sales Response Increase with Different Payback Levels at Low Level of Uncertainty...	163
Table 4.58	Total Shipments for 40% Incentive with 40% Sales Response Increase with Different Payback Levels at High Level of Uncertainty..	164
Table 4.59	Distribution Cost Assignments	166
Table 4.60	Analysis of Variance of Financial Performance by Incentive Level at Low Level of Uncertainty (Option 1)	170
Table 4.61	Analysis of Variance of Financial Performance by Incentive Level at Low Level of Uncertainty (Option 2)...	171
Table 4.62	Analysis of Variance of Financial Performance by Incentive Level at High Level of Uncertainty (Option 1)	172
Table 4.63	Analysis of Variance of Financial Performance by Incentive Level at High Level of Uncertainty (Option 2)	173
Table 4.64	Analysis of Variance of Financial Performance for 20% Incentive with Different Sales Response Increases at Low Level of Uncertainty (Option 1)	176
Table 4.65	Analysis of Variance of Financial Performance for 20% Incentive with Different Sales Response Increases at Low Level of Uncertainty (Option 2)	177
Table 4.66	Analysis of Variance of Financial Performance for 20% Incentive with Different Sales Response Increases at High Level of Uncertainty (Option 1)	178

Table 4.67	Analysis of Variance of Financial Performance for 20% Incentive with Different Sales Response Increases at High Level of Uncertainty (Option 2)	179
Table 4.68	Analysis of Variance of Financial Performance for 40% Incentive with Different Sales Responses at Low Level of Uncertainty (Option 1)	182
Table 4.69	Analysis of Variance of Financial Performance for 40% Incentive with Different Sales Responses at Low Level of Uncertainty (Option 2)	183
Table 4.70	Analysis of Variance of Financial Performance for 40% Incentive with Different Sales Responses at High Level of Uncertainty (Option 1)	184
Table 4.71	Analysis of Variance of Financial Performance for 40% Incentive with Different Sales Responses at High Level of Uncertainty (Option 2)	185
Table 4.72	Analysis of Variance of Financial Performance for 20% Incentive with 20% Sales Response Increase with Different Payback Levels at Low Level of Uncertainty (Option 1)	189
Table 4.73	Analysis of Variance of Financial Performance for 20% Incentive with 20% Sales Response Increase with Different Payback Levels at Low Level of Uncertainty (Option 2)	190
Table 4.74	Analysis of Variance of Financial Performance for 20% Incentive with 20% Sales Response Increase with Different Payback Levels at High Level of Uncertainty (Option 1)	191
Table 4.75	Analysis of Variance of Financial Performance for 20% Incentive with 20% Sales Response Increase with Different Payback Levels at High Level of Uncertainty (Option 2)	192

Table 4.76 Analysis of Variance of Financial Performance for 20% Incentive with 40% Sales Response Increased with Different Payback Levels at Low Level of Uncertainty (Option 1)	193
Table 4.77 Analysis of Variance of Financial Performance for 20% Incentive with 40% Sales Response Increased with Different Payback Levels at Low Level of Uncertainty (Option 2)	194
Table 4.78 Analysis of Variance of Financial Performance for 20% Incentive with 40% Sales Response Increased with Different Payback Levels at High Level of Uncertainty (Option 1)	195
Table 4.79 Analysis of Variance of Financial Performance for 20% Incentive with 40% Sales Response Increased with Different Payback Levels at High Level of Uncertainty (Option 2)	196
Table 4.80 Analysis of Variance of Financial Performance for 40% Incentive with 20% Sales Increase with Different Payback Levels at Low Level of Uncertainty (Option 1)	198
Table 4.81 Analysis of Variance of Financial Performance for 40% Incentive with 20% Sales Increase with Different Payback Levels at Low Level of Uncertainty (Option 2)	199
Table 4.82 Analysis of Variance of Financial Performance for 40% Incentive with 20% Sales Increase with Different Payback Levels at High Level of Uncertainty (Option 1)	200
Table 4.83 Analysis of Variance of Financial Performance for 40% Incentive with 20% Sales Increase with Different Payback Levels at High Level of Uncertainty (Option 2)	201
Table 4.84 Analysis of Variance of Financial Performance for 40% Incentive with 40% Sales Increase with Different Payback Levels at Low Level of Uncertainty (Option 1)	204

Table 4.85 Analysis of Variance of Financial Performance for 40% Incentive with 40% Sales Increase with Different Payback Levels at Low Level of Uncertainty (Option 2)	205
Table 4.86 Analysis of Variance of Financial Performance for 40% Incentive with 40% Sales Increase with Different Payback Levels at High Level of Uncertainty (Option 1)	206
Table 4.87 Analysis of Variance of Financial Performance for 40% Incentive with 40% Sales Increase with Different Payback Levels at High Level of Uncertainty (Option 2)	207
Table 4.88 Testing Environment Output	209
Table 5.1 Financial Performance Summary Percent Change in Performance from Non-incentive Scenario	220
Table 5.2 Managerial Guidelines Summary	223

LIST OF FIGURES

	Page
Figure 1.1 SPSF Testing Environment	16
Figure 2.1 Relationship Between Manufacturer and Retailer/Distribution Center Cost and Revenue Curves	34
Figure 2.2 Trade-Off Limits: Contribution from % Change in Sales Volume vs. Carrying Cost of 1-Week's Inventory	41
Figure 2.3 Causal Loop Structure	43
Figure 3.1 Response of a Production-Distribution System to a 10% Unexpected Rise and Fall in Retail Sales Over a One-Year Period	58
Figure 3.2 Order Point and Dependent Demand	59
Figure 3.3 Channel System Configuration	63
Figure 3.4 Incentive Timing and Response	65
Figure 3.5 Incentive Sales Payback	66
Figure 4.1 Comparison of Inventory Levels for Incentive and Non-Incentive Testing Conditions	82
Figure 4.2 Comparison of Inventory Levels for 20% Incentive with Different Sales Response Levels	86

Figure 4.3	Comparison of Inventory Level for 40% Incentive with Different Sales Response Levels	90
Figure 4.4	Comparison of Inventory Level for 20% Incentive with 20% Sales Response Increase with Different Payback Levels	93
Figure 4.5	Comparison of Inventory Level for 20% Incentive with 40% Sales Response Increase with Different Payback Levels	97
Figure 4.6	Comparison of Inventory Level for 40% Incentive with 20% Sales Increase with Different Payback Levels	100
Figure 4.7	Comparison of Inventory Level for 40% Incentive with 40% Sales Increase with Different Payback Levels	104
Figure 4.8	Comparison of Customer Service Levels for Incentive and Non-Incentive Testing Conditions	109
Figure 4.9	Comparison of Customer Service Level for 20% Incentive with Different Sales Response Levels	113
Figure 4.10	Comparison of Customer Service Level for 40% Incentive with Different Sales Response Levels	118
Figure 4.11	Comparison of Customer Service Level for 20% Incentive with 20% Sales Response Increase with Different Payback Levels ..	119
Figure 4.12	Comparison of Customer Service Level for 20% Incentive with 40% Sales Response Increase with Differnt Payback Levels ...	125
Figure 4.13	Comparison of Customer Service Level for 40% Incentive with 20% Sales Increase with Different Payback Levels	126

Figure 4.14	Comparison of Customer Service Level for 40% Incentive with 40% Sales Increase with Different Payback Levels	131
Figure 4.15	Comparison of Financial Performance for Incentive and Non-Incentive Testing Conditions	169
Figure 4.16	Comparison of Financial Performance for 20% Incentive with Different Sales Response Levels	175
Figure 4.17	Comparison of Financial Performance for 40% Incentive with Different Sales Response Levels	181
Figure 4.18	Comparison of Financial Performance for 20% Incentive with 20% Sales Response Increase with Different Payback Levels ..	186
Figure 4.19	Comparison of Financial Performance for 20% Incentive with 40% Sales Response Increase with Different Payback Levels ..	188
Figure 4.20	Comparison of Financial Performance for 40% Incentive with 20% Sales Response Increase with Different Payback Levels ..	197
Figure 4.21	Comparison of Financial Performance for 40% Incentive with 40% Sales Response Increase with Different Payback Levels ..	203

CHAPTER I

INTRODUCTION

The objective of this dissertation is to examine the distribution channel performance impacts of industry trade incentives. Trade incentives affect many facets of a distribution channel resulting in measurable impacts on cost and customer service. Past research has not investigated the channel performance impacts of incentives resulting in a fertile area of study to develop guidelines for the effective use of trade incentives.

The dollar magnitude of trade incentives has increased significantly in the recent past¹ and at the same time their percentages of total marketing budgets has increased.² There has not been a similar increase in the understanding of the overall management of incentives³ although such a development has been called for in the literature.⁴

Trade incentives exist for a number of reasons, including the ability to shift the demand curve in the short term,⁵ transfer inventory to lower points in the channel,⁶ and to gain economies of scale in production and distribution processes. These and other reasons are believed by various channel members to increase their firm's financial performance.

This perceived financial gain may be for the channel in total, or suboptimally for an individual channel member. These relationships and impacts have not been empirically proven for a total channel, although they have been viewed in the context of a single echelon, the retail level.

At the same time that the need exists for clarification of this issue, methodologies have been developed that make this type of research possible. Dynamic simulation modeling,⁸ with appropriate experimental techniques such as factorial designs utilizing analysis of variance,⁹ can be used as a testing environment to evaluate overall channel performance.

The present research is designed to utilize the above methodology to examine the effects of trade incentives on distribution channel performance. In addition it is intended to develop guidelines that reflect tested relationships between various parameters and conditions that result in improved channel performance. The guidelines are intended to provide the discipline with an increased understanding of channel operations under trade incentives. The guidelines may also provide practitioners with a means of determining how and under what conditions to implement trade incentives in consideration of channel performance impacts.

This chapter outlines the background of the use and impact of trade incentives within a channel of distribution, the research questions and hypothesis to be examined in the

research, the research methodology to be utilized, and the justification and limitations of the research.

Background

Trade incentives are a commonplace activity within distribution channels and have grown at a rapid rate in recent years. Trade incentives are defined as activities including but not limited to seasonal, quantity, and case discounts. These incentives may appear at any level within a channel of distribution, and may or may not result in an incentive in the form of a price discount and aimed directly at the ultimate consumer.¹⁰ The growth in the use of, and the expenditures on incentives has increased a need to further understand the total ramification of incentive usage. Trade incentives impact not only sales responses at various levels within the channel, but also directly impact the performance of that channel. Performance is defined as the relationship between customer service capability and associated total cost.¹¹ The status of research on the subject reflects the former issue, however, not the latter. In as much as incentives impact sales response and logistical activities, the problem must be examined from both perspectives, as they are highly interrelated. Before this can be accomplished, it becomes necessary to understand the rationales for the existence of incentives, the causes of their increased use in recent years, and the logic of why the issue of performance measurement is seen to be increasingly important. In addition, it is important to understand

the impact that incentives have on the consumer market in terms of sales response.

Reasons for the Existence of Trade Incentives

Trade incentives exist for two primary reasons: one market related, one production related. The market rationale for incentives is usually associated with a short term increase in sales and market share.¹² In addition to this primary rationale, there are further objectives that are related. These include modifying the distribution pattern by increasing the number of members at a given level within the channel. Further objectives may be consumer related, such as acquiring new customers or accelerating the rate of product usage. Finally, within market related rationales, there may be objectives related to competition, such as increasing market share or responding to competitors' promotions.¹³

In addition to the market rationale, there exists a number of reasons that are based within the production activity of the firm. Of these, the most prevalent rationale is that of utilizing incentives to move merchandise down the channel thereby shifting inventory carrying costs down the channel. Implicit in this rationale is the assumption that there exists a mismatch between supply and demand at a given point in time. This may occur due to seasonal demand fluctuations that are being anticipated by a higher than normal production level, or batch type production with high set up costs that make large production runs necessary to minimize per unit costs.

A number of reasons exist for the dramatic increases seen in the use of, and expenditures on, promotion and trade incentives. These include both causes internal and external to the firm. Internal causes observed include:¹⁵

- Promotions have become more acceptable to senior management.
- More executives are better qualified to handle promotion activities.
- The use of the product manager system, with individuals desiring a quick return on investment, has caused an increased emphasis on promotion due to its short term payoff.

External causes cited include:¹⁶

- The number of brands has increased; as new brands typically use promotion at the time of introduction, the number of brands directly increases the amount of promotion.
- The increased number of brands causes an increase in promotion as they compete for limited amounts of shelf space.
- The increased number of brands also may result in shorter product life cycles. Promotions may be used to prevent or delay the onset of the decline stage.
- Competitors are becoming more promotion minded, therefore, firms are forced to become part of a scenario of increased promotional activity for competitive reasons.
- General economic conditions have declined, causing a need to engage in activities that will result in increased demand.

An example of the last point is that of the tremendous increase in rebates to consumers for products such as automobiles during the period of 1973-1975. This rebate was a form of trade incentive that bypassed the dealer to ensure compliance. Prior to that period incentives within this

industry had been given to retail dealers without specific performance requirements as to passing on price reductions. The period 1979-1982 also saw an increased use in this type of activity, however, for lower-priced, convenience-type merchandise.

The above internal and external reasons for the increased use of promotions represent an overview of the factors causing this phenomena to occur. In addition, the reasons cited will undoubtedly continue to increase and continue to place further pressure on the development and use of promotions and incentives.

This past set of circumstances that has caused increases in promotional activity has also resulted in substantial changes in the overall structure of marketing expenditures. Between 1969 and 1975 promotion expenditures increased at a rate twice that of advertising.¹⁸ According to a survey of sixty-five packaged goods companies in 1980, their marketing budgets devoted 34.9% of total dollars spent to trade promotion and 24.7% to consumer promotion.¹⁹ The total of these two categories exceeds the amount spent on consumer advertising. Another study has shown for grocery products and health and beauty aids that between sixty and seventy-five percent of goods in these categories were shipped on some form of an incentive basis.²⁰ The total expenditure for these categories on promotion and incentives was shown to have exceeded 9.8 billion dollars annually.

Although the above figures represent dramatic evidence of the widespread use of promotions and trade incentives, it must be kept in mind that these figures are, if anything, understated. Many times the expense of an incentive, in the form of a price discount or allowance, is not reflected in the financial statements of a company. The top line may reflect sales net of any discount or allowance. Thus the issue of incentive cost is ignored or taken for granted, much in the same way that freight costs have been traditionally treated by many firms.²¹

Trade incentives and promotional activity have been discussed simultaneously although a difference does exist. Trade incentives have as their focus selling activities to other channel members whereas promotional activity has as its focus selling activities to the final consumer. In many cases, the activity aimed at the consumer has as its origin a trade incentive with a specific performance requirement. A description of various types of trade incentives appears in Appendix A.

Calls for Research

The tremendous increase in promotion and trade incentive activity has created a need for further understanding of the cost effectiveness of these activities. As stated by one author, trade promotions are where advertising was twenty years ago, "large, rapidly growing budgets with no real measurement, planning, or management tools to apply these budgets."²² Another perspective on the problem has been brought forth by Haugh²³ who states:

Unless it is documented that trade promotions are unprofitable, expenditures will continue to increase faster than sales because of continuous competitive pressure because trade promotions increase sales in the short run and because the sales department will feel the pressure from the trade for higher discounts.

Other authors have stated that improved measurement, planning and management can result in improved promotion effectiveness, and that these techniques exist or can be developed.²⁴ It is also believed that improvements in effectiveness will take years, however, even small efficiency improvements will impact profits dramatically.²⁵ In addition, it has been observed that there are wide differences between promotional patterns, problems, and opportunities for various companies and industries, although common measurement and management tools can be utilized.²⁶

It has been suggested that management information systems be modified to identify promotion costs. These include changes to identify costs associated with special packaging, consumer education programs, sales and dealer incentives, and loss of revenue from temporary price reduction programs.²⁷ From a total strategic perspective, it has been observed that these activities may result in improved promotion management by analyzing past spending, establishing objectives, selecting appropriate techniques, and pretesting.²⁸

The rapid growth in the use of trade incentives and the costs associated with incentives has created a very real need to understand the impacts that these activities have on

the performance of a distribution channel. The purpose of the present research is to determine that relationship. The retail sales impact of promotions, within the context of trade incentives, has been examined in previous research and provides a background that can be useful in understanding the nature of market response and for establishing parameters for testing the model.

Market Response to Trade Incentives

Market response as it relates to incentives can be separated into two areas. The first area is the response of channel members to incentive activities conducted by other channel members. The second area is that of final consumer response. The literature on intermediary response is extremely limited, however, there is a wide body of literature on end-level, consumer response to incentive activities.

Consumer response to promotion and incentive type activities has been examined in the literature from a number of different perspectives. These include the reasons that consumers have for accepting a price deal, which has been seen to be based on a relatively lower cost of holding inventory or the portion of cost that is associated with storage.²⁹ Associated with this finding is that the source of the sales response to a promotional deal may be a stockpiling activity on the part of the consumer and not brand switching activity. In comparing the responses to promotions and advertising, it has been observed that promotions yield faster results than advertising, however,

they do not produce new, long-term buyers.³⁰ Advertising, on the other hand, has been seen as being able to increase long-term sales.

Additional studies have examined market response to promotion in the context of market structure and product life cycle,³¹ brand loyalty,³² pricing,³³ and package size.³⁴

In summary, promotion and trade incentive activities are widely used for consumer goods. Their relative use compared to other marketing activities is growing at a rapid rate. Their cost effectiveness has been questioned, and remains unanswered. To answer this question, two primary areas must be examined. These are the response to this type of activity in the marketplace and the impact of this activity upon the channel. The present investigation is designed to utilize assumptions of the former to develop empirical findings of the latter. The operational focus of the research is on trade incentives, however, promotional activities aimed at the consumer are implicit with these trade incentives.

Research Questions and General Hypotheses

The overall nature of the problem examined is the impact of trade incentives on logistical channel performance. Impact may be considered to include all associated changes on the channel of distribution that are caused by the existence of the incentive activity. These associated changes include but are not limited to, changes in inventory

levels at various points in the channel, changes in the flow of merchandise through the channel, changes in the cost and type of transportation utilized, changes in material handling procedures, changes in the flow of information and changes in margin structure through the channel. These associated changes may be thought of as the variations that occur on the activities related to the product that is involved in the incentive under examination. In addition, incentive activities associated with one product may have impacts of the above nature on other products that may ultimately affect product and customer mix in the long term.

Channel performance may be considered to be all elements of cost and customer service capability. Costs can be measured on many dimensions including inventory, transportation, material handling, communications, and overall administration costs. Customer service capability can be measured on dimensions including order cycle time, back-orders, fill rate, and incorrect orders shipped. As with impacts, these measures of performance may be considered not only for the product that is under an incentive, but for all products and customers of the firm.

The essential problem relates to the overall efficiency of the system, and the effect that incentive activities have on that efficiency. This problem of efficiency has been seen by House and Karrenbauer³⁵ in their discussion of logistical models as follows:

The basic problem under investigation is deceptively simple. If we have m productive facilities

$P_1 \dots P_m$ and n consumption points, $C_1 \dots C_n$, then we can define the role of a logistics system to be that of providing the linkage between the productive facilities and the consuming units. A more precise statement of the problem emphasizes the determination of the needs of the n consumers in terms of product and service, the determination of the product/service delivery capabilities of the m producers, and the matching of production and consumption units with the most economical system which satisfies customer service constraints.

This issue of efficiency or "economical system" as described by House and Karrenbauer is also reflected in the following statement by Bowersox:³⁶

Physical distribution is an integrative field which combines transportation, inventory, warehouse operations, order communication, and material handling as components of a single performance system. The structure of the system is determined by the number, size, and geographical arrangement of warehouse facilities that serve as nodal points in the integration of the above components. The planning objective in physical distribution is to isolate the operating system structure and procedures which most satisfactorily contribute to the firm's profit goals.

This statement expands the idea of "economical system" to the notion of "operating system structure and procedures." In addition, the concept of tradeoff between production/service capabilities and customer requirements is expanded to be "the firm's profit goals."

From this it can be seen that the nature of the problem can be expanded to include not only the impact of incentives upon logistical channel performance in terms of costs and customer service capabilities, but also their combined impact on the overall profitability of the firm and channel.

To reflect the problem as it has been developed, the general question is stated as follows:

What is the impact of levels of variables associated with a trade incentive on measurable outputs of logistical performance for a channel of distribution including overall financial performance?

From this, the following research questions reflect individual specific areas of the first part of the above question:

What effect does a trade incentive have on:

- inventory levels?
- customer service levels?
- shipment sizes?
- number of shipments?

These questions reflect the impact of incentives on the logistical performance of a channel. Given information relative to the customer service trade-offs and requirements for a specific firm, the changes in revenue due to the incentive, and the sales response due to the incentive, the impact on the overall profitability of the firm and channel can also be identified. The above research questions are restated in hypothesis form as follows:

- H₁ The use of an incentive increases inventory levels for the product under the incentive at the distribution center.
- H₂ The use of an incentive decreases the overall customer service level for products under the incentive.
- H₃ The use of an incentive results in variation in shipment sizes between the manufacturer and the distribution center.
- H₄ The use of an incentive results in an increase in the total number of shipments from the manufacturer to the distribution center.

Finally, to reflect the impact of trade incentives on the profitability of the distribution center/retail network,

given the above impacts plus cost and volume changes, the last hypothesis states:

- H₅ The use of an incentive results in a decreased level of profitability for the distribution center/retail network.

The following section describes the research design utilized to test the hypotheses and to develop guidelines for the cost ramifications of trade incentives on channel performance.

Methodology

In order to test for the impacts of trade incentives on logistical activities of a firm and channel, the research design must be capable of evaluating logistical system performance under conditions of incentive and non-incentive activity. In addition, in order to develop guidelines for a broad range of conditions, the design must evaluate results from different combinations of alternative conditions. Specifically, the design must be capable of the following requirements:

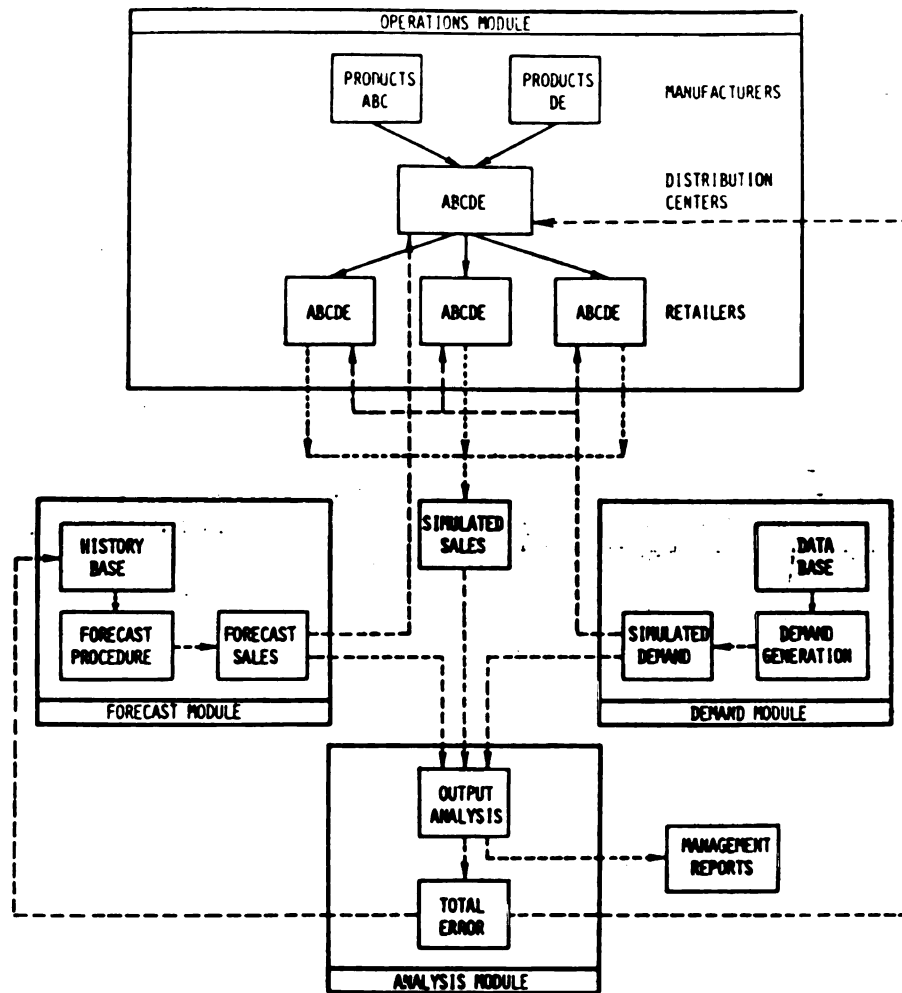
- Testing a logistical system under conditions of an incentive, and making comparisons with that same system under non-incentive conditions.
- Evaluating specific operational impacts of changes in levels of parameters associated with an incentive activity, such as the level of sales response, and the payback in sales at the conclusion of the incentive period.
- Replicate a multi-echelon distribution system, with multiple members in the channel at the distribution center and retail level.
- Replicate a multi-product system in order to evaluate comparisons between products under incentive activities with products under normal conditions.

- Account for dynamic elements of a logistical operating system, including the interaction of temporal and spacial considerations.
- Replicate reality as closely as possible.

Dynamic simulation models represent a methodology that is capable of achieving the above objectives. Models that have been previously designed, tested and validated at Michigan State University include the LREPS (Long-Range Environmental Planning Simulator)³⁷ model and SPSF (Simulated Product Sales Forecasting)³⁸ model. The SPSF model, which was developed after the LREPS model, combines attributes of dynamic simulation, market area demand simulation, and statistical sales forecasting.

Model and Structure Utilized

The present research utilized a modified SPSF model that was developed in order to allow for the manipulation of variables associated with trade incentive activity. This model was operable on an IBM Personal Computer. Data that was generated in each simulation run was collected into a data file stored on diskettes. This data file was then transferred to the Michigan State University Cyber mainframe system for analysis. The general design of the SPSF testing environment appears in Figure 1.1 below:

Figure 1.1

Source: Simulated Product Sales Forecasting. D.J. Bowersox, D.J. Closs, J.T. Mentzer, J.R. Sims. MSU Business Studies, 1979.

In the context of the SPSF testing environment, the structure of the model and the factors examined are as follows:

Echelon Structure: The echelon structure represents a grocery products distribution system. This includes a manufacturer, five distribution centers, each with five retail locations.

Product and Product Mix: The products tested in the model consist of a mix of ten identical products. Five of the products are subject to trade incentives; the remaining five are on a non-incentive basis. The products represent typical non-perishable grocery items.

Transportation Method: The transportation method utilized consists of plant inventory location to distribution centers being shipped by common carrier and rail. From distribution centers to retail locations, shipments are made by private fleet on a regularly scheduled basis.

Inventory Level: Initial inventory levels are established at a level of 12 days supply.

Inventory Reorder Logic: The reorder logic utilized in the model is a reorder point and quantity method. Reorder points and quantities are based on a level that would result in a customer service level 90-95% with a moderate degree of demand uncertainty and 80-85% with a high level of uncertainty. In the case of a sales incentive, the entire incentive amount for the incentive period became the minimum order quantity on the first day of the incentive.

Customer Service Levels: Initial customer service levels were established for the testing environment in conjunction with the inventory reorder logic during a non-incentive simulation scenerio. These levels became the initial performance standards from which deviations were noted.

Time Period: The time period utilized in the testing environment consists of a three year simulation run. Each year contains two incentives, each two months in length.

Sales Incentive-Increase: Incentives were tested in three scenarios. The first is a non-incentive scenario, whereby no incentive is in effect. The second scenario is that of an increase in shipments during each incentive period of 20% above the normal sales level. The third scenario is that of an increased level of shipments at 40% above the normal sales level. In each case, the level of sales increase is tested independently of the incentive increase.

Sales Response-Increase: The sales response at the customer level is tested at three levels. The first is a zero level response. The second is a sales response of 20% above the normal sales level. The third sales response increase is 40% above the normal sales level.

Sales Response-Uncertainty: Sales response uncertainty is examined in two scenarios. The first is a relatively low level of uncertainty. The second scenario is that of a relatively high level of uncertainty.

Sales Response-Payback: Sales payback consisting of a decrease in sales after the incentive period is tested in three scenarios. The first is a zero payback at the conclusion of each incentive, i.e. sales returned to the level prior to the incentive. In the second scenario, a sales payback occurs equal to one-half of the sales increase during the incentive. The third scenario consisted of a payback amount equal to the entire increase during the incentive period. In each payback scenario, the pattern remains constant and is equal in time to the incentive period.

The model structure as outlined above allows comparisons of incentive versus non-incentive scenarios in addition to examining the effects of critical variables associated with a trade incentive activity. Based on this structure, a summary of the requisite simulation runs is:

<u>Factor</u>	<u>Runs Required</u>
Incentive Level	3
Sales Response-Increase	3
Sales Response-Uncertainty	2
Sales Response-Payback	<u>3</u>
Total runs required:	26

A total of twenty-six runs is required to examine all combinations of relevant factors. Twenty four runs depict

incentive scenarios whereas two runs depict non-incentive scenarios. In addition to the 26 simulation runs required to test all possible combinations, additional cost and revenue measures are assigned to each measure of output for the testing of hypothesis five.

The SPSF Testing Environment in combination with the research design provides a means to test the research hypotheses and to provide additional information relative to the impacts of different levels of parameters that are associated with logistical system performance. Inputs to the model that are independent variables associated with incentive activity generated in the Forecast and Demand Modules. The operating structure of the logistical system is defined in the Operations Module. The Analysis Module provides detailed output on logistical performance as impacted by the various combinations of parameter levels. This includes information about sales, stockouts, customer service levels, inventory, replenishment, and shipping volumes.

Justification and Limitations

This research provides a meaningful contribution from a number of perspectives. First, it addresses an area that has not been examined previously. This area is important due to the widespread acceptance and use of trade promotions and the cost ramifications of associated logistical activities on the firm and channel financial performance. The effects of trade promotions on logistical activity have not

been known. Without this knowledge, it is impossible to determine if trade promotions produce a positive benefit to the institutions involved. This research is designed to make this determination. In addition, the research provides additional insight into logistical performance over a wide range of operating conditions that may be of immediate use and also may be the basis of research beyond this dissertation.

The present research has implications for the discipline and practitioners. The research design, having in addition to the capability to answer the hypotheses developed for testing, provides a set of guidelines that illustrate the impacts of incentive activities for a wide range of operational considerations. These include various levels of market response to those incentives. These guidelines can be used to assess the feasibility of a given incentive activity prior to its inception. This knowledge provides substantial cost savings potential for a firm and channel.

Although the approach utilized in this research is designed to produce results that are as broadly applicable as possible, certain limitations exist. The findings of the research are applicable only to channel structure and product environments that are similar to the one tested in this study. In addition, the findings from testing various levels of parameters within the model structure are dependent upon those parameters and levels.

The chapter which follows examines the relevant literature relating to the theoretical base of the study, previous examination of this and related problems, and literature dealing with sales response to trade incentive and promotional activities. Chapter II examines the literature related to the present research. Chapter III outline the research methodology and hypotheses tested. Chapter IV details the results and conclusions of the testing environment. Finally, Chapter V discusses the implications of the research.

CHAPTER I -- FOOTNOTES

¹Strang, Roger A., "Sales Promotion-Fast Growth, Faulty Management," Harvard Business Review, 54:4 (July-August 1976), pp. 115-124.

²Donnelly Marketing, Third Annual Survey of Promotion Practices (July 1981).

³Strang.

⁴Strang.

⁵Cotton, B.C. and E.M. Babb, "Consumer Response to Promotional Deals," Journal of Marketing, 42 (July 1978), pp. 109-113.

⁶Chevalier, Michel and Ronald C. Curhan, "Temporary Promotions as a Function of Trade Deals: Descriptive Analysis," Working Paper, Marketing Science Institute, Cambridge, Mass., May 1975.

⁷Corstjens, Marcel and Peter Doyle, "A Model for Optimizing Retail Space Allocations," Management Science, 27:7 (July 1981), pp. 822-833.

⁸Bowersox, Donald J., "Planning Physical Distribution Operations With Dynamic Simulation" Journal of Marketing, Vol. 36 (January 1972), pp. 17-25.

⁹Bowersox, Donald J. et. al. Dynamic Simulation of Physical Distribution Systems, (1972), pp. 199, 202-204.

¹⁰Chevalier and Curhan.

¹¹Bowersox, Donald J., Logistical Management, Macmillan Publishing Co., Inc. New York (1978), pp. 19-21.

¹²Blattberg, Robert B., Gary D. Eppen, and Joshua Lieberman, "A Thoretical and Empirical Evaluation of Price Deals for Consumer Nondurables," Journal of Marketing 45 (Winter 1981), pp. 116-120.

¹³Quelch, John A., "Trade Promotion by Grocery Products Manufacturers: A Managerial Perspective," Marketing Science Institute Research Program, (August 1982), pp. 5.

¹⁴Bliemel, Friedhelm, "Inventory Decisions by Trade-Off Analysis: A New Approach in Product-Oriented Marketing Strategies," Journal of Business Logistics, Vol. 1, Number 2.

¹⁵Strang.

¹⁶Strang.

¹⁷The author was employed by Ford Motor Company at the time administering rebates and incentives.

¹⁸Strang.

¹⁹Donnelley Marketing.

²⁰Kingsbury, Steve, "Industry Trends in Promotion," presentation to SPAR Annual Seminar, Garden Island, Vermont, June 23, 1980.

²¹Bowersox, Logistical Management, pp. 255.

²²Lemont, F.L., "Room at the Top in Promotions," Advertising Age, March 23, 1981.

²³Haugh, Louis J., "Measuring Promotions Grows in Importance," Advertising Age, October 1, 1979, pp. 58-59.

²⁴Lemont.

²⁵Lemont.

²⁶Lemont.

²⁷Strang.

²⁸Strang.

²⁹Blattberg, et. al.

³⁰Brown, Robert G., "Sales Response to Promotions and Advertising," Journal of Advertising Research, 14:4 (August 1974), pp. 33-39.

³¹Chevalier, Michel, "Increase in Sales Due to In-Store Display," Journal of Marketing Research, 12:4 (November 1975), pp. 426-431.

³²Massy, William F. and Ronald E. Frank, "Short-Term Pricing and Dealing Effects in Selected Market Segments," Journal of Marketing Research, 11:2 (May 1965), pp. 171-185.

Also see McCann, J.M., "Market Segment Response to Marketing Decision Variables," Journal of Marketing Research, 11 (November 1974), pp. 399-412; Webster, Frederick E., Jr., "The Deal-Prone Consumer," Journal of Marketing Research, 2 (May 1965), pp. 186-189; Brown, op cit.

³³Woodside, Arch G. and Gerald L. Waddle, "Sales Effects of In-Store Advertising," Journal of Advertising Research, 15:3 (June 1975). Also see Cotton and Babb, op cit.

³⁴Massy and Frank.

³⁵House, Robert G. and Jeffrey J. Karrenbauer, "Logistics System Modelling," International Journal of Physical Distribution and Materials Management. Vol. 8 Number 4.

³⁶Bowersox, "Planning Physical Distribution Operations With Dynamic Simulation."

³⁷Bowersox, "Planning Physical Distribution Operations With Dynamic Simulation."

³⁸Bowersox, et al., pp. 29-30.

CHAPTER II

REVIEW OF THE LITERATURE

This chapter examines the theoretical base of the present research and the applicable literature. The theoretical base is examined from the context of price theory as applied to channels and from the concept of division of labor as it relates to the cost structures of institutions within a channel. Price theory enables the reader to understand the pricing logic and competitive environment of the channel structure under study. The examination of division of labor notion provides a framework whereby the relative cost structures for various channel members can be developed and envisioned.

Relevant literature is examined in four areas. First, a review is made of the historical and current calls for distribution efficiency. In order to answer that question as it relates to trade incentives, a review is made of the literature addressing single echelon models. Following that a review is made of multiple echelon problems and research designs. In order to understand the market impact of trade incentives and their related promotional activities a review is made of that body of literature. The chapter concludes with a discussion of the contribution of the present

research based on the literature cited, and the questions left unanswered.

Price Theory Applied to Channels

The nature of competition as it relates to channel structure has been examined by Mallen¹ who has suggested the application of price theory to this area. He suggests the use of traditional economic terminology to describe a classification of economic markets. The classification schema proposed is based primarily upon the degree of concentration and number of suppliers on the selling side, and the degree of concentration and number of middlemen on the buying side of the market.² The classification schema is based on the following principles:

1. The smaller the number and the greater the degree of concentration on the selling side, the less purely competitive and the more monopolistic that market becomes.
2. The smaller the number and the greater the degree of concentration on the buying side, the less purely competitive and the more monopsonistic that market becomes.
3. Where this diminishing number and increasing concentration are working on both sides of the market, the closer that market moves to bilateral monopoly.

His classification of economic markets is as follows:

<u>Suppliers</u> <u>(sellers)</u>	<u>Middlemen</u> <u>(buyers)</u>	<u>Market</u> <u>Situation</u>
Pure Competitor	Pure Competitor	Pure Competition
Oligopolist	Pure Competitor	Oligopoly
Monopolist	Pure Competitor	Monopoly
Pure Competitor	Oligopsonist	Oligoposony
Pure Competitor	Monopsonist	Monopsony
Oligopoly	Oligopsonist	Bilateral Oligopoly
Monopolist	Monopsonist	Bilateral Monopoly
Monopolist	Monopolist	Successive Monopoly

In his description of vertical price relationships, Mallen views the channel member who holds monopoly power as the one who determines the profits for the channel, and who reaps those profits. For example, he states:

Assume the retailer is the monopolist and the others (wholesalers and manufacturers) are pure competitors, as for example, a single department store in an isolated town. Total cost to the retailer are composed of the total cost of the other levels plus his own costs. No pure profits of the other levels are included in his costs, as they make none by definition (they are pure competitors).

The retailer would be in the same buying price position, so far as the lack of suppliers' profits are concerned, as would the vertically integrated firm. Thus, he charges the same price as the integrated monopolist and makes the same profits.

If the manufacturer were the monopolist and the other channel members pure competitors, he would calculate the maximizing profits for the channel, and then charge the wholesaler his cost plus the total channels' pure profits, all of which would go to him since the others are pure competitors. The wholesaler would take this price, add it on to his own costs, and the result would be the price to retailers. Then the retailer would do likewise for the consumer price.

In the context of grocery product channel market structure, an examination can be made of the number of and relative size of channel members. A typical grocery channel consists of a large number of manufacturers that sell to wholesalers or distribution centers that are of a relatively small number. They in turn sell to a large number of retailers.³ In some channel structures, the distribution center is owned by the same firm that owns and operates the chain of retail supermarkets that are sourced from the

distribution center. In others, the distribution center is owned and operated independently of the retail stores, which may be a chain or be independently owned.

The manufacturer competes with a large number of other manufacturers for the distribution center's business. This holds true for most product lines where several manufacturers' brands are available to the distribution center. The level of competition in many cases takes the form of monopolistic competition due to brand loyalty or product differentiation. The distribution center can be seen in this context also as in most markets the number of independent or vertically integrated centers is relatively small.⁴ Therefore, the distribution center may be seen from the point of view of the manufacturer as an oligopsonist, having the ability to influence price. From the perspective of the retailer, the distribution center may be its only source of supply, and thus represent a monopoly to the retailer. In other cases the distribution center may not be the only source of supply, and thus represent an oligopoly situation. Because of this primarily monopolistic relationship between the distribution center and the retailer, the operational difference between an independent channel and a vertically integrated one becomes minimal.

The retailer competes with other retailers for the final consumer's business. Most products sold are not differentiated between stores, however, some attempts are made on the part of the retailer to differentiate store

brands, meat, and produce items.⁵ In theory, the grocery retailer is in a purely competitive market, although it may be argued that due to location and other factors, the retailer does in fact have a degree of differentiation, and thus is actually a monopolistic competitor.⁶ For the purposes here, given similarity of goods and the mobility of most consumers, the individual retailer is considered to be in a state of pure competition. Given the relationship to the distribution center, however, most large markets are increasingly becoming oligopolistic in nature with minimal price competition.⁷ The retailer, given its relatively small size and dependence on the distribution center has relatively little influence on price. The market structure as described can be seen in Table 2.1 below:

Table 2.1
Competitive Market Structure

Channel Member	Selling Market	Buying Market
Manufacturer	Monopolistic Competition	See *
Distribution Center	Monopoly/Oligopoly	Oligoposony
Retailer	Pure Competition	No control of price

*The manufacturer undoubtedly possesses power to influence price, however, this element is outside the domain of the present study.

In the context of Mallen's framework, this channel structure would approach that of a simple monopoly, however, the channel member that has a channel monopoly/monopsony, the distribution center, does in fact compete with other channel structures within a given market. The nature of competition between distribution centers in a given market can be viewed as oligopolistic in nature, although they compete indirectly through retailers. Competition across retailers can then be viewed as a competitive oligopoly, where the competitive state is limited to the degree of competition between distribution centers, that set cost (and selling price assuming a direct pass through) for the retailer.

The role of price/incentive activity within this framework can be seen as follows: The distribution center receives a price incentive from the manufacturer. This incentive is based on the desire of the manufacturer to increase sales and market share at the expense of other competing brands.⁸ A performance requirement on the part of the distribution center/retail network may or may not be required.⁹ The incentive based on the performance requirement may or may not be passed along to the retailer and consumer. For the purposes of this study, it is assumed that the incentive is passed along at both levels.

The above discussion examined the competitive structure of grocery channels citing the nature of competition within and across channels based on the application of price theory

as proposed by Mallen. In order to understand the nature of the channel in terms of channel member size and cost structure, and the underlying rationale on the part of the manufacturer for price incentives, the theorem on division of labor as it relates to vertical integration as proposed by Stigler¹⁰ can be utilized.

Division of Labor - Channel Structure

In 1951, George J. Stigler published "The Division of Labor is Limited by the Extent of the Market." He proposed that the concept of division of labor could be applied to the understanding of vertical market structures. Stigler viewed the firm as engaging in a series of activities, each of which may have a different cost relationship. These activities, when seen in terms of different operations within a channel, would in many cases result in non-optimal operating volumes for certain channel members. It would therefore follow that the size of the institution would eventually conform to the optimal output level for that activity at that point in the vertical channel structure. As Stigler pointed out, however, this might not always be the case. A monopoly situation or public regulation might interfere with the natural workings of the price system. In addition, new firms might require services that are below the level of optimum output for another channel member. Therefore they might be required to engage in the activity to ensure the function being carried out. Firms in mature or declining industries might also find themselves required

to engage in activities that previously had been performed by other firms for the same reason. In this case the firm that needed the activity performed would be forced to vertically integrate to assure a source of supply or other function.

In the context of channel structure in the grocery industry, the division of labor and its resultant cost structures results in three distinctly different sizes and types of operations. The manufacturer typically has great economies of scale, and therefore operates a limited number of processing plants. The wholesaler or distribution center has relatively large operating economies, however, it must exist at a point between the producer and the market, and due to market size and market share, its operating level may be less than it would be excluding this fact. The retailer has the lowest relative operating level due to the necessity of being close to its consumer market.

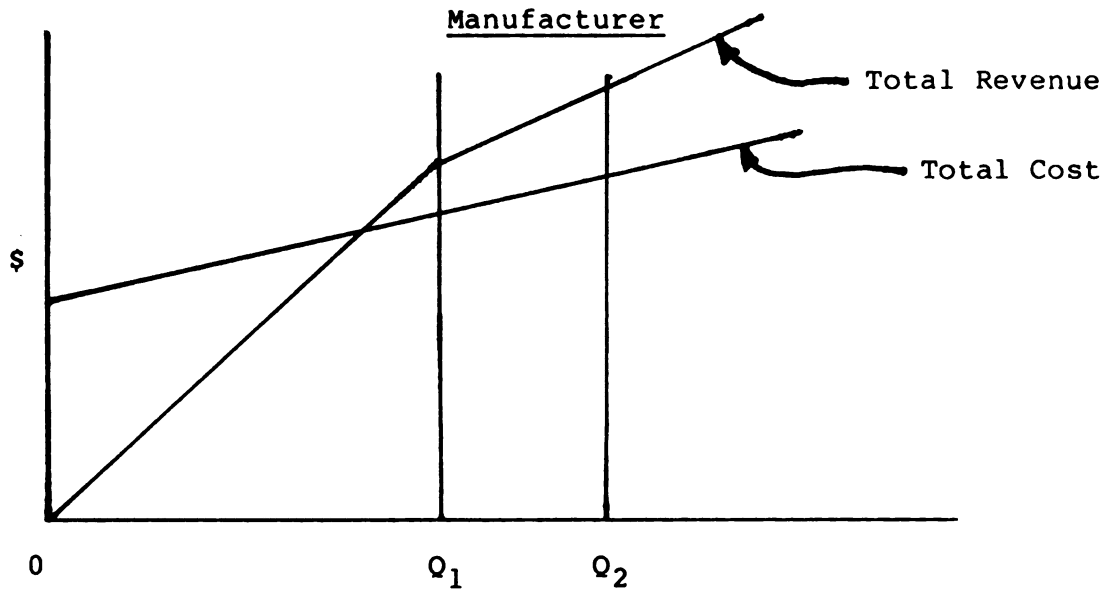
Because of the decreasing cost function of the manufacturer additional output is a desirable objective. This can be accomplished through a trade incentive, that to a certain extent reflects the production cost saving in price reduction. This incentive may have a much different effect on the distribution center. Because of the fact that a distribution center may not have the same falling or relatively constant cost function as the manufacturer, the incentive may simply increase those costs. In addition, those increased costs may not be offset by increased total gross

margin during the incentive period. Given that the manufacturer may be offering the same incentive to other distribution centers within the same market area, increases in volume for the retailer may not be significant. In addition, the increase in sales may be at the expense of other products carried by the distribution center and retailer.

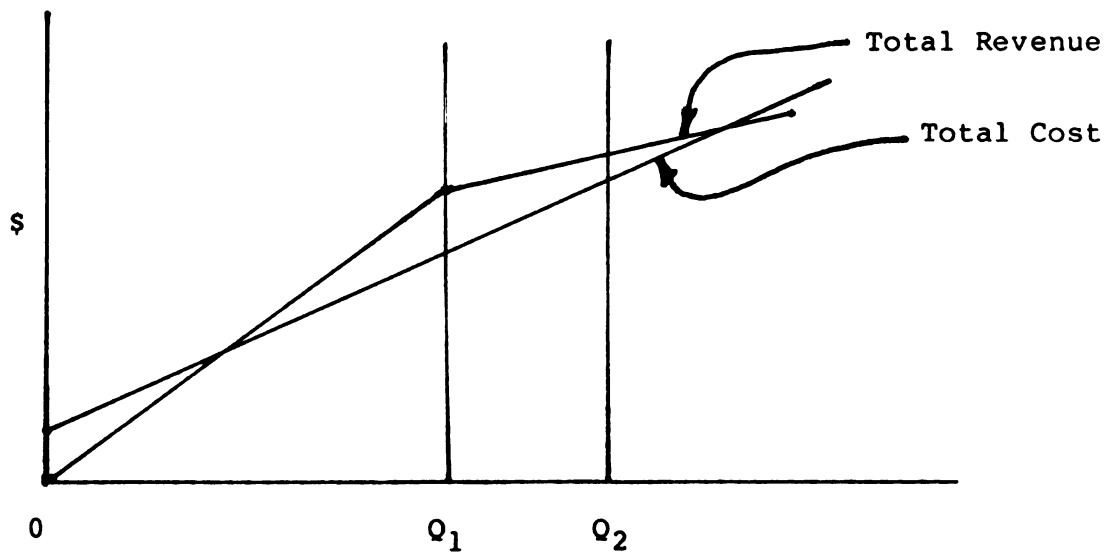
The difference in the cost structures between the channel members may make use of an incentive beneficial to the manufacturer only. Potential benefits to the distribution center and retailer may be negated because of different and increasing cost functions in addition to a highly competitive market structure. The hypothesized relationship between these cost structures is seen in Figure 2.2. At point Q_1 the level of sales is depicted in a non-incentive situation. Both manufacturer and distribution center/retailer are operating at a profit. At Q_2 which represents an increase in volume due to the incentive, profit level for the manufacturer has increased. Despite the leveling of the total revenue curve due to the lowering of price by the manufacturer, overall profitability has increased as costs continue to increase at a relatively moderate rate due to continuing economies of scale. Thus, for the manufacturer, the incentive increases volume and profitability.

Figure 2.1

Relationship Between Manufacturer and
Retailer/Distribution Center Cost and Revenue Curves



Retailer/Distribution Center



The retailer/distribution center faces a different cost curve as seen in the lower panel. As with the manufacturer, revenue declines on a relative basis due to the lowered price during the incentive. Total costs, however, follow a different pattern. The retailer/distribution center has costs that differ in structure and pattern from the economies of scale of the manufacturer. It is hypothesized that these costs increase on a relative basis and result in a decrease in overall profitability to the retailer and distribution center. This study is designed to examine the exact nature of those costs as they result in increased or decreased profitability for the retailer and distribution center. The overall impact on profitability is dependent also on the slope of the total revenue curve. In the present study, the slope of the revenue curve is depicted by differing levels of input parameters including sales response increase, payback, and sales revenue per unit.

Figure 2.1 depicts this relationship including those areas of cost and revenue lines for the retailer/ distribution center that this study has examined.

Importance of Distribution Efficiency

The general issue of distribution efficiency has been of concern to marketing scholars for the better part of this century. Early studies within the discipline and courses instructed carried the term "distribution" prior to the common acceptance of the term "marketing."¹¹ Early descriptive studies of distribution practices in relation to farm

products were done by James E. Hagerty¹² and John Franklin Crowell¹³ in the first decade of the twentieth century. The depression of the 1930's brought forth concern with market and distribution efficiency and produced major studies such as the Does Distribution Cost Too Much? report prepared by The Twentieth Century Fund in 1939.¹⁴ The period following the Second World War saw further developments including the development of the systemic approach by Bryer¹⁵ whereby selling activities within a channel of distribution were considered to be one of several "disposal" activities for a channel member.

Distribution efficiency as it relates to total channel performance was examined in the years following from a total cost and systems approach. Lewis, Culliton, and Steel¹⁶ examined air freight from a total cost approach, including all costs required to carry out a logistical task. The systems approach, as applied to logistics by Shycon and Maffei,¹⁷ Parker,¹⁸ and others allowed for the examination of tradeoffs within a logistical system. Within this framework, the field of logistical management and the measurement of distribution efficiency has developed at a rapid rate.

The specific issue relating to the impact of incentives on channel performance has not been examined to any great extent in the literature, although there have been calls for it, some reaching back to the early 1950's.¹⁹ The following

two sections examine the relevant literature that has addressed this and similar problems.

Single Echelon Models

This literature deals with endeavors to arrive at decision rules relative to the use of an incentive. These typically involve criteria that a channel member may use to arrive at the quantity that should be ordered in an incentive scenario. This literature essentially deals with profit maximization at one level of the channel. It does not incorporate multi-echelon considerations or any factors that are dynamic in nature. Within these limitations, this literature is directly concerned with cost efficiency for a channel member as impacted by an incentive activity.

One such approach to the decision criteria for the acceptance of volume discounts has been made by Weiss.²⁰ He suggests using a return on investment criteria within an economic order formulation. This formulation is then modified for a volume discount situation. The basic formula that he proposes is:

$$D = \left[\frac{1}{C + ROI} + M \right] (C) (EOQ)$$

Where: D = Order quantity producing the desired ROI
 M = Minimum inventory units to usage
 C = Carrying cost

This formula, with a carrying cost of 20% and a ROI of 15%, will cause the traditional EOQ to be reduced by approximately one third. To examine order quantity under

condition of an incentive, Weiss suggests the following fomulation:

Order the larger quantity if the following is true:

$$ROI + C < \frac{A(E-G) + AK\left\{\frac{1}{D} - \frac{1}{F}\right\}}{\frac{FG - DE}{2} - MA(E-G)}$$

Where: A = Annual usage in units
 D = Smaller order quantity
 E = Unit price of smaller quantity
 F = Larger order quantity
 G = Unit price of larger quantity
 K = Cost of ordering

This formulation, in addition to utilizing the concept of return on investment where the inventory acquisition is required to generate a given return, also incorporates a decision rule. This rule, based on the cost versus benefit of taking a larger quantity, allows a purchasing manager to assess the relative benefit of the larger order, within the constraints of the formula. The higher the result of the formula is above the figure [ROI + C] the more advantageous it is to take that quantity at that price. Although used by FMC Corporation, the decision rule relates to one level only of a multi-echelon channel structure, and does not include many factors that are subject to change with larger order quantities in an incentive situation.

Another formulation to determine the proper quantity to order is offered by Silver.²¹ His approach is based on a case lot scenario, whereby a buyer has the option of purchasing in single or case lot quantities. If the purchase

is made in case lot quantity, a discount is offered. Although this is not technically an incentive, the same basic principles apply. Silver's approach is based initially on the determination of what he terms ROSA, or return on supplementary asset. In this computation, a comparison is made between the savings associated with the larger purchase quantity, and the added carrying costs on carrying the additional inventory, assuming a normal pattern of sales. This savings (or added expense) is then compared to the additional investment required to finance the increased inventory. Finally, this figure is adjusted to reflect the debt/equity relationship within the organization and becomes what he terms ROSE, or return on supplementary equity. The decision to accept or reject the larger quantity and lower cost relates to the threshold level of managerially acceptable ROSE. As with the formula proposed by Weiss, Silver's approach is single echelon in nature and excludes many dynamic elements.

Multiple Echelon Models

This area of the literature consists of examination of related problems within a multi-echelon structure utilizing relatively advanced research designs. This literature, although addressing problems only related to the present study, provides a background of research within the general area of distribution channel performance and efficiency.

Literature that deals with multiple echelon problems to the present one includes an approach by Bliemel²² who

proposes using a trade-off approach in making inventory decisions. His position is that a firm must go beyond attempting to minimize cost at a given service level. He states that the real challenge is to maximize benefit to the firm by making trade-offs between market response and costs associated with inventory decisions. To illustrate his position, he utilizes examples of trade-off decisions as they relate to capital tied up versus incremental sales volume, and capital tied up in inventory versus spoiled goods. Although Bliemel's intent to illustrate the use of trade-off analysis in inventory decisions apart from the impact of incentives on channel performance, his use of trade-off examples closely parallels the format of results to be generated in this study. An example of this can be seen in Figure 2.2. In this example, Bliemel shows the relationship between the contribution margin of the product, the cost of capital, and the change in sales volume associated with one week's increase in inventory. For example, with the data given in Figure 2.2, given a contribution margin of 30%, a cost of capital of 15% and an increase in the level of inventory by one week, a .7% increase in the level of sales would be required to make this a profitable trade-off.

The form of this presentation, showing multiple trade-offs in an inventory decision environment is very similar to the type of trade-offs that are examined in the present study.

Figure 2.2

**Trade-off Limits:
Contribution from % Change in Sales Volume vs.
Carrying Cost of 1-Week's Inventory**

Contribution Margin of Product	Contribution opportunity of % changes in sales volume equivalent to 1 week's inventory when cost of capital is		
	10%	15%	20%
10%	1.80	2.70	3.60
20%	.80	1.20	1.60
30%	.47	.70	.93
40%	.30	.45	.60
50%	.20	.30	.40
60%	.13	.20	.27
70%	.09	.13	.17
80%	.05	.02	.10

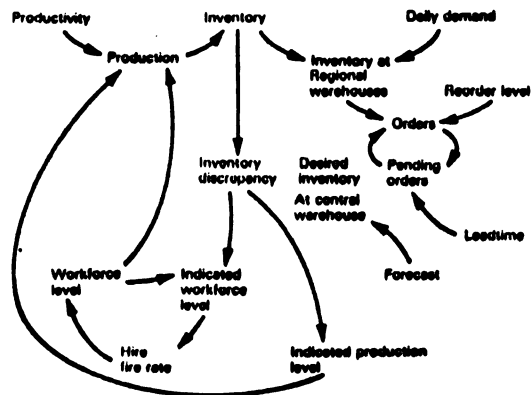
EXAMPLE: A .7% change in sales volume caused by a 1 week's change in inventory would be a limit for a profitable trade-off between contribution opportunity and carrying costs, given that the contribution margin of the product is 30% and cost of capital is 15%.

Source: Bliemel, Friedhelm. "Inventory Decisions by Trade-Off Analysis: A New Approach In Product-Orientated Marketing Strategies," Journal of Business Logistics, Vol. 1, No. 2.

An approach utilized by Mohantray and Chandrashekhar²³ examined a problem similar to the present one. Their concern was that of co-ordination between production and distribution subsystems, the primary concern being that ordering policies in the distribution subsystem may affect the way demand arrives at the production subsystem, and that scheduling policies in the production subsystem can affect supply to distributors. Their examination of this problem utilized simulation modeling whereby a single manufacturing

plant producing multiple products through multiple warehouses was replicated. The factors examined included production rates, work force levels, and inventory levels in the system at different points in time. Their system allowed for the smoothing of production to account for discrepancies in production level versus forecast production. The forecast was the sum of the orders received from the distribution subsystem. Production smoothing was achieved through a mixed strategy of inventory holding and changes in production rates and overtime. The causal loop structure of this system is seen in Figure 2.3.

Within this system it was found that the optimal policy was to hold 17.5% of lead time requirements as safety stock. This level would result in the least amount of total cost for the system when applied to each warehouse as operating policy. In addition, in order to examine the effects of interactions between the production and distribution systems, a partial factorial design was utilized. This research, although dealing with a different problem, utilized similar methodology to the present research. In addition, it dealt with dynamic interactions within a production and distribution environment that are closely related to those of the present study.

Figure 2.3

Source: Mohanty, R.P., and Chandrashekhar, V., "Computer Simulation Study for a Production-Distribution System," International Journal of Physical Distribution and Materials Management. Vol. 13, No. 3.

Corstjens and Doyle²⁴ examined the problem of channel optimization utilizing signomial geometric programming to solve three distribution decisions simultaneously. One element of the three, the use of price to influence the performance of the units within the channel, has significance for the present study. Their methodology was designed to solve simultaneously problems of distribution strategy, intensity, and management. Distribution strategy is defined as the selection of channels to serve end-markets. Distribution intensity relates to the number of outlets to be operated within each channel utilized. Distribution management relates to the use of price and other variables to influence the performance of units within the channel.

The business that their approach was based upon was a manufacturer of high quality candy that operated its own

retail network in addition to selling to other stores that sold their candy on a franchise basis. The company also sold to distributors in European countries and to domestic retailers utilizing the retailer's brand name. The problem facing the company was which channels to concentrate on, the number of outlets to have in each channel, and what margins to seek in each channel. The model developed in the study was based on a series of demand and cost functions. These demand and cost functions were derived from observed data and management judgement, and resulted in suggestions for increased prices, concentration on larger company owned stores and export and private label business.

Corstjens and Doyle, although utilizing a new and different methodology from the present study, addressed a conceptually similar problem. The cost and demand functions utilized to determine optimal strategies relate closely to the theoretical base of this research. This research, dealing in a fixed channel structure scenario, has cost structure variations between manufacturer and distribution center as the proposed basis for the research hypotheses. In addition, differing levels and patterns of demand are utilized to partially determine overall levels of channel performance.

These investigations of related problems in a multiple echelon structure provide insight into comparable research designs related to logistical performance issues in a multiple echelon setting. The discussion which follows

examines the relevant literature on market responses to trade incentive and promotional activities.

Market Response to Promotions and Incentives

This area of the literature relates to the impact of incentives on consumer purchase behavior. The impact of incentives on intermediaries within the channel is not well known, however, its impact on the ultimate consumer has been examined extensively in the literature. This information provides insight into the sales response function within the channel, which is predicated on the consumer response. In addition it provides insight into incentive activities at the retail level.

Literature on the market response to incentive activities covers a broad range of topics including the consumer rationale for accepting an incentive, the nature of the consumer response, the nature of products and prices as they relate to incentives, and the type of consumer segments that are likely to respond heavily to incentive activity. The research that has been conducted in this area provides a background for several of the assumptions that are made in Chapter III. As trade incentives often result in consumer related promotional activities, including special displays, advertising, and price discounts, this literature provides information on several aspects of trade incentives as they relate to market demand.

Blattberg, Eppen, and Lieberman²⁵ examined price dealing on consumer non-durables in the context of a model that

describes consumer and retailer welfare. The model for the retailer examined quantity sold on deal, and the frequency and magnitude of deals. The consumer model examined the quantity bought on deal and the time between purchases. They concluded that price dealing exists because consumers engage in stockpiling activity. Both the retailer and consumer have inventory holding costs that are comprised of two components. These include a cost of capital and a cost of storage. The cost of storage is less for the consumer, thus a retailer through a deal can shift inventory to the consumer in return for a decrease in revenue associated with the deal. An alternative theory that was not supported by the data collected suggested that dealing exists as a means to reduce the cost of a consumer's experimental purchase with a new brand. The implication of their findings is that the benefit of price deal may be overstated as consumers are merely stockpiling the goods and not switching brands.

Cotton and Babb²⁶ utilizing consumer panel data on purchases of dairy products made a number of findings related to deal purchases. These include that the response to a promotional deal is much greater than a reduction in price alone. In addition, the response to a deal was less for products more familiar to the consumer. The lowest response was for fluid milk whereas response rates for products such as yogurt were much higher. They also determined that in store specials were less effective in increasing purchases than other types of specials. Finally,

it was determined that substantial increases in sales occurred during the promotion, however carryover effects in later periods were much less.

Massey and Frank²⁷ utilizing consumer panel data made a number of findings relative to dealing effects on food and household products typically sold through grocery stores. They determined that family units not loyal to brands had a much higher reaction to changes in price than brand loyal families. In addition, price elasticity was found to be higher for larger sized containers. Finally, price elasticity was found to be higher in chain stores as opposed to independent dealers.

Utilizing a similar data base Webster²⁸ determined that consumers prone to dealing activities tended to buy more brands and devote a smaller share of their purchases to favored brands. He determined that deal proneness is inversely related to the amount purchased. Also, older housewives appeared to be more prone to dealing than younger ones. Webster believed that the older housewife may be a more expert shopper or has a more flexible budget. The latter explanation parallels the findings of Massey and Frank, as they found a positive relationship between income and size of package purchased, the larger size having a greater price elasticity. Both findings would also tend to support the consumer stockpiling notion advanced by Blattberg, et al.

McCann²⁹ determined that medium to light users of a product responded less to price dealing than did heavy users which would also support the stockpiling notion. Households paying a higher price were also more responsive to price dealing than households paying a lower price. McCann indicates that the household paying the higher price may believe that it is "splurging", therefore they may be sensitive to price changes within their evoked set. A household paying lower prices may be satisfying their price consciousness simply by paying the lower price initially. A further explanation might be found in the previously cited notion of financial ability to stockpile, as indicated by the pattern of higher priced purchases. McCann also determined that innovators were more responsive to price dealing than non-innovators, and that households that limited their purchases to a small number of brands were less sensitive to dealing activities than those that purchased a wider variety of brands. Store loyalty was seen to have the opposite effect. The higher the loyalty to the store, the greater the response to dealing activities within the context of that store.

Brown³⁰ determined further the relationship between brand loyalty and responsiveness to dealing activity for purchasers of instant coffee. Utilizing a telephone survey it was determined that promotional activities yielded a faster response than did advertising. The promotional activities did not, however, produce long-term buyers.

A similar finding was made by Sexton³¹ whereby in a study of the relative effects of pricing, dealing, and print media versus long term advertising, it was found that the former activities have a greater impact on short-term brand share.

In a comparison of pricing changes to point of sale promotions, Woodside and Waddle³² found that for instant coffee in a supermarket setting, consumers responded at a higher level for point of sale promotion than for price reduction when each was taken separately. When both were used in combination, the sales increase proved to be the sum of the two independent increases when taken separately. These findings are similar to those of Cotton and Babb in this regard.

Chavalier³³ using an experimental design with eight products determined that competitive market structures where no one particular product had a clear market share advantage resulted in increased market response to in-store displays. This result is similar in nature to those regarding brand loyalty by Cotton and Babb, Massey and Frank, McCann, and Brown cited previously. In addition, Chavalier determined that products in a mature stage of the product life cycle had a higher sales response than products in an earlier stage. This study also determined that previous advertising activity had little effect on the degree of sales response, and that the size of the price reduction likewise had minimal effect. It would appear that the tradition of

special displays being associated with price reduction caused consumers to react in a pre-learned manner. These results closely follow those of Cotton and Babb, and Woodside and Waddle in the comparison of pricing to promotional activities on sales response.

The literature on sales response to promotional activities at the retailer-consumer level yields an overall pattern of behavior on the part of the consumer. Consumers appear to be engaging in a stockpiling as opposed to a brand switching activity. This would indicate that promotional activities are at best transferring inventory to the consumer on a short-term basis. It would logically follow that a sales payback function at the end of the promotion would be relatively high. Brand loyalty appears to be inversely related to response to promotional deals, and at the same time consumers who are more adventuresome have a higher response rate to promotions. Package size appears to be related to response to promotional deals, as larger sizes yield a higher response rate. In a similar fashion, higher income and older consumers were more prone to respond to a promotional deal. These findings would also support the stockpiling notion. Finally the degree of price reduction associated with the promotional deal appears to have a minor effect relative to the other activities associated with the promotion. A summary of the literature on market response to incentive activities appears in Appendix A.

Contribution of the Present Research

Based on the review of the literature in this chapter the following conclusions are warranted:

- 1) The competitive and price environment in a grocery products distribution system is that where there is a strong inducement for a manufacturer to utilize trade incentives.
- 2) Because of variations in cost structure these incentives, although producing positive benefits for the manufacturer, may be done so at the expense of the distribution center/retail network.
- 3) Single echelon models have addressed this issue from the perspective of one channel member, however they do not allow for many variables, including the dynamic nature of a multi-echelon trade incentive activity.
- 4) Multiple echelon models have addressed related problems; the need remains, however to utilize this type of research methodology to investigate the logistical impacts of trade incentive activity.
- 5) A broad base of literature exists that provides a background of knowledge on the market reaction to trade incentive/promotional activities. This background can be utilized to operationalize a multiple echelon model to investigate the present problem.

The present research is designed to address the issue of distribution performance measures and overall efficiency as it is impacted by trade incentive activity in a dynamic multiple echelon environment. Despite calls for this type of research, and the existence of research methodologies capable of addressing the problem, this issue has not been previously investigated. This research project is designed to address that need.

This chapter has examined the theoretical base for the present study, and the related literature. The chapter which follows details the model structure to be utilized and the assumptions developed to test the research hypotheses.

FOOTNOTES-CHAPTER II

¹Mallen, Bruce, "Introducing the Marketing Channel to Price Theory," Journal of Marketing, Vol. 28 (July 1964) pp. 29-33.

²Ibid.

³Marion, Bruce W., et al. The Food Retailing Industry (Praeger Publishers, New York, 1979), pp. 6.

⁴Daft, Lynn M., "Competition in the Grocery Retailing Industry," Ph.D. Dissertation. Michigan State University, 1969. pp. 84.

⁵Gold, Faye, et al. Modern Supermarket Operations Third Edition (Fairchild Publications, New York, 1981), pp. 17.

⁶Chamberlain, E.H., The Theory of Monopolistic Competition (Cambridge: Harvard University Press, 1957).

⁷Daft, pp. 88.

⁸Blattberg, Robert B., Gary D. Eppen, and Joshua Lieberman, "A Theoretical and Empirical Evaluation of Price Deals for Consumer Nondurables," Journal of Marketing, 45 (Winter 1981), pp. 116-129.

⁹Refer to Appendix B for types of trade incentive performance requirements.

¹⁰Stigler, George J., "The Division of Labor is Limited by the Extent of the Market," Journal of Political Economy, 1951.

¹¹Bartels, Robert, The History of Marketing Thought Second Edition (Grid Series in Marketing, 1976), pp. 21-22.

¹²Ibid. pp. 142.

¹³Crowell, J.F., "Report of the Industrial Commission on the Distribution of Farm Products (Washington, D.C.: Government Printing Office, 1901).

¹⁴The Twentieth Century Fund, Does Distribution Cost Too Much? (New York, 1939).

¹⁵Breyer, Ralph F., Quantitative Systemic Analysis and Control: Study No. 1-Channel and Channel Group Costing. (Philadelphia: College Offset Press, 1949).

¹⁶Lewis, Howard T., James W. Culliton, and Jack D. Steel, The Role of Air Freight in Physical Distribution, Graduate School of Business Administration, Harvard University 1956.

¹⁷Shycon, Harvey N., and Richard B. Maffei, "Simulation-Tool for Better Distribution," Harvard Business Review Vol. 38. November-December 1960.

¹⁸Parker, Donald D., "Improved Efficiency and Reduced Cost in Marketing," Journal of Marketing, Vol. 26. April 1962. pp. 89-101.

¹⁹Smith, Carles W., "Increasing Distribution Efficiency by Better Organized Research," The Journal of Marketing (January, 1953).

²⁰Weiss, Fred R., "When do Volume Discounts Pay?" Purchasing Magazine.

²¹Silver, Alan. "When to Buy in Case Lot Quantities," ID (November 1983). pp. 125-134.

²²Bliemel, Friedhelm, "Inventory Decisions By Trade-Off Analysis: A New Approach in Product-Oriented Marketing Strategies," Journal of Business Logistics Volume 1, Number 2. pp. 103-119.

²³Mohanty, R.P., Chandrashekhar, V., "Computer Simulation Study for a Production Distribution System," International Journal of Physical Distribution and Materials Management Volume 13, pp. 51-67.

²⁴Corstjens, Marcel and Peter Doyle, "Channel Optimization in Complex Marketing Systems," Management Science Volume 25, Number 10, October 1979.

²⁵Blattberg, et al. pp. 116-129.

²⁶Cotton, B.C. and E.M. Babb, "Consumer Response to Promotional Deals," Journal of Marketing, 42 (July 1978), pp. 109-113.

²⁷Massy, William F. and Ronald E. Frank, "Short Term Pricing and Dealing Effects in Selected Market Segments," Journal of Marketing Research, 11:2 (May 1965), pp. 171-185.

²⁸Webster, Frederick E., Jr., "The Deal-Prone Consumer," Journal of Marketing Research, 2 (May 1965), pp. 186-189.

²⁹McCann, J.M., "Market Segment Response to Marketing Decision Variables," Journal of Marketing Research, 11 (November 1974), pp. 399-412.

³⁰Brown, Robert G., "Sales Response to Promotions and Advertising," Journal of Advertising Research, 14:4 (August 1974), pp. 33-39.

³¹Sexton, D.E., Jr., "Estimating Marketing Policy Effects on Sales of a Frequently Purchased Product," Journal of Marketing Research, 7 (August 1970), pp. 338-347.

³²Woodside, Arch G. and Gerald L. Waddle, "Sales Effects of In-Store Advertising," Journal of Advertising Research, 15:3 (June 1975).

³³Chevalier, Michel, "Increase in Sales Due to In-Store Display," Journal of Marketing Research, 12:4 (November 1975), pp. 426-431.

CHAPTER III

RESEARCH METHODOLOGY

Introduction

This chapter examines the research hypotheses and the structure of the model utilized to investigate them. The hypotheses are developed based upon possible negative impacts of incentive activities on measureable outputs of distribution channel performance. The simulation model is described, including the system configuration, operational policies, and the levels of parameters to be tested. The method of analysis, utilizing chi-square and analysis of variance is detailed, indicating the nature of the output and the means of analysis.

Development of Hypotheses

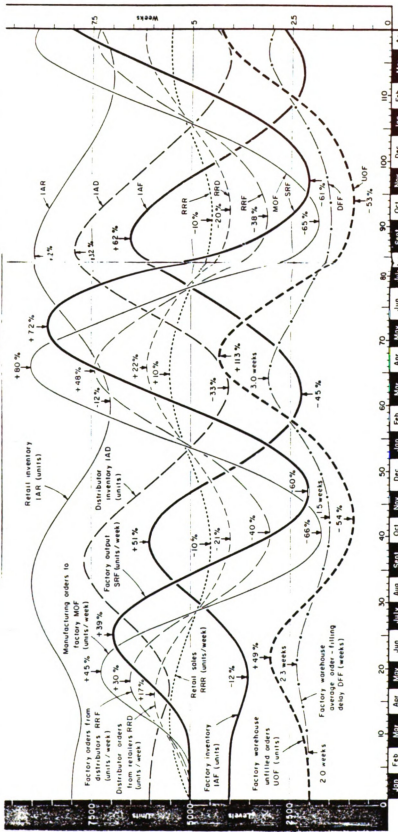
Trade incentive activity has increased at a rapid rate in recent years¹ and in all probability will continue to do so. Despite the widespread use of trade incentives, little is known about their overall impact on channel performance. This research is designed to provide insight into this problem with the hypotheses providing as wide a perspective as possible on the issue at hand. The general nature of the individual hypotheses is the impact of trade incentive

activities on specific measures of distribution channel performance.

Prior research has demonstrated impacts of ordering policies on multi-echelon systems. Forrester² has shown the impacts on a production-distribution system of changes in the pattern of retail orders. Figure 3.1 shows the impact of a 10% unexpected rise and fall in retail sales over a one year period. As shown in the figure, substantial changes occur across the channel that clearly have performance implications. Changes in retail orders are similar in nature to the use of a trade incentive, as they can both cause changes in volume of goods, and the pattern that they follow through a distribution channel. This change in volume and pattern was shown by Forrester's experiments to result in substantial fluctuations in inventory levels, production output, and order filling delays. These changes, it would logically follow, would have a negative impact on channel performance.

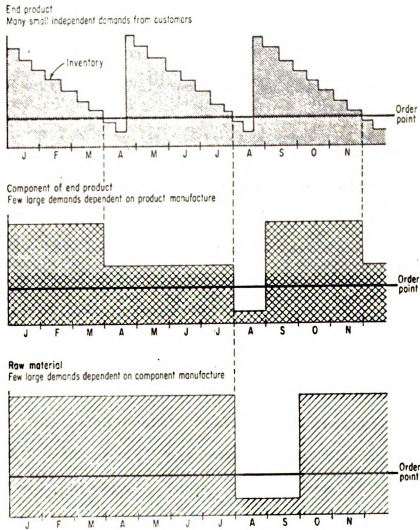
Orlicky³ has suggested in the context of a manufacturing environment that end orders can create "lumpy demand" through the use of order point logic. In his example, seen in Figure 3.2, the demand for and inventory levels of items further back in the system show marked discontinuity. This is due to the timing of orders on an irregular basis and also due to the difference in the lot size at each level. Although Orlicky's presentation is in the context of a manufacturing environment, both conditions of irregular

Figure 3.1
Response of a Production-Distribution System to a 10% Unexpected Rise and Fall
in Retail Sales Over a One-Year Period.



Source: Forrester, Jay W., *Industrial Dynamics*, The M.I.T. Press and John Wiley and Sons, Inc. New York. 1961.

Figure 3.2
Order Point and Dependent Demand



Source: Orlicky, Joseph, Material Requirements Planning
 McGraw Hill Inc. 1975. pp. 26.

demand and difference in lot sizes exist in a distribution environment under an incentive.

The examples cited would imply, if transferred to a distribution environment with incentive activity that A) cycles of inventory levels and other channel performance criteria would develop and B) flow of merchandise could occur on an irregular basis. The hypotheses which follow are thus based on the negative impacts of activities associated with trade incentives on distribution channel performance.

General Research Question: To reflect the overall nature of the problem at hand, the general research question is stated as:

What is the impact of variables associated with a manufacturer sponsored trade incentive on a company owned distribution center and retail store network in terms of measureable outputs of logistical performance which in turn impact the overall financial performance of that network?

The above question contains three basic elements: 1) variables associated with a manufacturer sponsored trade incentive, 2) measureable outputs of logistical performance, and 3) financial performance of the distribution center/retail network. Thus, the nature of the general research question and specific hypotheses take the form of variables associated with incentive activity as the independent variables impacting measurable outputs of logistical performance as the dependent variables. These outputs of logistical performance then in turn impact the profitability of the distribution center/retail network.

The following hypotheses reflect these relationships:

- H₁ The use of an incentive increases inventory levels for the products under the incentive at the distribution center.
- H₂ The use of an incentive decreases the overall customer service level from the distribution center to the retailer for products under the incentive.
- H₃ The use of an incentive results in increased variation in shipment sizes between the manufacturer and the distribution center.
- H₄ The use of an incentive results in an increase in the total number of shipments from the manufacturer to the distribution center.
- H₅ The use of an incentive results in a decreased level of financial performance for the distribution center/retail network.

Model Development

Overview: In order to test the research hypotheses a grocery product distribution system was modeled utilizing the Simulated Product Sales Forecasting (SPSF) model. The grocery product utilized was a typical packaged goods product. The product modeled packed twelve to a case, and weighed one pound per unit. Initial non-incentive unit cost for the distribution center was \$1.00. This product was simulated in a mix of ten products produced by a single manufacturer. Each of the ten products was configured with the specifications of this product.

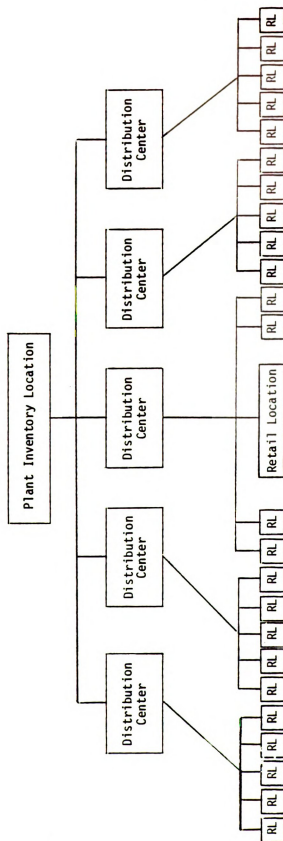
System Configuration: The simulated system configuration consisted of three echelons, a single plant inventory location, five distribution centers, each with five retail locations. The plant inventory location carried five

products that were subject to a trade incentive, and five other products that were not subject to the incentive. The distribution center and retail locations were configured as being owned by the same concern, which is typical of large chain operations.⁴ The echelon structure is depicted in Figure 3.3.

Incentive Description: The incentive that was utilized in the testing environment was initiated by the manufacturer in order to increase production volume and to move inventory to lower points in the channel. The incentive consisted of a price reduction in return for a larger order commitment by the distribution center. The incentive was accepted by the distribution center with cost and volume changes as detailed in Table 4.59. The sales response of the market was modeled independently of the acceptance of the incentive by the distribution center. The retail locations were assumed to promote the incentivized products and to either pass or not pass along the price reduction to the consumer depending on the scenario. The specific actions taken by the management of the retail locations is outside of the domain of this research, however the results of those activities are implicit in the sales response levels modeled. The cost information utilized in testing hypothesis five considers this activity.

The duration time of each incentive period was two months in length. There were two incentive periods modeled in each year, with each simulation run spanning three years.

Figure 3.3
Channel System Configuration



The time frame of the incentives are depicted in Figure 3.4.

At the conclusion of the incentive, under two of the three levels for this factor, it was assumed that there will be a reduction in sales due to stockpiling activity on the part of the consumer.⁵ In the third level, no reduction in sales occurred at the end of the incentive period. These payback levels and periods are illustrated in Figure 3.5.

Inventory Policies: Initial demand for products was based on daily sales demand by consumers at the retail level. In the case of a stockout, the order was permanently lost. Replenishment of inventory for the retailer was obtained through orders placed with the distribution center. The retailer ordered in variable quantities based on previous and anticipated demand sufficient to carry through to the following shipment. The retailer ordered in minimums of single case size quantities and attempted to maintain a minimum of stock above that on shelf display.⁶ If an order was out of stock at the distribution center or plant inventory location, it was not backordered.⁷

The distribution center acquired inventory by orders placed with the manufacturer. The distribution center utilized an order point, order quantity method with the order quantity predicated on forecasted demand. Inventory levels and safety stock were maintained based on previous experience with fluctuations in demand from the retail locations and orders from the plant inventory location.

Figure 3.4
Incentive Timing and Response

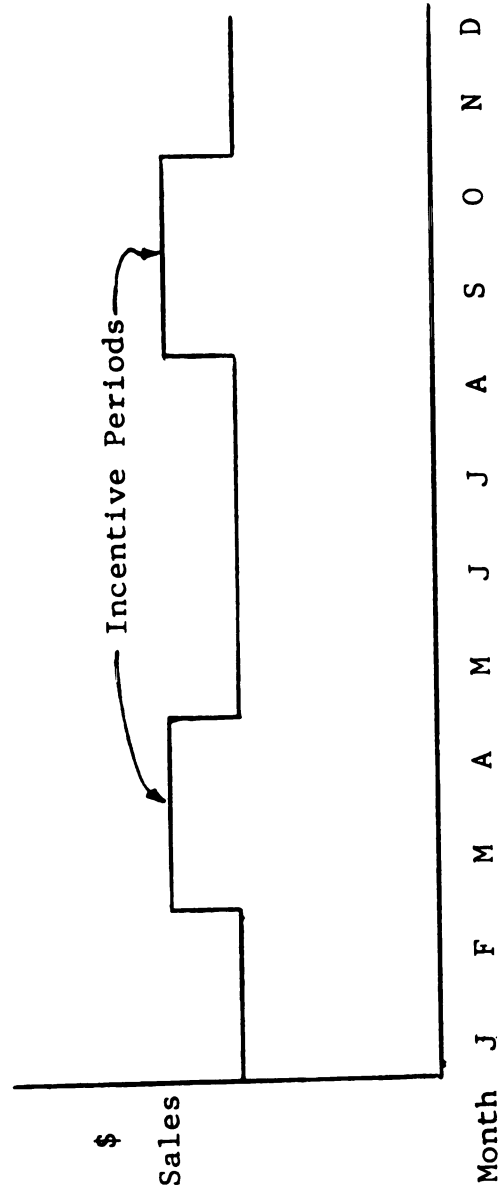
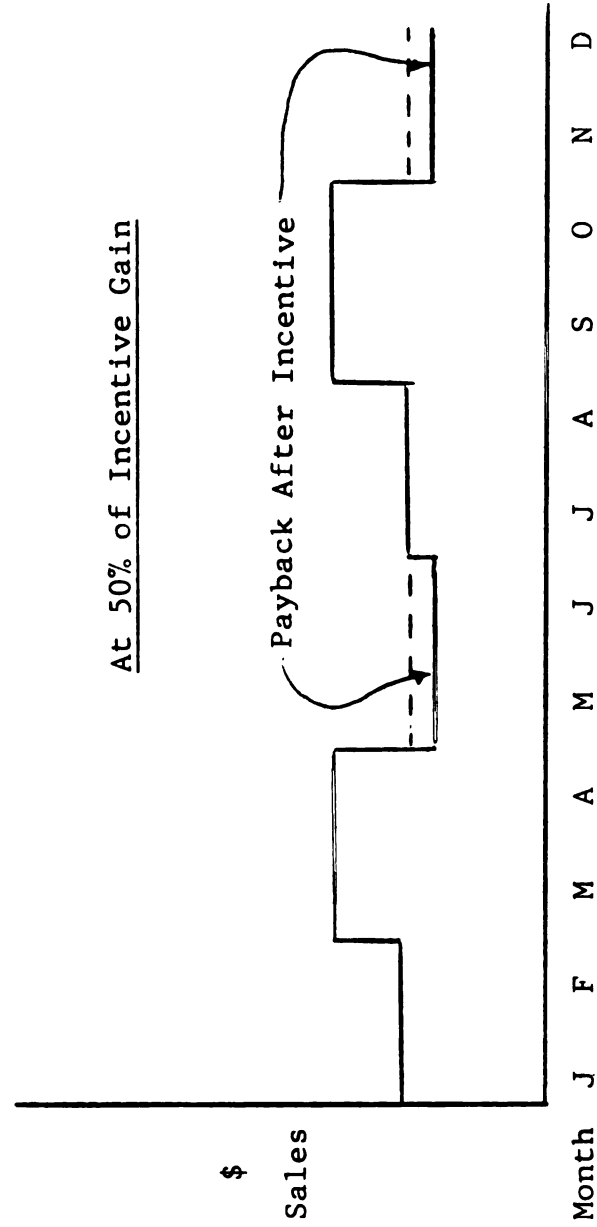


Figure 3.5
Incentive Sales Payback



These policies were designed to yield a customer service level at or around 92%.

The manufacturer produced the products on a continuous basis utilizing historic data. Production volume levels were constant with enough inventory front loaded to allow for incentive shipments from the plant inventory location. Sales volume simulated was within the capacity of the manufacturing operation, and the availability of raw materials was considered infinite. It was assumed that the manufacturing operation could adjust production levels to match normal changes in demand. In the case of a variation in demand that was above a forecasted level that was positive, stockouts would occur. In the case of an unusual decrease in demand, it was assumed that the excess production would be held in plant inventory.

Uncertainty: Uncertainty within the channel configuration was produced through stochastic lead time and demand variables. Lead time uncertainty was replicated by the use of a gamma distribution. The gamma distribution produces non-negative values that are skewed to the right.⁸ Uncertainty of demand was also created through the use of a gamma distribution. Utilizing the gamma distribution, a random number generator within the demand module of the SPSF generated daily demand.⁹

Transportation System and Cost: The transportation system between the manufacturer and distribution center consisted of common carrier truck and rail shipments with

freight rates as seen in Table 4. Outbound shipments from the distribution center to the retail locations were made via a private fleet owned by the retail/distribution center concern. Cost of outbound freight was a cost per hundred-weight basis, with no other rates or breaks applicable. Shipments inbound to the distribution center were made as required, whereas outbound shipments to the retail locations were made on a predetermined daily schedule. When necessary, additional shipments were scheduled to the retail locations on a temporary basis.

Given the above model configuration and assumptions, the discussion which follows details the variables and levels employed in the testing environment.

Research Design

In order to structure the research design, variables are defined and abbreviations assigned for each of the independent and dependent variables. Table 3.1 lists the variables to be utilized, and a description of each follows.

Table 3.1
Testing Environment Variables

<u>Variables</u>	<u>Abbreviation</u>	<u>SPSS Integer Code</u>
(Independent)		
Sales Response Increase		
Increase of 0%	SRI00	1
Increase of 20%	SRI20	2
Increase of 40%	SRI40	3
Sales Reponse Uncertainty		
Low Uncertainty Level	SLSU1	1
High Uncertainty Level	SLSU2	2
Sales Response Payback		
Zero Payback	SRP00	1
50% Payback	SRP50	2
100% Payback	SRP10	3
Incentive Level		
Non-Incentive Scenario	INC00	1
20% Incentive Increase	INC20	2
40% Incentive Increase	INC40	3
Product		
Incentive Products (Products 1-5)	PROD1	1
Non-Incentive Products (Products 6-10)	PROD2	2
(Dependent)		
Inventory Level	TTINV	
Shipment Size		
Manufacturer to D.C.	SHPCAT	
Number of Shipments		
Manufacturer to D.C.	TOTSHP	
Customer Service Level		
D.C. to Retail Location	SVC	
Total Financial Performance	TOTCOST	

Independent variables that are associated with an incentive activity were tested in all possible combinations. These variables are as follows:

Sales Response Increase

- SRI00 No increase in sales during the incentive period; the non-incentive scenario.
- SRI20 An increase in sales during the incentive period of 20% above the normal level of sales.
- SRI40 An increase in sales during the incentive period of 40% above the normal level of sales.

Sales Response Uncertainty

- SLSU1 A relatively low level of sales uncertainty. Coefficient of variation = .3 of daily demand.
- SLSU2 A relatively high level of sales uncertainty coefficient of variation = .7 of daily demand.

Sales Response Payback

- SPA00 A reduction in the normal level of sales at the conclusion of the incentive period at a level of zero.
- SPA50 A reduction in the normal level of sales at the conclusion of the incentive period equal to 50% of the sales increase during the incentive period.
- SPA10 A reduction in the normal level of sales at the conclusion of the incentive period equal to 100% of the sales increase during the incentive period.

Incentive Level

- INC00 The non-incentive scenario whereby reorder logic remains the same during the incentive periods as non-incentive periods.

- INC20 A 20% incentive whereby shipments are made at the beginning of the incentive equal to the normal sales level prior to the incentive plus 20% for the incentive period.
- INC40 A 40% incentive whereby shipments are made at the beginning of the incentive equal to the normal sales level prior to the incentive plus 40% for the incentive period.

Dependent variables that measure cost and customer service ramifications of the various combinations of the above variables are as follows:

Inventory Level

- TTINV The inventory level of products at the distribution center location. This is measured in average inventory per product per distribution center for each report period.

Shipment Size

- SHPCAT The shipment sizes between the manufacturer and the distribution center. This is measured by the number of shipments that fall into the following rate breaks for each reporting period: 4000 LBS; 20,000 LBS; 30,000 LBS; 40,000 LBS; 100,000 LBS.

Number of Shipments

- TOTSHP The total number of shipments from the manufacturer to the distribution center.⁶ This is measured in total for each reporting period. It was assumed that incentive activity on a product will not increase the number of shipments to the retail location as the one product represents a minimal percentage of total sales.

Customer Service Level

SCV The percent of orders shipped on time from the distribution center to the retail location.

Total Financial Performance

TOTCOST The summary of financial performance based on cost and revenue assignments made to measures of logistical performance. This is based on: $TOTCOST = REV - (SHPCOST + INVCOST + SVCCOST)$

A total of twenty six simulation runs was required to test all relevant combinations. An incentive scenario is depicted in twenty four runs and a non-incentive scenario is depicted in two runs. For the non-incentive scenario, the only variable that is tested at different levels was sales uncertainty. A summary of incentive run combinations appears in Table 3.2. In addition to testing the research hypotheses, the simulation runs provided a wide range of information on the impacts of various factors associated with incentive activities.

The discussion which follows examines the structure of the simulation runs, the output generated, and the method of analysis.

Simulation Runs: Each of the twenty six simulation runs replicated the distribution channel activities of the network for a three year period. The three year period was of sufficient length to allow for changes in outputs during incentive periods and to capture their effect on subsequent periods of time. Measures of outputs were made at the end

TABLE 3.2

TESTING ENVIRONMENT SIMULATION RUN COMBINATIONS

<u>TESTING CONDITION</u>	<u>LEVEL OF INDEPENDENT VARIABLE</u>			
	<u>INC</u>	<u>SRP</u>	<u>SRI</u>	<u>SLSU</u>
001	1.0	1.0	1.0	.3
002	1.2	.8	1.2	.3
003	1.2	.8	1.4	.3
004	1.2	.6	1.4	.3
005	1.2	1.0	1.0	.3
006	1.2	1.0	1.2	.3
007	1.2	1.0	1.4	.3
008	1.4	.8	1.2	.3
009	1.4	.8	1.4	.3
010	1.4	.6	1.4	.3
011	1.4	1.0	1.0	.3
012	1.4	1.0	1.2	.3
013	1.4	1.0	1.4	.3
014	1.0	1.0	1.0	.7
015	1.2	.8	1.2	.7
016	1.2	.8	1.4	.7
017	1.2	.6	1.4	.7
018	1.2	1.0	1.0	.7
019	1.2	1.0	1.2	.7
020	1.2	1.0	1.4	.7
021	1.4	.8	1.2	.7
022	1.4	.8	1.4	.7
023	1.4	.6	1.4	.7
024	1.4	1.0	1.0	.7
025	1.4	1.0	1.2	.7
026	1.4	1.0	1.4	.7

of each year's activity. Output was measured from the plant inventory location and distribution center, as appropriate. The total sample which resulted from the simulation run consisted of five measures for each product and distribution center at the end of each year. Thus, for a single measure of performance each of the simulation runs produced 150 measures of output (5 distribution centers x 10 products x 3 years reports). The study in total produced 19,500 measures of output (150 per measure per simulation x 5 measures x 26 simulation runs). In addition to this, shipment summaries for the system in total for each report period were generated.

Method of Analysis: To test for the relative impacts of incentive versus non-incentive conditions on channel performance, an analysis of variance or chi square analysis was performed between appropriate testing conditions. Analysis of variance is described below:

"Analysis of variance is a statistical technique that assesses the effect of one or more categorical independent variables (factors), measured at any level upon a continuous dependent variable that is usually assumed to be measured at an interval level. Conceptually the cases are divided into categories based on their values for each of the independent variables, and the differences between the means of these categories on the dependent variable are tested for statistical significance. The relative effect upon the dependent variables of each of the independent variables, their combined effects and interactions, may be assessed."¹⁰

The SPSS ANOVA¹¹ procedure is based on the least-squares general-linear hypothesis approach and as noted above measures differences in the means of interval

level dependent variables. Outputs of the testing environment simulation runs are in the form of interval level. Interval level measurement is described as: "The interval level of measurement has the property that the distances between the categories are defined in terms of fixed and equal units."¹² Testing environment outputs met this criteria, as unit counts, dollar levels, and percentages are interval level. Mean scores were generated for each output variable from 75 observations across the three year simulation runs. These observations include those prior to, during, and after incentive periods. They thus measure average levels of performance for the dependent variable given the levels of the independent factors.

In the SPSS ANOVA procedure, independent variables may be all nonmetric or combinations of nonmetric and metric variables. In the testing environment for the present research, the independent variables are nonmetric, categorical variables and are thus referred to as factors.¹³

In order to test the specific research hypotheses, factors that are secondary to the hypothesis were held constant, allowing the difference in the factor directly related to the hypothesis to be examined. For the present research, incentive levels (incentive versus non-incentive) were examined, with the other factors held constant. This procedure was performed for each of the dependent variables as they relate to each specific hypothesis. In addition, an analysis of variance was performed within each incentive

scenario to determine the relative impacts of each of the other independent variables on each dependent variable. In order to test the hypotheses related to shipments, chi-square analysis¹⁴ was also utilized to determine the significance of shipment changes between testing conditions.

A final analysis of the testing environment output was made whereby a dollar cost was assigned to each level of dependent measures. Comparisons were then made to determine the overall cost effectiveness of incentive versus non-incentive activities. In this procedure a total financial performance figure was developed for each testing condition. The above analysis of variance procedure was then followed to determine the impact of the various factors on total financial performance.

Model Validation

The SPSF model was originally validated through an extensive procedure whereby the model was tested by each individual module for logical program statistical output, face validity by review groups, model stability, and model sensitivity.¹⁵ Program validity consists of testing the model's reaction to various input parameters to determine that the model operates according to design specifications. Face validity is more qualitative in nature and deals with the assumptions in the model reflecting actual business operations, understandability of the reports generated, applicability to various situations, and the fit of the results to what would be expected in a business situation.

Prior to the initialization of the present testing environment, the model was tested for stability and for reaction to input variables. Customer service level was utilized to test for stability within this procedure. Simulation runs were made on testing conditions 001, 010, and 013. These conditions represented a non-incentive scenario, an incentive scenario with sales increase with no payback, and an incentive scenario with sales increase with payback. Utilizing an analysis of variance procedure, customer service levels were compared for each of the products across the three year time duration of the simulation. F values ranged from .683 to 1.973 with the significance levels of the F values ranging from .1465 to .5084, indicating no statistically significant difference across time at the $\alpha = .05$ level.

The model was also tested for reaction to the input variables. A comparison was made for each dependent variable based on changes in the INC, SRI, SRP, and SLSU variables. The result of these initial runs and the analysis of variance tests on customer service levels may be seen in Appendix C.

Summary

This chapter has developed and structured the research hypotheses. Independent and dependent variables have been developed and defined. The structure of the model and the assumptions within it have been presented. Finally, the nature of the output and the method of analysis has been

identified. The chapter which follows describes the output of the testing environment and the statistical analysis of the results generated.

CHAPTER III - FOOTNOTES

¹Strang, Roger A., "Sales Promotion-Fast Growth, Faulty Management," Harvard Business Review, 54:4 (July-August 1976), pp. 115-124.

²Forrester, Jay W. Industrial Dynamics, The M.I.T. Press and John Wiley and Sons, Inc. New York. 1961.

³Orlicky, Josephy, Material Requirements Planning. McGraw Hill Inc. 1975. pp. 26-27.

⁴Marion, Bruce W., et al. The Food Retailing Industry-Market Structure, Profits, and Prices, Praeger Publishers, New York (1979) pp. 12-13.

⁵Blattberg, Robert B., Gary D. Eppen, and Joshua Lieberman. "A Theoretical and Empirical Evaluation of Price Deals for Consumer Nondurables," Journal of Marketing, 45 (Winter 1981), pp. 116-129.

⁶Gold, Faye, et al. Modern Supermarket Operations, Fairchild Publications, New York (1981) pp. 87.

⁷This is the normal procedure in the grocery industry. For pharmaceutical type items, backorders are usually accepted. Reference discussion with Richard Fezette, Distribution Manager, Dow Chemical Company, Consumer Products Division, Indianapolis, Indiana.

⁸Basic, E. Martin, "Development and Application of a Gamma Based Inventory Management Theory" (Ph.D. dissertation, Michigan State University, 1965).

⁹Bowersox, Donald J., et al. Simulated Product Sales Forecasting, M.S.U. Business Studies (1979) pp. 14-15.

¹⁰Nie, Norman H., et al., Statistical Package for the Social Sciences, McGraw Hill Book Company, New York (1975), pp. 9.

¹¹Ibid.

¹²Ibid. pp. 5.

¹³Ibid. pp. 399.

¹⁴Ibid. pp. 223.

¹⁵Bowersox, Donald J. et al., Simulated Product Sales Forecasting. MSU Business Studies, 1979. pp. 199-271.

CHAPTER IV

RESULTS AND CONCLUSIONS

This chapter details the findings of the present research. Hypotheses are presented in the order previously listed with output data presented in tables, graphs and in statistical analysis reports. Each hypothesis is examined first, then a review is made of additional input variables and their impact on the dependent variable related to that hypothesis.

Hypothesis One: The use of an incentive increases inventory levels for the product under the incentive at the distribution center.

The results of the testing environment support this hypothesis. As seen in Figure 4.1 incentive conditions resulted in an increase in inventory level over the non incentive condition. Testing condition 001 represented a non-incentive scenario whereas testing condition 006 and 013 represented incentive scenarios with 20% and 40% sales increases respectively. The presence of an incentive increased dramatically the average inventory. In non-incentive scenario average inventory was 1,295 cases. This level increased to 2,437 and 2,687 cases during the incentive scenarios for the higher level of sales uncertainty. A

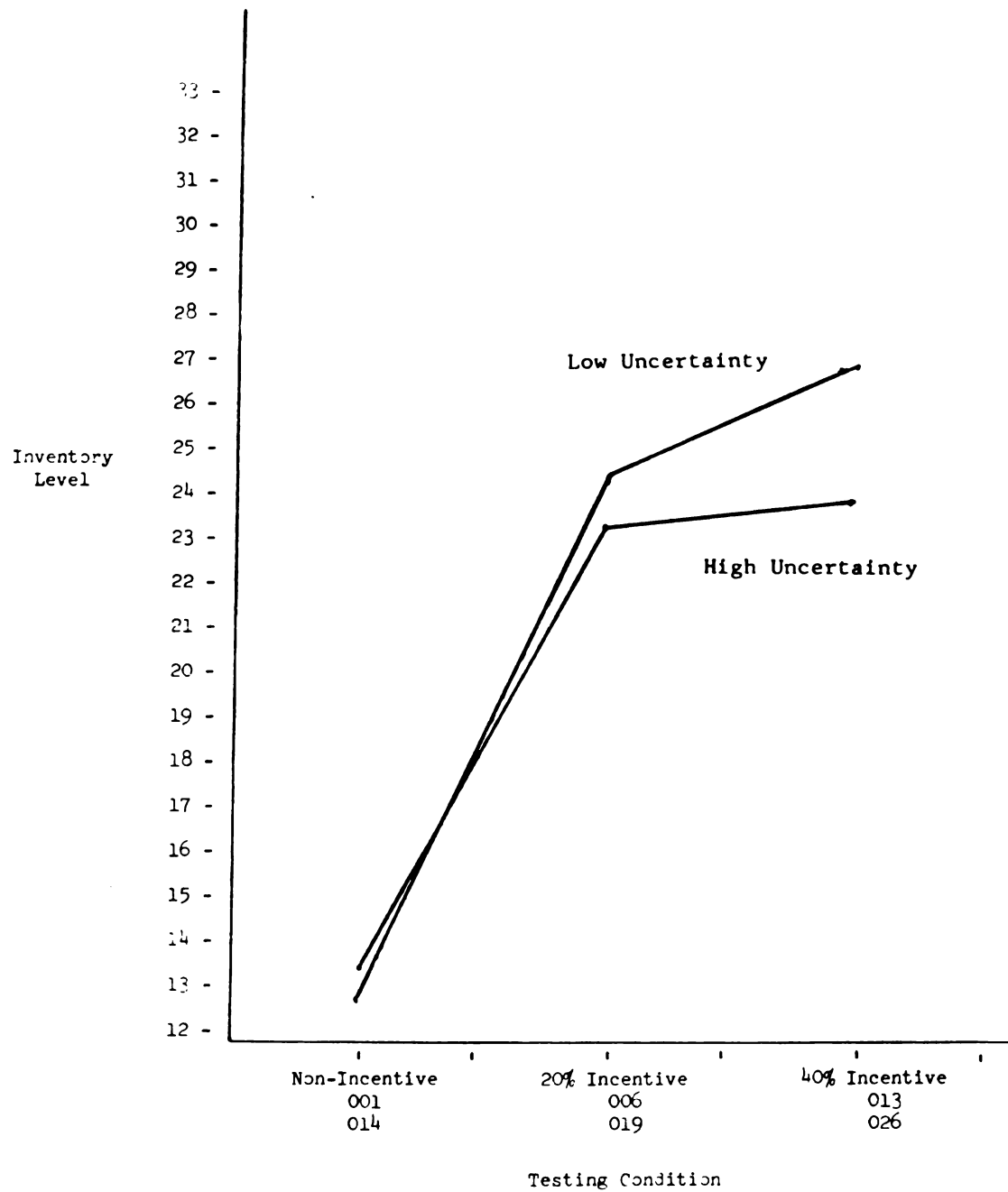


Figure 4.1 Comparison of inventory levels for incentive and non incentive testing conditions

lower level of uncertainty also resulted in a higher level of inventory.

To test this hypothesis, a one-way analysis of variance was performed to test for the impact of incentive level with an equal sales increase without any payback. These results are seen in Table 4.1. This resulted in an F-value of 6537.8 with the probability of F at zero for the lower level of uncertainty. This would clearly indicate that there was a major and significant difference in average inventory level during incentive testing conditions as opposed to the non-incentive scenario.

At a higher level of uncertainty, the difference in inventory level was not as great, however they were also significantly different at a F probability of zero. These results are seen in Table 4.2. These and the results which follow were due to the changes in independent variables, not from the random number stream, which was the same for each testing condition. These results overall strongly supported Hypothesis One.

To test for the impacts of other variables on inventory levels within 20% and 40% incentive levels further comparisons were made. Figure 4.2 depicts the impact of various sales responses without payback within a 20% incentive. Testing condition 005 represents a zero sales increase due to the incentive whereas TC 006 and 007 represent 20% and 40% sales increases. In this comparison inventory levels did decrease as the sales response becomes greater. These

TABLE 4.1

ANALYSIS OF VARIANCE OF INVENTORY LEVEL BY INCENTIVE LEVEL
AT LOW LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		2	82664126.0356	41332063.0178	6537.841	0
Within Groups		222	1403478.2933	6321.9743		
Total		224	84067604.3289			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
001	75	1295.3467	32.8043	3.7879	1198.0000	1385.0000	1287.7991 to 1302.8942
006	75	2437.9867	91.6156	10.5789	2203.0000	2614.0000	2416.9078 to 2459.0655
013	75	2687.6800	97.4494	11.2525	2447.0000	2938.0000	2665.2589 to 2710.1011
Total	225	2140.3378			1198.0000	2938.0000	

TABLE 4.2
ANALYSIS OF VARIANCE OF INVENTORY LEVEL BY INCENTIVE LEVEL
AT HIGH LEVEL OF UNCERTAINTY

<u>Source</u>	<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups	2	55397134.8267	27698567.4133	498.387	0
Within Groups	222	12337973.1733	55576.4557		
Total	224	67735108.0000			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
014	75	1316.9467	28.3382	3.2722	1256.0000	1419.0000	1310.4266 to 1323.4667
019	75	2337.9333	120.5979	13.9254	2068.0000	2706.0000	2310.1863 to 2365.6804
026	75	2398.5200	389.0790	44.9270	1238.0000	2928.0000	2309.0011 to 2488.0389
Total	225	2017.8000			1238.0000	2928.0000	

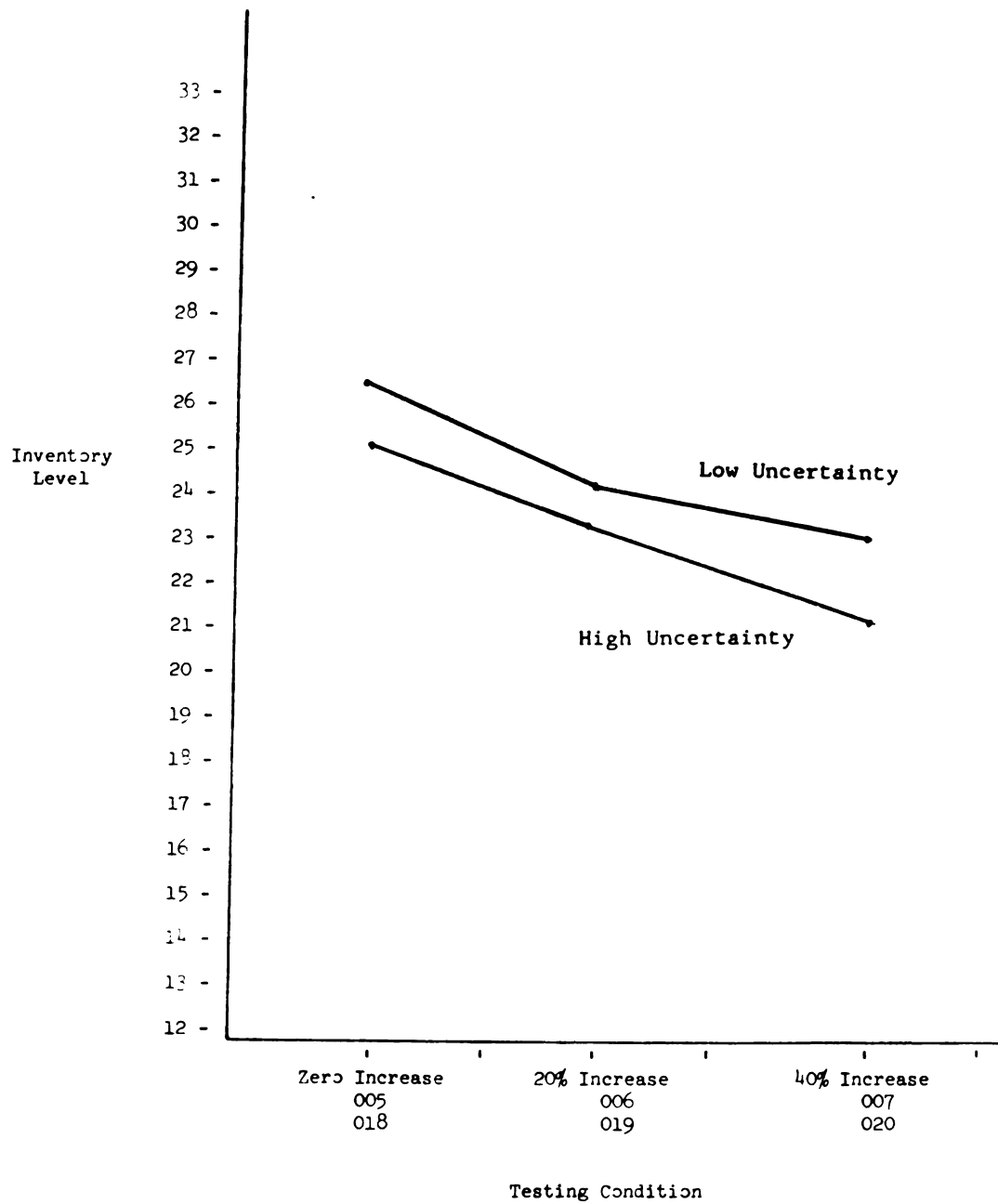


Figure 4.2 Comparison of inventory levels for 20% incentive with different sales response level

levels do not however decrease rapidly. At a low level of uncertainty the inventory level decreased from 2,655 cases to 2,317 cases, as the sales response increased from zero to 40%. This would further support Hypothesis One. Differences in inventory level were seen to be significant between the different levels of sales response increase as seen in Tables 4.3 and 4.4.

The same procedure was utilized to examine the impact of sales response on inventory level with a 40% incentive in effect. As seen in Figure 4.3 the results were similar to the 20% incentive comparison, although the reduction in inventory was relatively greater as the level of sales increase became larger.

An analysis of variance depicted in Table 4.5 indicated that as with the 20% incentive there was a significant difference between inventory levels as sales increased for level of uncertainty. Results were also the same for level of uncertainty as seen in Table 4.6.

To examine the impact of sales payback on inventory level, a comparison was made between different payback levels within the 20% and 40% incentives. As depicted in Figure 4.4 for the 20% incentive with a 20% sales increase, payback levels did not reduce levels substantially. An analysis of variance procedure was performed which produced an F value of .908 with a significance of F of .3421, indicating that there was not a significant difference between inventory levels at a low level of uncertainty.

TABLE 4.3

ANALYSIS OF VARIANCE OF INVENTORY LEVEL BY 20% INCENTIVE
WITH DIFFERENT SALES INCREASES AT LOW LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		2	4402359.3156	2201179.6578	262.744	.0000
Within Groups		222	1859840.2400	8377.6587		
Total		224	6262199.5556			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
005	75	2655.5467	98.2581	11.3459	2411.0000	2860.0000	2632.9395 to 2678.1538
006	75	2437.9867	91.6156	10.5789	2203.0000	2614.0000	2416.9078 to 2459.0655
007	75	2317.5333	84.1719	9.7193	2143.0000	2502.0000	2298.1671 to 2336.8995
Total	225	2470.3556			2143.0000	2860.0000	

TABLE 4.4

ANALYSIS OF VARIANCE OF INVENTORY LEVEL BY 20% INCENTIVE
WITH DIFFERENT SALES INCREASES AT HIGH LEVEL OF UNCERTAINTY

<u>Source</u>	<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups	2	3833401.6089	1916700.8044	84.124	0000
Within Groups	222	5058084.2400	22784.1632		
Total	224	8891485.8489			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
018	75	2503.0533	156.5070	18.0719	2197.0000	2979.0000	2467.0443 to 2539.0623
019	75	2337.9333	120.5979	13.9254	2068.0000	2706.0000	2310.1863 to 2365.6804
020	75	2183.3867	171.2139	19.7701	1520.0000	2534.0000	2143.9939 to 2222.7794
Total	225	2341.4578			1520.000	2979.0000	

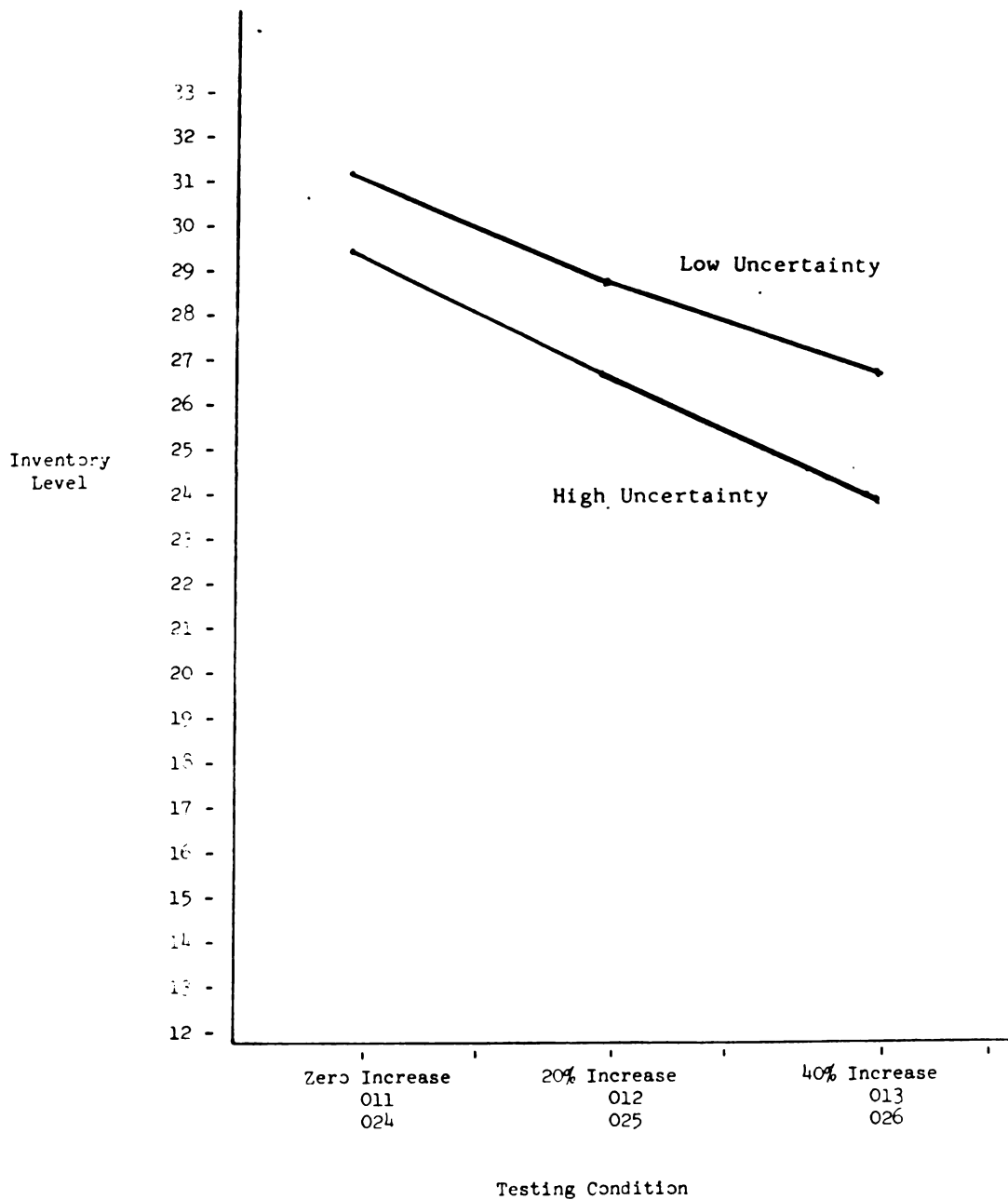


Figure 4.3 Comparison of inventory level for 40% incentive with different sales response levels.

TABLE 4.5

ANALYSIS OF VARIANCE OF INVENTORY LEVEL BY 40% INCENTIVE WITH
DIFFERENT SALES INCREASES AT LOW LEVEL OF UNCERTAINTY

<u>Source</u>	<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups	2	8713292.3467	4356646.1733	387.145	.0000
Within Groups	222	2498223.0933	11253.2572		
Total	224	11211515.4400			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
011	75	3167.8533	114.0411	13.1683	2873.0000	3390.0000	3141.6149 to 3194.0918
012	75	2891.1467	106.1038	12.2518	2632.0000	3105.0000	2866.7344 to 2915.5589
013	75	2687.6800	57.4494	11.2525	2447.0000	2938.0000	2665.2589 to 2710.1011
Total	225	2915.5600			2447.0000	3390.0000	

TABLE 4.6
ANALYSIS OF VARIANCE OF INVENTORY LEVEL BY 40% INCENTIVE
WITH DIFFERENT SALES INCREASES AT HIGH LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		2	11355293.5200	5677646.7600	77.306	.0000
Within Groups		222	16304436.7200	73443.4086		
Total		224	27659730.2400			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
024	75	2948.6000	182.8573	21.1145	2611.0000	3533.0000	2906.5284 to 2990.6716
025	75	2686.4000	188.4436	21.7596	1898.0000	3180.0000	2643.0431 to 2729.7569
026	75	2398.5200	389.0790	44.9270	1238.0000	2928.0000	2309.0011 to 2488.0389
Total	225	2677.8400			1238.0000	3533.0000	

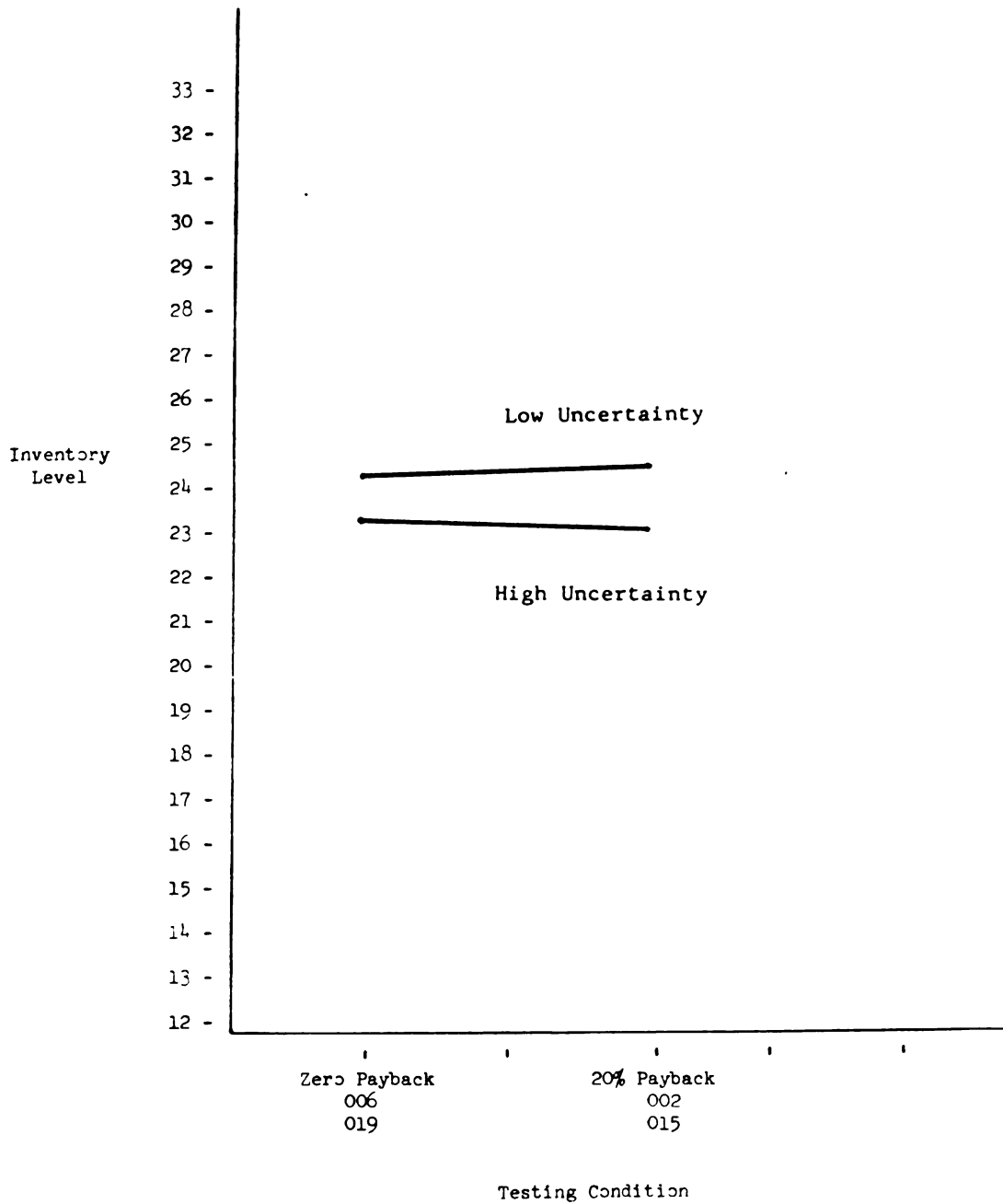


Figure 4.4 Comparison of inventory level for 20% incentive with 20% sales response increase with different payback levels.

This result was similar for the high level of uncertainty. These results are seen in Table 4.7 and 4.8.

The same procedure was followed for a 20% incentive with a 40% sales response increase with various payback levels. As seen in Figure 4.5, again relatively small changes occurred in inventory level as the payback became larger. This held true for both high and low levels of uncertainty. An analysis of variance procedure confirmed this with a F value of .709 with a significance of F of .4934 for the low level of uncertainty. At a high level of uncertainty the F ratio was 2.123 with a significance of F at .1220. This would again indicate that there was not a significant difference at $\alpha = .05$. These analyses are seen in Table 4.9 and 4.10 respectively.

This procedure was again performed for a 40% incentive with a 20% sales increase at difference payback levels as seen in Figure 4.6. Very little change in inventory level occurred. This was confirmed by the analysis of variance procedure. For the low level of uncertainty F value produced was .833 with a significance of F at .3629 indicating no significant difference. At a high level of uncertainty the F-ratio was .805 with a significant of F at .3711 indicating no significant differences between inventory level due to changes in payback levels. These results are seen in Tables 4.11 and 4.12 respectively.

This procedure was finally utilized on a 40% incentive with a 40% sales increase with different payback levels. As

TABLE 4.7

ANALYSIS OF VARIANCE OF INVENTORY LEVEL BY 20% INCENTIVE
WITH 20% SALES RESPONSE INCREASE WITH DIFFERENT PAYBACK
LEVELS AT LOW LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		1	7618.4067	7618.4067	.908	.3421
Within Groups		148	1241132.6667	8386.0315		
Total		149	1248751.0733			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
006	75	2437.9867	91.6156	10.5789	2203.0000	2614.0000	2416.9078 to 2459.0655
002	75	2452.2400	81.5349	10.5695	2283.0000	2768.0000	2431.1797 to 2473.3003
Total	150	2445.1133			2203.0000	2768.0000	

TABLE 4.8

ANALYSIS OF VARIANCE OF INVENTORY LEVEL BY 20% INCENTIVE
WITH 20% SALES RESPONSE INCREASE WITH DIFFERENT PAYBACK
LEVELS AT HIGH LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		1	11881.5000	11881.5000	.844	.3598
Within Groups		148	2084237.3333	14082.6847		
Total		149	2096118.8333			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
019	75	2337.9333	120.5979	13.9254	2068.0000	2706.0000	2310.1863 to 2365.6804
015	75	2320.1333	116.7113	13.4767	2064.0000	2699.0000	2293.2805 to 2346.9862
Total	150	2329.0333			2064.0000	2706.0000	

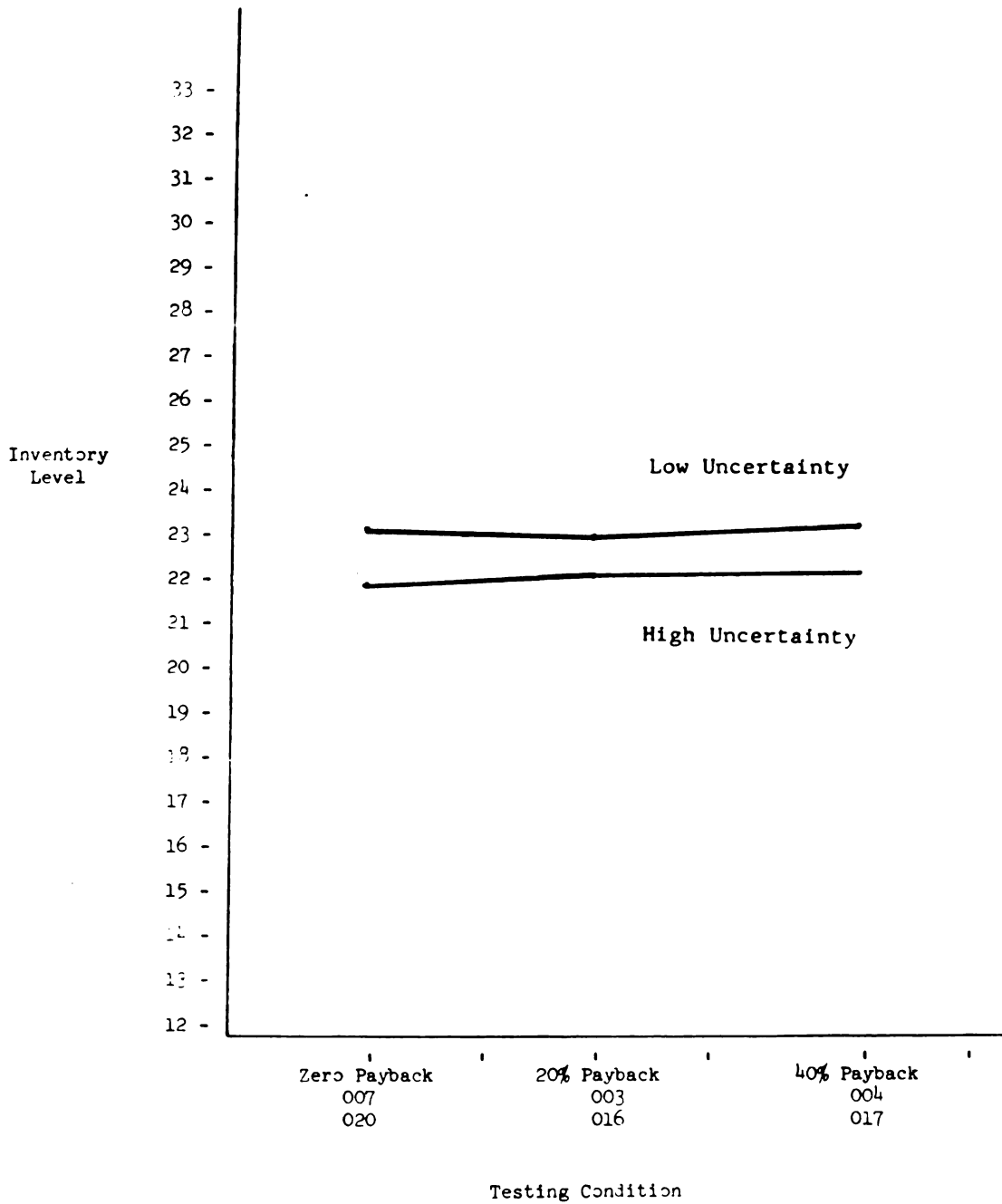


Figure 4.5 Comparison of inventory level for 20% incentive with 40% sales response increase with different payback levels.

TABLE 4.9

ANALYSIS OF VARIANCE OF INVENTORY LEVEL BY 20% INCENTIVE
WITH 40% SALES RESPONSE INCREASE WITH DIFFERENT PAYBACK
LEVELS AT LOW LEVEL OF UNCERTAINTY

Testing Condition	Source	Count	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
	Between Groups		2	8219.0489	4109.5244	.709	.4934
	Within Groups		222	1287170.0000	5798.0631		
	Total		224	1295389.0489			
Testing Condition	Count	Mean	Standard Deviation	Standard Error	95 Pct Conf Int for Mean		
					Minimum	Maximum	
007	75	2317.5333	84.1719	9.7193	2143.0000	2502.0000	2298.1671 to 2336.8998
003	75	2313.6267	73.3755	8.4727	2120.0000	2560.0000	2296.7445 to 2330.5098
004	75	2327.9467	70.1806	8.1038	2151.0000	2577.0000	2311.7996 to 2344.0938
Total	225	2319.7022			2120.0000	2577.0000	

TABLE 4.10

ANALYSIS OF VARIANCE OF INVENTORY LEVEL BY 20% INCENTIVE WITH
40% SALES RESPONSE INCREASE WITH DIFFERENT PAYBACK
LEVELS AT HIGH LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		2	68409.1289	34204.5644	2.123	.1220
Within Groups		222	3576088.9867	16108.5089		
Total		224	3644498.1156			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
020	75	2183.3867	171.2139	19.7701	1522.0000	2534.0000	2143.9939 to 2222.7794
016	75	2215.8800	102.3127	11.8141	1989.0000	2515.0000	2192.3400 to 2239.4200
017	75	2223.6400	92.4308	10.6730	2024.000	2479.0000	2202.3736 to 2244.9064
Total	225	2207.6356			1520.0000	2534.0000	

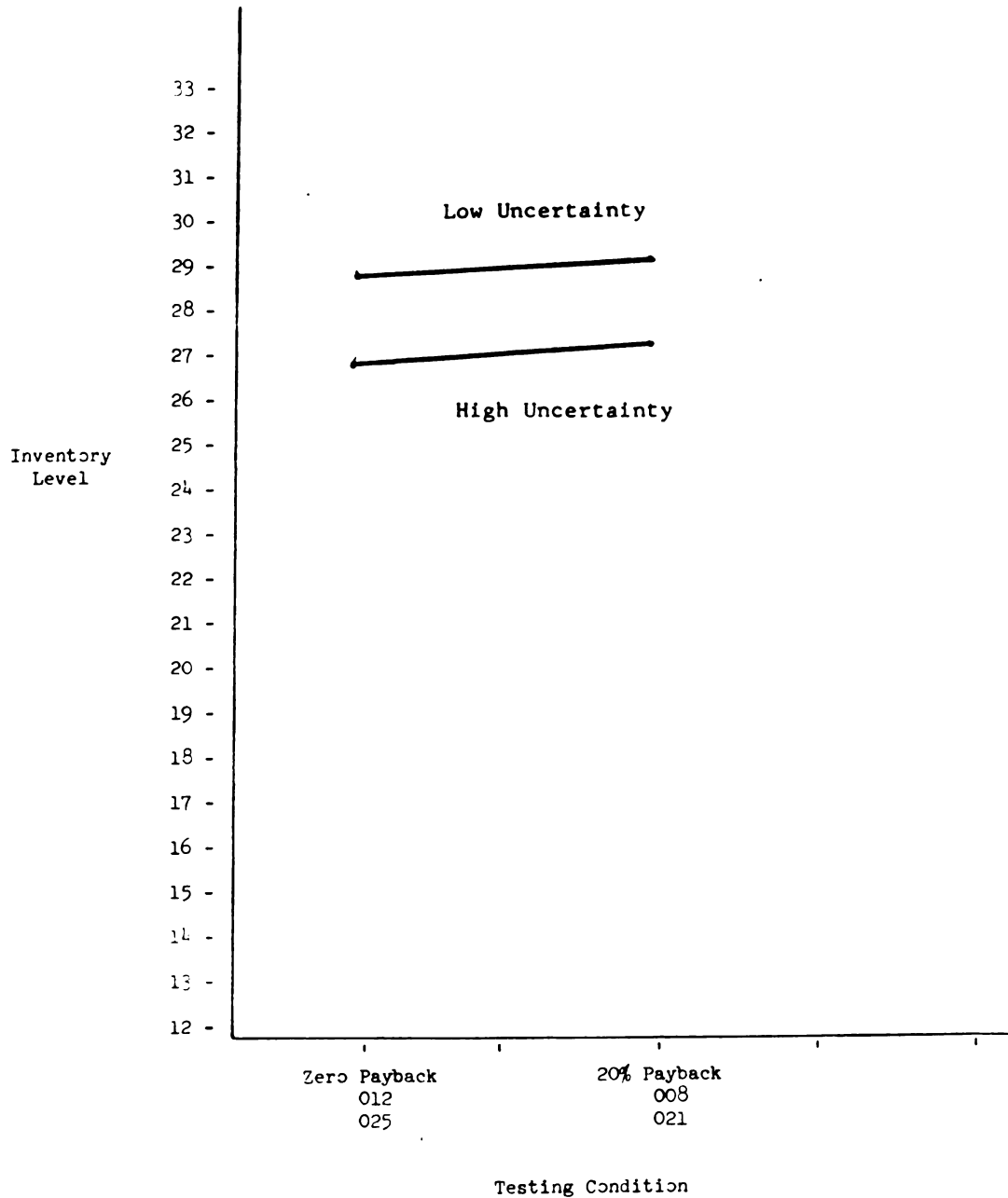


Figure 4.6 Comparison of inventory level for 40% incentive with 20% sales increase with different payback levels.

TABLE 4.11

ANALYSIS OF VARIANCE OF INVENTORY LEVEL BY 40% INCENTIVE
WITH 20% SALES INCREASE WITH DIFFERENT PAYBACK LEVELS AT
LOW LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		1	9172.8600	9172.8600	.833	.3629
Within Groups		148	1629985.9733	11013.4187		
Total		149	1639158.8333			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
012	75	2891.1467	106.1038	12.2518	2632.0000	3105.0000	2866.7344 to 2915.5589
008	75	2906.7867	103.7729	11.9827	26950000	3268.0000	2882.0000 to 2930.6626
Total	150	2898.9667			2632.0000	3268.0000	

TABLE 4.12

ANALYSIS OF VARIANCE OF INVENTORY LEVEL BY 40% INCENTIVE
WITH 20% SALES INCREASE WITH DIFFERENT PAYBACK
LEVELS AT HIGH LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		1	24832.6667	24832.6667	.805	.3711
Within Groups		148	4565520.6667	30848.1126		
Total		149	4590353.3333			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
025	75	2686.4000	188.4436	21.7596	1898.0000	3180.0000	2643.0431 to 2729.7569
021	75	2712.1333	161.8186	18.6852	2371.0000	3162.0000	2674.9023 to 2749.3644
Total	150	2699.2667			1898.0000	3180.0000	

seen in Figure 4.7 for a low level of uncertainty there was very little change in inventory level. The analysis of variance for this comparison indicated an F value of 1.720 indicating no significant difference at $\alpha = .05$. For the higher level of uncertainty, there was a slightly higher difference in inventory levels with a F ratio of 6.849. This difference was significant at the $\alpha = .05$ level. These results are seen in Tables 4.13 and 4.14 respectively.

For all testing conditions results generated for Hypothesis One appear in Table 4.15. Overall, Hypothesis One was accepted as incentive testing conditions produced significantly higher average inventory levels. Within those incentive testing conditions, however, the relative impact of the level of uncertainty, incentive, sales response increase, and sales response payback was much less. Although a statistically significant difference occurred, the impact of sales response increase caused inventory levels to decrease by only 13% to 18% as the sales response increased. Sales response payback increases did not cause a significant increase in inventory level. These results indicate that the sales increase, being closer in time to the incentive inventory loading had a higher impact, as those changes impacted that inventory level soon after it was increased. The sales payback function, conversely, impacted the inventory level only after it had been increased for the period of the incentive. Thus, its position further out in time from the initial loading diminished its effect on

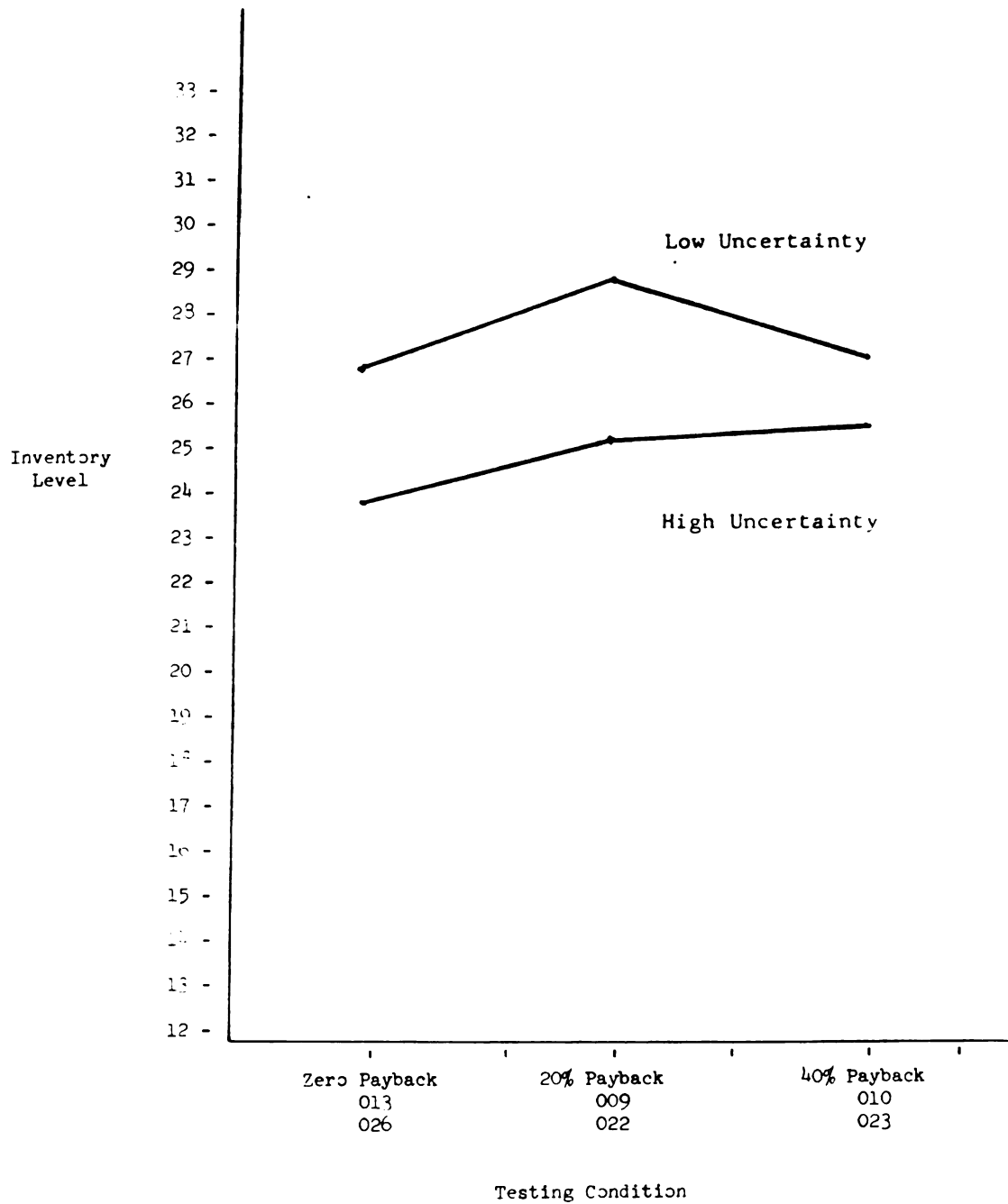


Figure 4.7 Comparison of inventory level for 40% incentive with a 40% sales increase with different payback levels.

TABLE 4.13

ANALYSIS OF VARIANCE OF INVENTORY LEVEL BY 40% INCENTIVE
WITH 40% SALES INCREASE WITH DIFFERENT PAYBACK
LEVELS AT LOW LEVEL OF UNCERTAINTY

Source		D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.	
Between Groups		2	23667.3422	11833.6711	1.720	.1814	
Within Groups		222	1527260.2133	6879.5505			
Total		224	1550927.5555				
Testing Condition	Count	Mean	Standard Deviation	Standard Error	Minimum	Maximum	95 Pct Conf Int for Mean
	75	2687.6800	97.4494	11.2525	2447.0000	2938.0000	2665.2589 to 2710.1011
	75	2884.4267	74.3656	8.5870	2491.0000	2877.0000	2667.3167 to 2701.5368
	75	2707.6267	74.9134	8.6503	2522.0000	2895.0000	2690.3907 to 2724.8627
Total	225	2693.2444			2447.0000	2938.0000	

TABLE 4.14

ANALYSIS OF VARIANCE OF INVENTORY LEVEL BY 40% INCENTIVE
WITH 40% SALES INCREASE WITH DIFFERENT PAYBACK
LEVELS AT HIGH LEVEL OF UNCERTAINTY

		<u>Source</u>	<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
		Between Groups	2	940988.7289	470494.3644	6.849	.0013
		Within Groups	222	15249692.4533	68692.3083		
		Total	224	16190681.1822			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
026	75	2398.5200	389.0790	44.9270	1238.0000	2928.0000	2309.0011 to 2488.0389
022	75	2508.5467	199.6902	23.0582	1810.0000	2915.0000	2462.6021 to 2554.4912
023	75	2552.2267	121.7304	14.0562	2264.0000	2885.0000	2524.2190 to 2580.2343
Total	225	2486.4311			1238.0000	2928.0000	

TABLE 4.15

TESTING ENVIRONMENT OUTPUT, HYPOTHESIS ONE,
ALL TESTING CONDITIONS

Testing Condi- tion	INC	SRP	SRI	SLSU	Inventory Level	
					Mean	S.D.
001	1	1	1	1	1295.35	32.80
002	2	2	2	1	2452.24	91.54
003	2	2	3	1	2313.63	73.38
004	2	3	3	1	2327.95	70.18
005	2	1	1	1	2655.55	98.26
006	2	1	2	1	2437.39	91.62
007	2	1	3	1	2317.53	84.17
008	3	2	2	1	2906.79	103.77
009	3	2	3	1	2684.43	74.37
010	3	3	3	1	2707.63	74.91
011	3	1	1	1	3167.85	114.04
012	3	1	2	1	2891.15	106.10
013	3	1	3	1	2687.68	97.45
014	1	1	1	2	1316.95	28.34
015	2	2	2	2	2320.13	116.71
016	2	2	3	2	2215.88	102.31
017	2	3	3	2	2223.64	92.43
018	2	1	1	2	2503.05	156.51
019	2	1	2	2	2337.93	120.60
020	2	1	3	2	2183.39	171.22
021	3	2	2	2	2712.13	161.82
022	3	2	3	2	2508.55	199.69
023	3	3	3	2	2552.23	121.73
024	3	1	1	2	2948.60	182.86
025	3	1	2	2	2686.40	188.44
026	3	1	3	2	2398.52	389.08

average inventory level. Further discussion of the causes and implications of these effects occurs in Chapter V.

Hypothesis Two: The use of an incentive decreases the overall customer service level for products under the incentive.

Results of the testing environment caused this hypothesis to be rejected. As seen in Figure 4.8 incentive testing conditions resulted in an overall increase in customer service level. Testing condition 001 represented a non-incentive scenario whereas testing condition 006 and 013 represented incentive scenarios with 20% and 40% sales increases respectively. For the lower level of uncertainty the presence of an incentive increased the customer service level. In testing condition 001 the customer service level was .9111. This increased to .9411 for testing condition 006, and decreased back to .9387 for testing condition 013. This pattern was almost identical for the higher level of uncertainty. For both uncertainty levels there was a significant difference at a α of .01 as seen in Table 4.16 and 4.17. For SLSU1 the F value was 61.681 with a significance of F at zero. For SLSU2 the F value was 30.635 with a significance of F at zero. This apparently was due to an increased inventory level at the beginning of the incentive period, resulting in a higher customer service level. Further explanation of this impact is given in Chapter V. Based on these findings, Hypothesis Two was rejected. Evidence from the testing environment would support the opposite conclusion, that the use of an

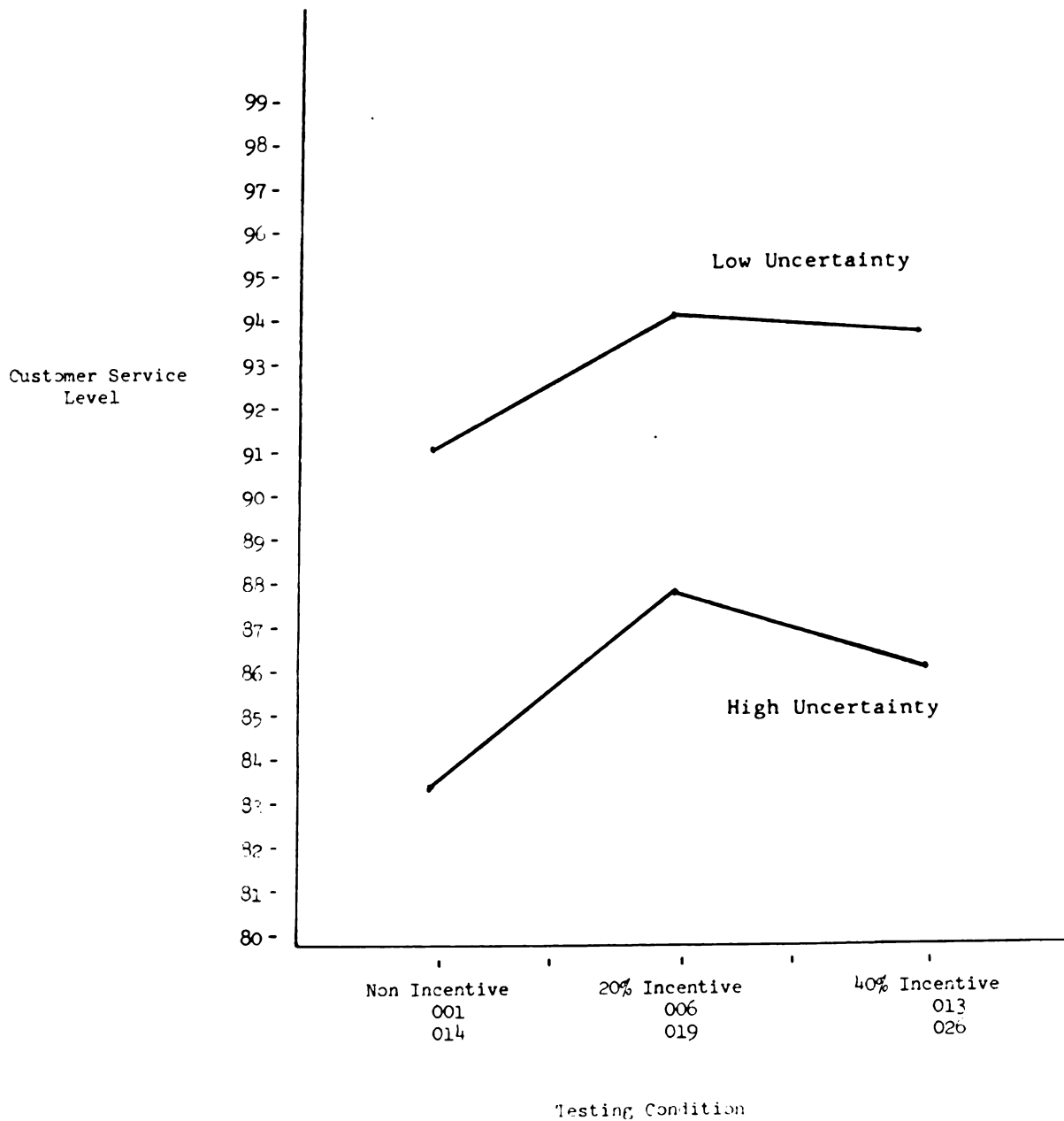


Figure 4.8 Comparison of customer service levels for incentive and non-incentive testing conditions.

TABLE 4.16

ANALYSIS OF VARIANCE OF CUSTOMER SERVICE LEVEL BY
INCENTIVE LEVEL AT LOW LEVEL OF UNCERTAINTY

	<u>Source</u>	<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
	Between Groups	2	.0416	.0208	61.681	.0000
	Within Groups	222	.0748	.0003		
	Total	224	.1164			
<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>95 Pct Conf Int for Mean</u>	
					<u>Minimum</u>	<u>Maximum</u>
001	75	.9111	.0185	.0021	.8420	.9069 to .9154
006	75	.9411	.0190	.0022	.8970	.9367 to .9455
013	75	.9387	.0175	.0020	.8910	.9347 to .9427
Total	225	.9303			.8420	.9840

TABLE 4.17

ANALYSIS OF VARIANCE OF CUSTOMER SERVICE LEVEL BY
INCENTIVE LEVEL AT HIGH LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		2	.0814	.0407	30.635	.0000
Within Groups		222	.2950	.0013		
Total		224	.3765			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
014	75	.8333	.0297	.0034	.7590	.8970	.8265 to .8402
019	75	.8795	.0307	.0035	.8130	.9410	.8725 to .8866
026	75	.8616	.0465	.0054	.7090	.9350	.8509 to .8723

incentive results in an increase in the average customer service level for the channel member receiving increased inventory due to the incentive.

In order to examine the impact of sales response within an incentive a comparison was made of TC005, TC006 and TC007. This comparison is depicted in Figure 4.9. Each of these testing conditions represented a 20% incentive level, however TC005 represented a zero level of sales increases, TC006 represented a 20% sales increase, and TC007 represented a 40% sales increase. This last level exceeded the expected outcome of this incentive. In this comparison as the sales response level increased, the customer service level decreased, reflecting the lower stock availability due to higher sales. This decrease reflected a statistically significant change at the $\alpha = .01$ level, as seen in Tables 4.18 and 4.19.

A similar comparison was made at a 40% incentive level. In this comparison, again the customer service level was lower, with the significance of the decrease also being significant at the .01 level. This result held true for both levels of uncertainty as seen in Tables 4.20, 4.21, and Figure 4.10.

In order to examine the impact of payback levels on customer service levels, comparisons were made between testing conditions, holding the incentive level and sales response increase constant. Figure 4.11 depicts the customer service levels produced from TC006 and TC002. Both

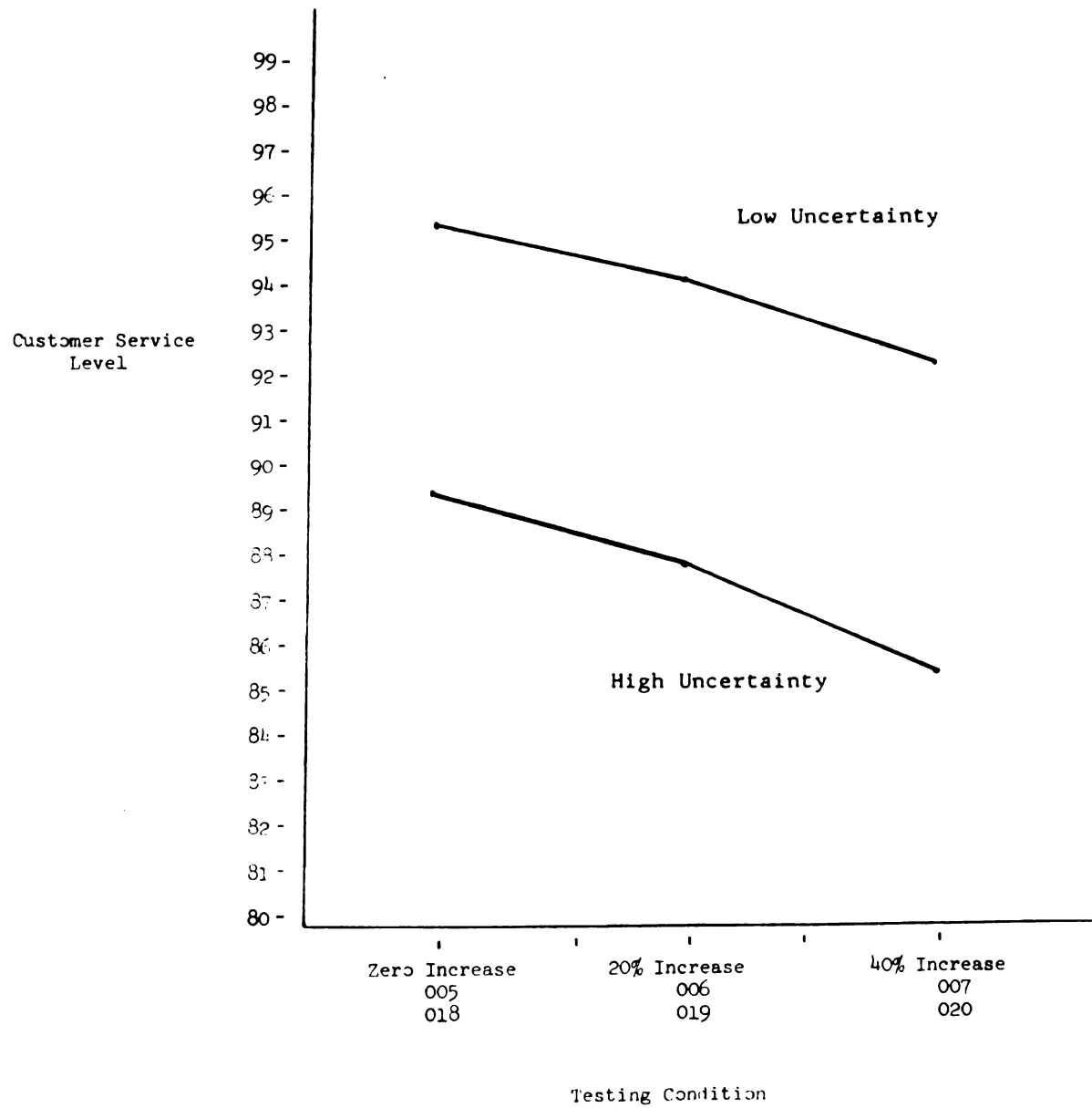


Figure 4.9 Comparison of customer service level for 20% incentive with different sales response levels.

TABLE 4.18

ANALYSIS OF VARIANCE OF CUSTOMER SERVICE LEVEL FOR
20% INCENTIVE WITH DIFFERENT SALES INCREASES
AT LOW LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		2	.0281	.0141	45.027	.0000
Within Groups		222	.0694	.0003		
Total		224	.0975			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
005	75	.9524	.0159	.0018	.9180	.9870	.9488 to .9561
006	75	.9411	.0190	.0022	.8970	.9840	.9367 to .9455
007	75	.9252	.0180	.0021	.8920	.9690	.9210 to .9293
Total	225	.9396			.8920	.9870	

TABLE 4.19

ANALYSIS OF VARIANCE OF CUSTOMER SERVICE LEVEL FOR
20% INCENTIVE WITH DIFFERENT SALES INCREASES
AT HIGH LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		2	.0596	.0298	30.542	.0000
Within Groups		222	.2166	.0010		
Total		224	.2762			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
018	75	.8934	.0275	.0032	.8230	.9530	.8870 to .8997
019	75	.8795	.0307	.0035	.8130	.9410	.8725 to .8866
020	75	.8541	.0351	.0041	.7670	.9190	.8460 to .8621
Total	225	.8757			.7670	.9530	

TABLE 4.20

ANALYSIS OF VARIANCE OF CUSTOMER SERVICE LEVEL FOR
40% INCENTIVE WITH DIFFERENT SALES INCREASES
AT LOW LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		2	.0200	.0100	36.456	.0000
Within Groups		222	.0608	.0003		
Total		224	.0807			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
011	75	.9617	.0145	.0017	.9270	.9970	.9584 to .9651
012	75	.9490	.0174	.0020	.9130	.9890	.9450 to .9530
013	75	.9387	.0175	.0020	.8910	.9800	.9347 to .9427
Total	225	.9498					

TABLE 4.21

ANALYSIS OF VARIANCE OF CUSTOMER SERVICE LEVEL FOR
40% INCENTIVE WITH DIFFERENT SALES INCREASES
AT HIGH LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		2	.0728	.0364	29.999	.0000
Within Groups		222	.2692	.0012		
Total		224	.3420			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
024	75	.9045	.0250	.0029	.8230	.9530	.8987 to .9102
025	75	.8919	.0291	.0034	.8160	.9530	.8851 to .8986
026	75	.8616	.0465	.0054	.7090	.9350	.8509 to .8723
Total	225	.8860			.7090	.9530	

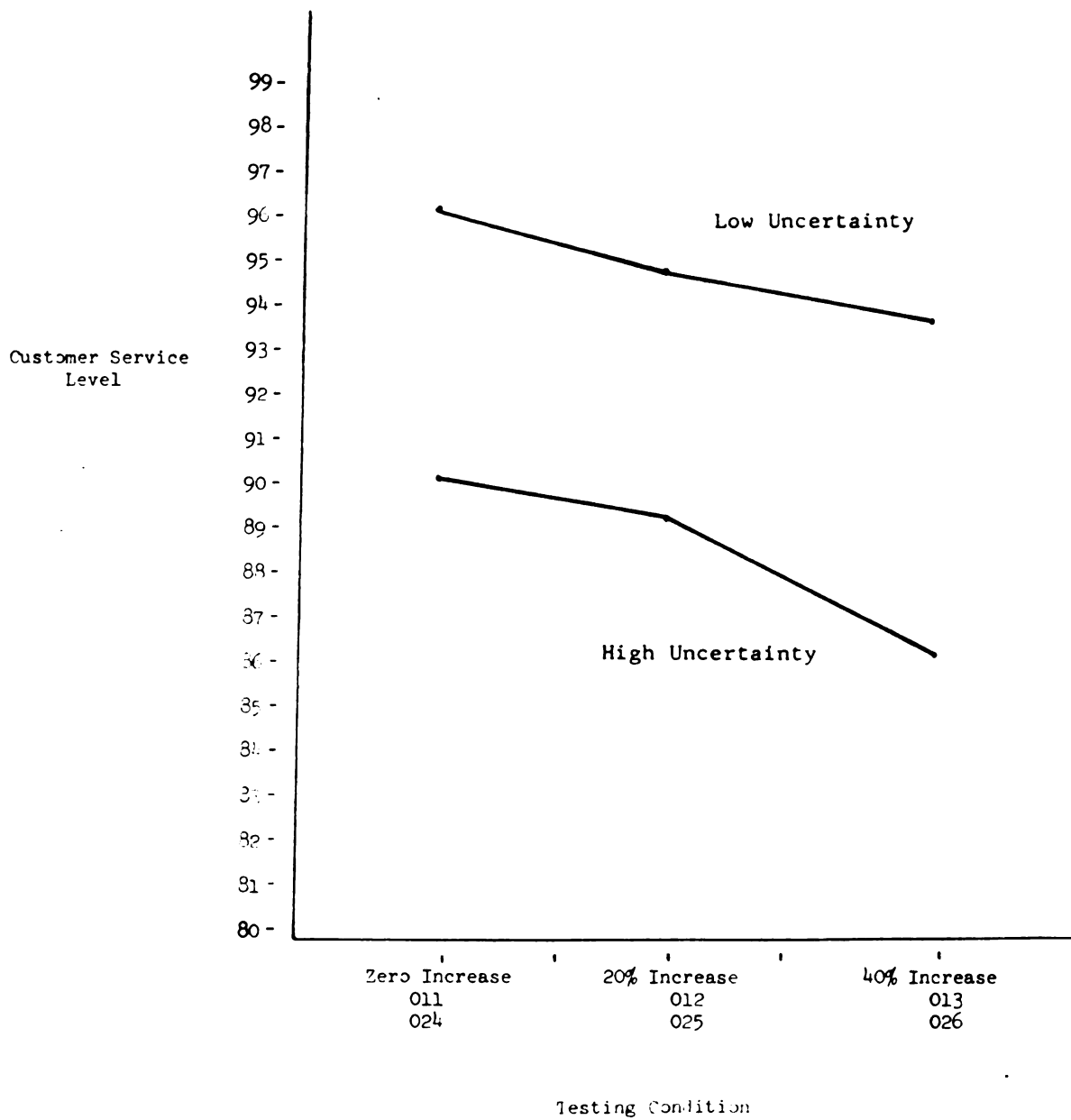


Figure 4.10 Comparison of customer service level for 40% incentive with different sales response levels.

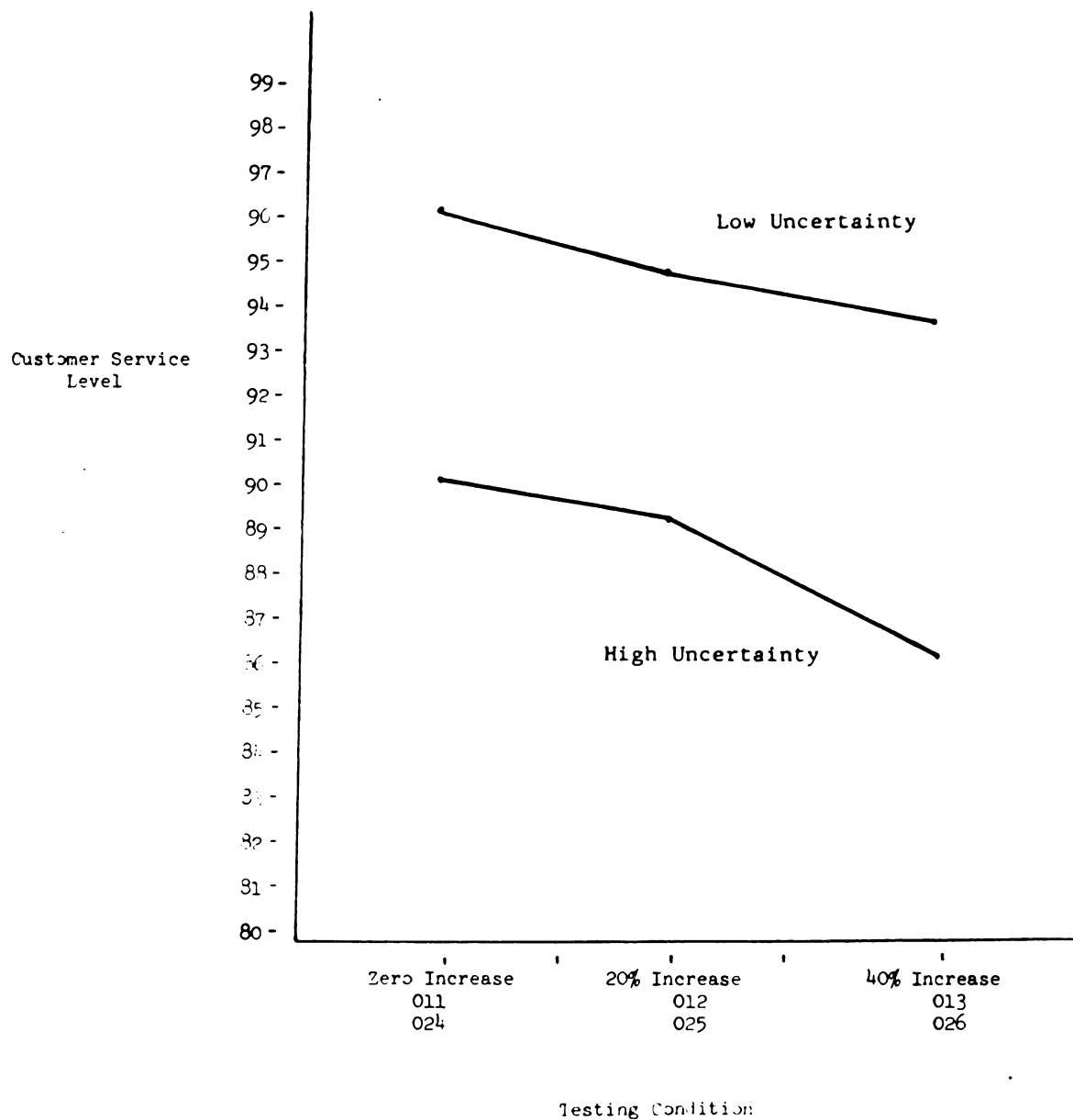


Figure 4.10 Comparison of customer service level for 40% incentive with different sales response levels.

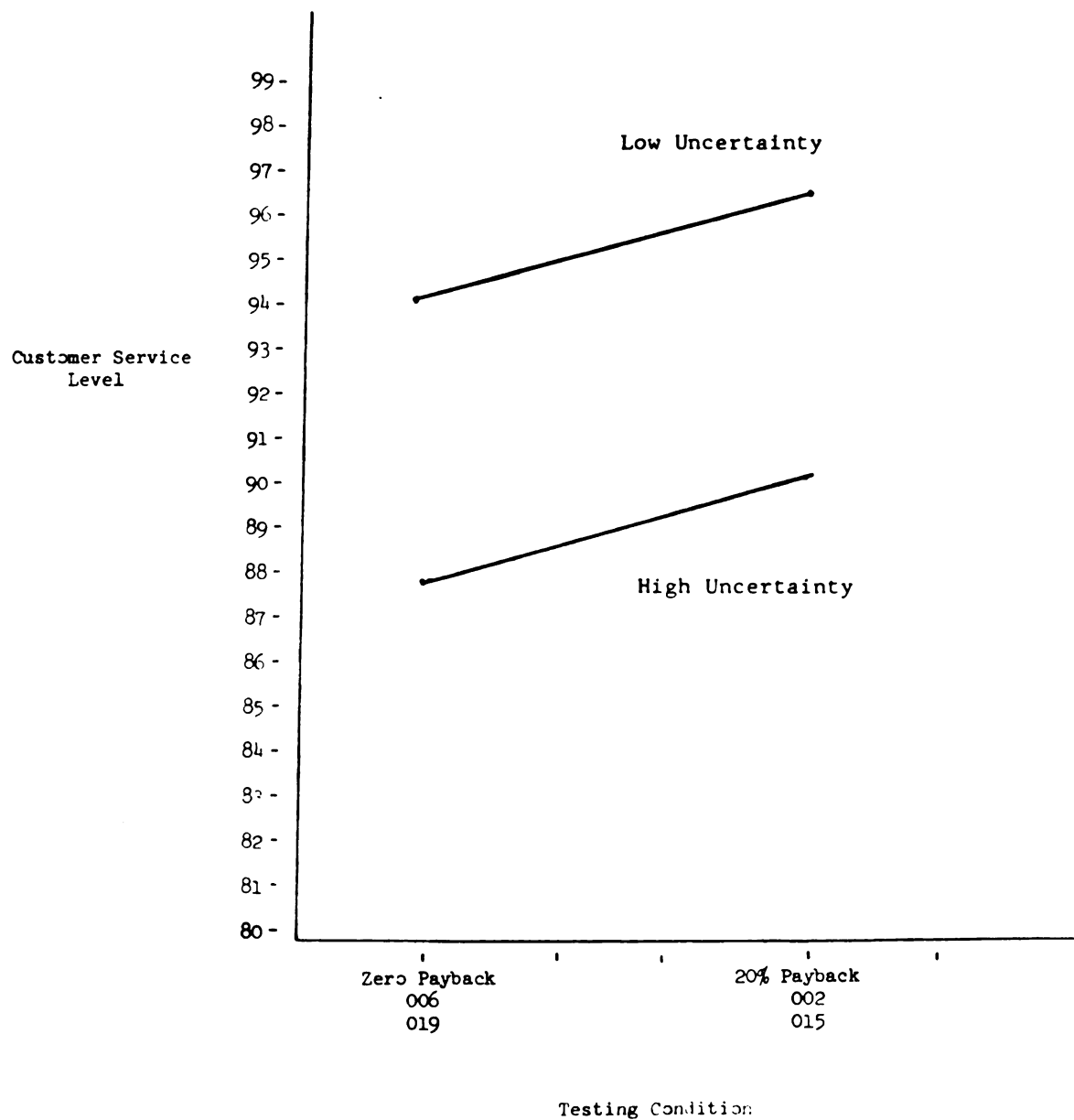


Figure 4.11 Comparison of customer service level for 20% incentive with 20% sales response increase with different payback levels.

testing conditions represent a 20% incentive with a 20% sales response increase. The sales response payback was tested at a level of zero in TC006 and at an amount equal to the incentive in TC002. As the sales payback increased the customer service level increased, reflecting additional inventory available due to lost sales at the conclusion of the incentive. These increases were significant at the $\alpha = .01$ level as seen in Tables 4.22 and 4.23.

A similar comparison was made between TC007, TC003 and TC004. This represented a 20% incentive level with a 40% sales response increase and sales payback levels at zero, 20% and 40%. In this comparison the customer service levels did increase overall, reflecting the higher inventory level. Again, this increase was significant at the $\alpha = .01$ level as seen in Tables 4.24, 4.25, and Figure 4.12.

This relationship was also examined for a 40% incentive with a 20% sales increase at two levels of payback as seen in Figure 4.13. As with the preceding comparisons there were increases in customer service levels at both levels of uncertainty. These were significantly different at the $\alpha = .01$ level, as seen in Tables 4.26 and 4.27.

A final comparison was made of TC013, TC009 and TC010. This comparison consisted of payback level changes for a 40% incentive with a 40% sales increase. There was a significant difference between these customer service levels at the $\alpha = .01$ level. These results are seen in Tables 4.28, 4.29, and Figure 4.14.

TABLE 4.22

ANALYSIS OF VARIANCE OF CUSTOMER SERVICE LEVEL BY 20% INCENTIVE
WITH 20% SALES RESPONSE INCREASE WITH DIFFERENT PAYBACK
LEVELS AT LOW LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		1	.0244	.0244	85.183	.000
Within Groups		148	.0424	.0003		
Total		149	.0669			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
006	75	.9411	.0190	.0022	.8970	.9840	.9367 to .9455
002	75	.9666	.0146	.0017	.9300	.9970	.9633 to .9700
Total	150	.9539			.8970	.9970	

TABLE 4.23

ANALYSIS OF VARIANCE OF CUSTOMER SERVICE LEVEL BY 20% INCENTIVE
WITH 20% SALES RESPONSE INCREASE WITH DIFFERENT PAYBACK
LEVELS AT HIGH LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		1	.0305	.0305	39.152	.0000
Within Groups		148	.1152	.0008		
Total		149	.1457			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
019	75	.8795	.0307	.0035	.8130	.9410	.8725 to .8866
015	75	.9080	.0248	.0029	.8450	.9590	.9023 to .9138
Total	150	.8938			.8130	.9590	

TABLE 4.24

ANALYSIS OF VARIANCE OF CUSTOMER SERVICE LEVEL BY 20% INCENTIVE
WITH 40% SALES RESPONSE INCREASE WITH DIFFERENT PAYBACK
LEVELS AT LOW LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		2	.0502	.0251	92.429	.000
Within Groups		222	.0603	.0003		
Total		224	.1105			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
007	75	.9252	.0180	.0021	.8920	.9690	.9210 to .9293
003	75	.9471	.9159	.0018	.8960	.9820	.9434 to .9507
004	75	.9615	.0155	.0018	.9100	.9920	.9580 to .9651
Total	225	.9446			.8920	.9920	

TABLE 4.25

ANALYSIS OF VARIANCE OF CUSTOMER SERVICE LEVEL BY 20% INCENTIVE
WITH 40% SALES REPOSE INCREASE WITH DIFFERENT PAYBACK
LEVELS AT HIGH LEVEL OF UNCERTAINTY

Source		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		2	.0672	.0336	32.852	.0000
Within Groups		222	.2272	.0010		
Total		224	.2945			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
020	75	.8541	.0351	.0041	.7670	.9190	.8460 to .8621
016	75	.8816	.0292	.0034	.8120	.9600	.8748 to .8883
017	75	.8957	.0314	.0036	.8160	.9650	.8885 to .9029
Total	225	.8771			.7670	.9650	

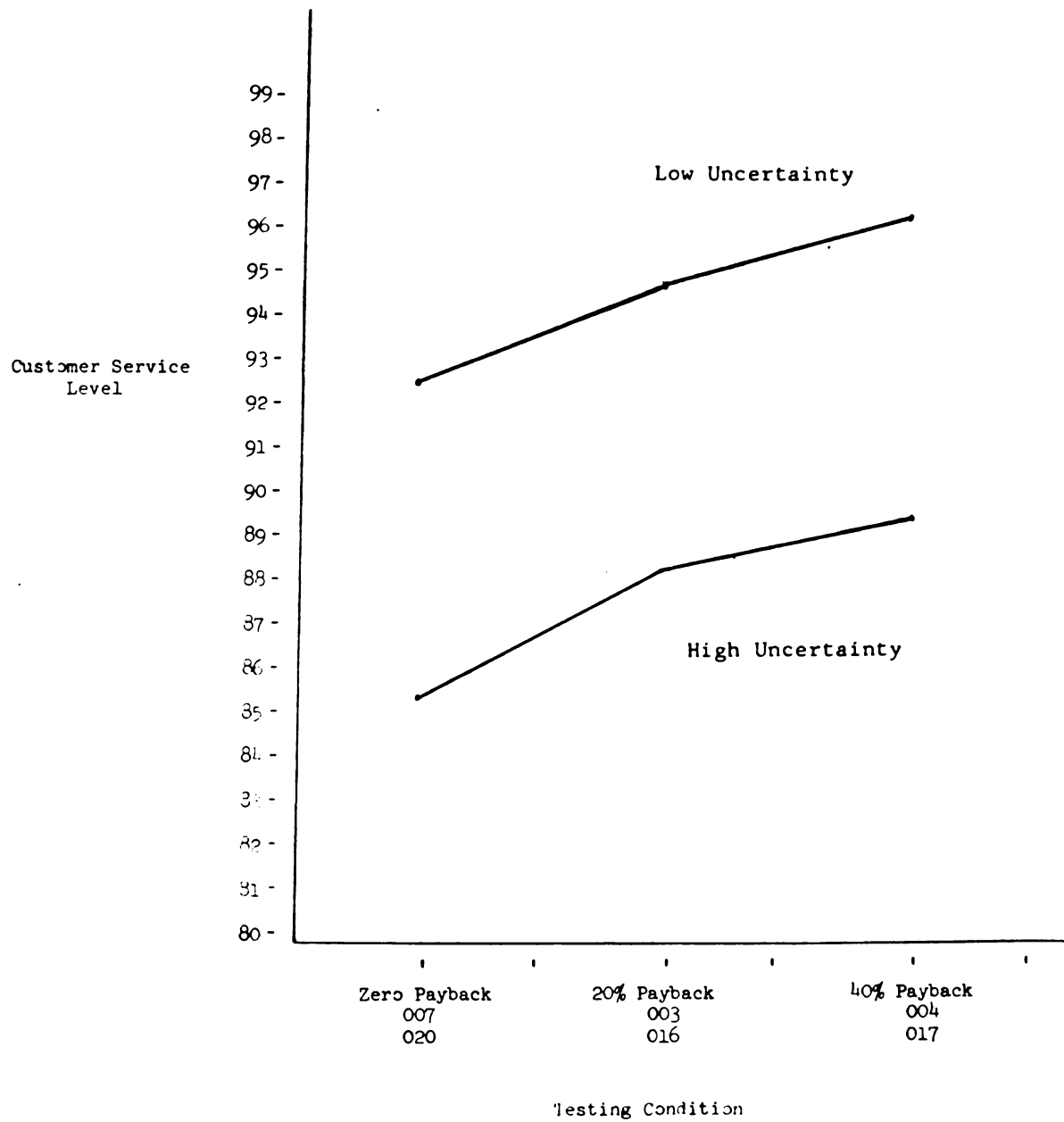


Figure 4.12 Comparison of customer service level for 20% incentive with 40% sales response increase with different payback levels.

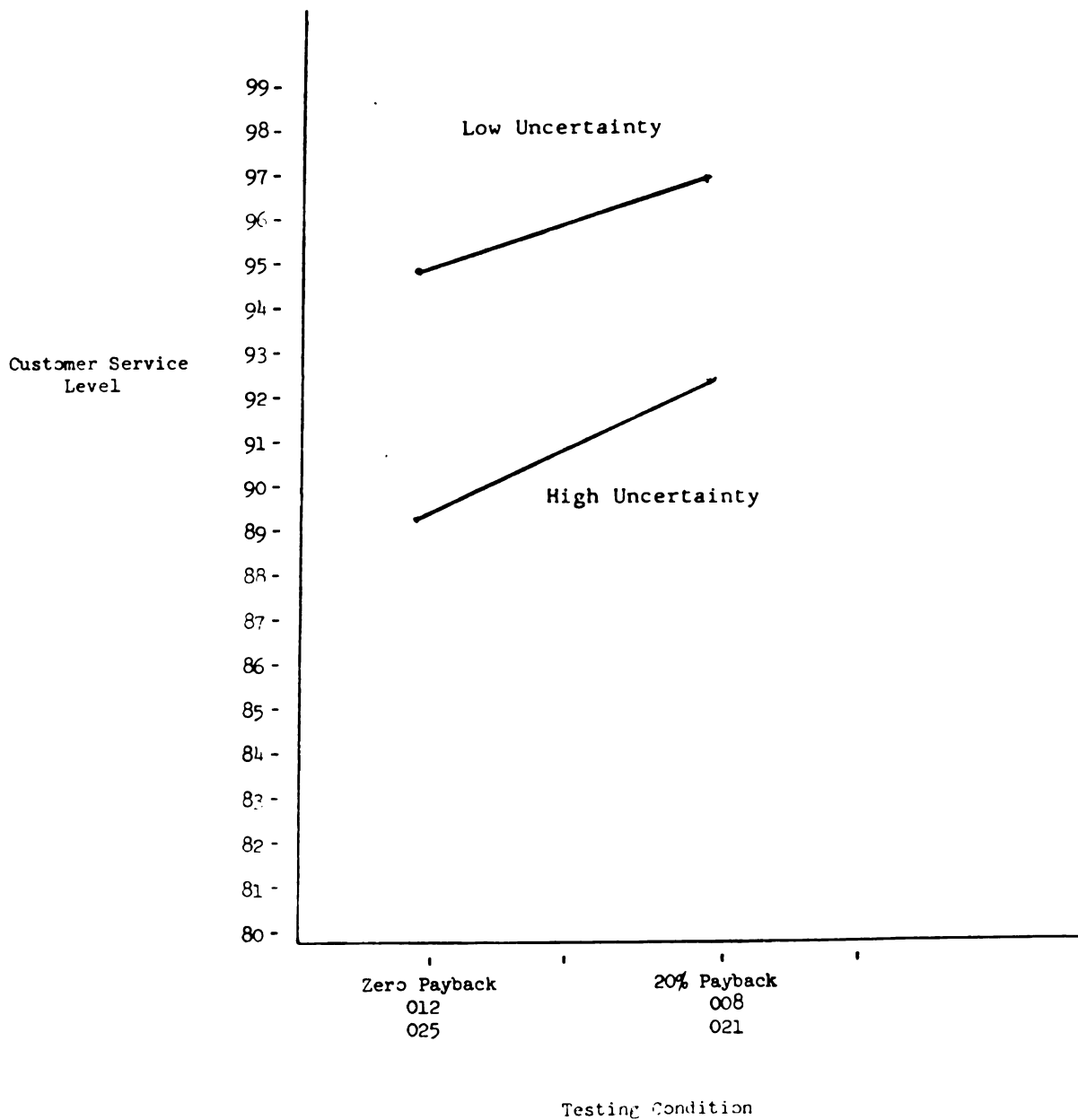


Figure 4.13 Comparison of customer service level for 40% incentive with a 20% sales increase with different payback levels.

TABLE 4.26
ANALYSIS OF VARIANCE OF CUSTOMER SERVICE LEVEL BY 40% INCENTIVE
WITH 20% SALES RESPONSE INCREASE WITH DIFFERENT PAYBACK
LEVELS AT HIGH LEVEL OF UNCERTAINTY

		<u>Source</u>	<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
		Between Groups	1	.0155	.0155	67.320	.0000
		Within Groups	148	.0340	.0002		
		Total	149	.0495			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
012	75	.9490	.0174	.0020	.9130	.9890	.9450 to .9530
008	75	.9693	.0125	.0014	.9370	.9980	.9665 to .9722
Total	150	.9592			.9130	.9980	

TABLE 4.27

ANALYSIS OF VARIANCE OF CUSTOMER SERVICE LEVEL BY 40% INCENTIVE
WITH 20% SALES RESPONSE INCREASE WITH DIFFERENT PAYBACK
LEVELS AT HIGH LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		1	.0349	.0349	51.175	.0000
Within Groups		148	.1008	.007		
Total		149	.1357			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
025	75	.8919	.0291	.0034	.8160	.9530	.8851 to .8986
021	75	.9223	.0227	.0026	.8770	.9790	.9171 to .9276
Total	150	.9071			.8160	.9790	

TABLE 4.28
ANALYSIS OF VARIANCE OF CUSTOMER SERVICE LEVEL BY 40% INCENTIVE
WITH 40% SALES RESPONSE INCREASE AT DIFFERENT PAYBACK
LEVELS AT LOW LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		2	.0277	.0138	58.472	.0000
Within Groups		222	.0525	.0002		
Total		224	.0802			

<u>Testing Condition</u>	<u>Count</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>
013	75	.9387	.0175	.0020	.8910	.9800	.9347 to .9427
009	75	.9566	.0141	.0016	.9180	.9900	.9534 to .9599
010	75	.9653	.0143	.0016	.9130	.9920	.9621 to .9686
Total	225	.9536			.8910	.9920	

TABLE 4.29
ANALYSIS OF VARIANCE OF CUSTOMER SERVICE LEVEL BY 40% INCENTIVE
WITH 40% SALES RESPONSE INCREASE AT DIFFERENT PAYBACK
LEVELS AT HIGH LEVEL OF UNCERTAINTY

<u>Source</u>		<u>D.F.</u>	<u>Sum of Squares</u>	<u>Mean Squares</u>	<u>F Ratio</u>	<u>F Prob.</u>
Between Groups		2	.1373	.0686	56.628	.0000
Within Groups		222	.2691	.0012		
Total		224	.4064			

<u>Testing Condition</u>	<u>Count</u>	<u>Standard Deviation</u>			<u>Standard Error</u>			<u>Minimum</u>			<u>Maximum</u>			<u>95 Pct Conf Int for Mean</u>		
		<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Mean</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Standard Error</u>	<u>Minimum</u>	<u>Maximum</u>	<u>95 Pct Conf Int for Mean</u>	<u>Mean</u>
026	75	.8616	.0465	.0054	.8616	.0054	.7090	.9350	.8509 to .8723	.8616	.0465	.0054	.7090	.9350	.8509 to .8723	.8616
022	75	.8996	.0301	.0035	.8996	.0035	.7930	.9490	.8927 to .9065	.8996	.0301	.0035	.7930	.9490	.8927 to .9065	.8996
023	75	.9214	.0238	.0028	.9214	.0028	.8440	.9740	.9159 to .9269	.9214	.0238	.0028	.8440	.9740	.9159 to .9269	.9214
Total	225	.8942			.8942		.7090	.9740		.8942			.7090	.9740		.8942

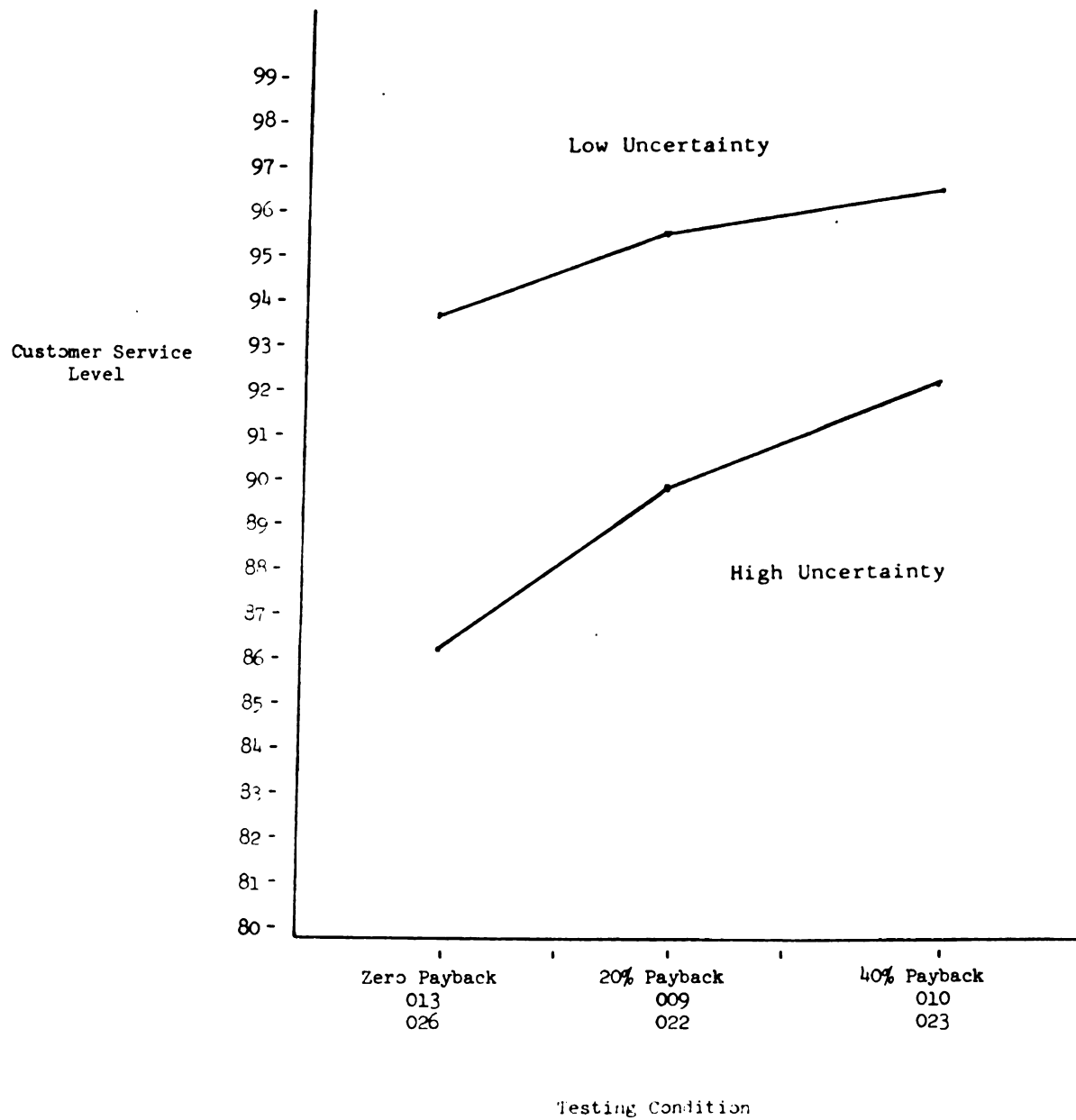


Figure 4.14 Comparison of customer service level for 40% incentive with a 40% sales increase with different payback levels.

Results of all testing conditions are seen in Table 4.30. Overall, Hypothesis Two was rejected. Incentive activity resulted in an increase in customer service level. In addition, within the incentive scenarios, changes in sales response increase, and sales response payback both significantly affected the customer service level. Further discussion of the causes and implications of this effect are discussed in Chapter V.

Hypothesis Three: The use of an incentive results in variation in shipment sizes between the manufacturer and the distribution center.

Results of the testing environment supported this hypothesis. As seen in Table 4.31 a high degree of variation was reported between the specific testing conditions. TC001 represented a non-incentive testing condition, whereas TC006 and TC014 represented a 20% and 40% incentive with equivalent sales increases with zero payback. The incentive testing conditions produced a shipment summary reflecting an increase in carload shipments compared to the non-incentive testing condition. A chi-square analysis performed produced a chi-square statistic of 88.509 with 8 degrees of freedom. This is substantially above the critical value of chi-square at $\alpha = .05$ and 8 degrees of freedom of 15.507. Therefore, comparison of the non-incentive testing condition with testing conditions 006, and 013, representing a 20% and 40% level incentive produced a significantly changed pattern of shipments. This result held equally true for the high level of uncertainty as seen in Table 4.32.

TABLE 4.30

TESTING ENVIRONMENT OUTPUT, HYPOTHESIS TWO,
ALL TESTING CONDITIONS

Testing Condi- tion	INC	SRP	SRI	SLSU	Customer Service Level	
					Mean	S.D.
001	1	1	1	1	.9111	.0185
002	2	2	2	1	.9666	.0146
003	2	2	3	1	.9471	.0159
004	2	3	3	1	.9615	.0155
005	2	1	1	1	.9524	.0159
006	2	1	2	1	.9411	.0190
007	2	1	3	1	.9252	.0180
008	3	2	2	1	.9693	.0125
009	3	2	3	1	.9566	.0141
010	3	3	3	1	.9653	.0143
011	3	1	1	1	.9617	.0145
012	3	1	2	1	.9490	.0174
013	3	1	3	1	.9387	.0175
014	1	1	1	2	.8333	.0297
015	2	2	2	2	.9080	.0248
016	2	2	3	2	.8816	.0292
017	2	3	3	2	.8957	.0314
018	2	1	1	2	.8934	.0275
019	2	1	2	2	.8795	.0307
020	2	1	3	2	.8541	.0351
021	3	2	2	2	.9223	.0227
022	3	2	3	2	.8996	.0301
023	3	3	3	2	.9214	.0238
024	3	1	1	2	.9045	.0250
025	3	1	2	2	.8919	.0291
026	3	1	3	2	.8616	.0465

TABLE 4.31

SHIPMENT SUMMARY FOR DIFFERENT INCENTIVE LEVELS
AT LOW LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
40% Incentive 013	88	411	105	31	30	665
20% Incentive 006	90	402	103	103	30	728
Non-Incentive 001	72	374	146	108	0	700
Total:	250	1187	354	242	60	2093

Expected Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
40% Incentive 013	79.4	377.1	112.5	76.9	19.1	665
20% Incentive 006	87.0	412.9	123.1	84.2	20.9	728
Non-Incentive 001	83.6	397.0	118.4	80.9	20.1	700
Total:	250	1187	354	242	60	2093

Chi-Square statistic = 88.509 with d.f. = 8 CV = 15.507

TABLE 4.32
SHIPMENT SUMMARY FOR DIFFERENT INCENTIVE LEVELS
AT HIGH LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
40% Incentive 026	50	450	142	38	28	708
20% Incentive 019	57	457	131	33	30	708
Non-Incentive 014	20	427	200	73	0	720
Total:	127	1334	473	144	58	2136

Expected Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
40% Incentive 026	42.1	442.2	156.8	47.7	19.2	708
20% Incentive 019	42.1	442.2	156.8	47.7	19.2	708
Non-Incentive 014	42.8	449.7	159.4	48.5	19.6	720
Total:	127	1334	473	144	58	2136

Chi-Square statistic = 85.096 with d.f. = 8 CV = 15.507

In order to test for changes in shipments based on sales response alone, comparisons were made between testing conditions 005, 006, and 007 at the low level of uncertainty and testing conditions 018, 019, and 020 at the high level of uncertainty. These conditions represented a 20% incentive with a zero, 20%, and 40% sales increase. As seen in Table 4.33, this process resulted in a chi-square statistic of 10.180. This indicated that there was not a significant difference in the shipment summary pattern between the testing conditions at the $\alpha = .05$ level. This held true also for the high level of uncertainty as seen in Table 4.34.

This procedure was performed with a 40% incentive in effect at different levels of sales increase. This resulted in a non-significant difference occurring on the low level of uncertainty, and a significant difference occurring at the high level of uncertainty. These results are seen in Table 4.35 and 4.36.

In order to examine the impact of sales payback, comparisons were within the 20% and 40% incentive levels. Table 4.37 depicts the shipment summaries for testing conditions 006 and 002. These represent a 20% incentive with a 20% sales response with a zero and 20% payback respectively, at a low level of uncertainty.

As seen in this table a significant difference did occur based on payback level within this scenario. For the

TABLE 4.33

SHIPMENT SUMMARY FOR 20% INCENTIVE WITH DIFFERENT
SALES INCREASES AT LOW LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Shipment Categories					Total
	4000	20000	30000	40000	100000	
40% Increase 007	88	384	109	54	30	665
20% Increase 006	90	402	103	36	30	661
Zero Increase 005	91	419	88	33	30	661
Total:	269	1205	300	123	90	1987

Expected Frequencies

Testing Condition	Shipment Categories					Total
	4000	20000	30000	40000	100000	
40% Increase 007	90.0	403.3	100.4	41.2	30.1	665
20% Increase 006	89.5	400.9	99.8	40.9	29.9	661
Zero Increase 005	89.5	400.9	99.8	40.9	29.9	661
Total	269	1205	300	123	90	1987

Chi-Square statistic = 10.180 with d.f. = 8 CV = 15.507

TABLE 4.34

SHIPMENT SUMMARY FOR 20% INCENTIVE WITH DIFFERENT
SALES INCREASES AT HIGH LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
40% Increase 020	46	447	154	32	30	709
20% Increase 019	57	457	131	33	30	708
Zero Increase 018	60	475	122	20	30	707
Total:	163	1379	407	85	90	2124

Expected Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
40% Increase 020	54.4	460.3	135.9	28.4	30.0	709
20% Increase 019	54.3	459.7	135.7	28.3	30.0	708
Zero Increase 018	54.3	459.0	135.5	28.3	30.0	707
Total	163	1379	407	85	90	2124

Chi-Square statistic = 10.583 with d.f. = 8 CV = 15.507

TABLE 4.35

SHIPMENT SUMMARY FOR 40% INCENTIVE WITH DIFFERENT
SALES INCREASES AT LOW LEVEL OF UNCERTAINTY

		Observed Frequencies				
Testing Condition	Shipment Categories					Total
	4000	20000	30000	40000	100000	
40% Increase 013	88	411	105	31	30	665
20% Increase 012	83	420	95	28	30	656
Zero Increase 011	89	437	73	26	30	655
Total	260	1268	273	85	90	1976

		Expected Frequencies				
Testing Condition	Shipment Categories					Total
	4000	20000	30000	40000	100000	
40% Increase 013	87.5	426.7	91.9	28.6	30.3	665
20% Increase 012	86.3	421.0	90.6	28.2	29.9	656
Zero Increase 011	86.2	420.3	90.5	28.2	29.8	655
Total	260	1268	273	85	90	1976

Chi-Square statistic = 7.308 with d.f. = 8 CV = 15.507

TABLE 4.36

SHIPMENT SUMMARY FOR 40% INCENTIVE WITH DIFFERENT SALES INCREASES
AT HIGH LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
40% Increase 026	50	450	142	38	28	708
20% Increase 025	61	460	138	18	30	707
Zero Increase 024	67	477	113	18	30	705
Total:	178	1387	393	74	88	2120

Expected Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
40% Increase 026	59.4	463.2	131.2	24.7	29.4	708
20% Increase 025	59.4	462.6	131.1	24.7	29.3	707
Zero Increase 024	59.2	461.2	130.7	24.6	29.3	705
Total	178	1387	393	74	88	2120

Chi-Square statistic = 17.971 with d.f. = 8 CV = 15.507

TABLE 4.37

SHIPMENT SUMMARY FOR 20% INCENTIVE WITH 20% SALES RESPONSE
INCREASE WITH DIFFERENT PAYBACK
LEVELS OF LOW LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
20% Payback 002	80	458	91	13	30	672
Zero Payback 006	90	402	103	36	30	661
Total:	170	860	194	49	60	1333

Expected Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
20% Payback 002	85.7	433.5	97.8	24.7	30.2	672
Zero Payback 006	84.3	426.5	96.2	24.3	29.8	661
Total:	170	860	194	49	60	1333

Chi-Square statistic = 15.683 with d.f. = 4 CV = 9.488

higher level of uncertainty however a significant difference did not occur at the $\alpha = .05$ level.

The same procedure was followed for a 20% incentive with a 40% sales response increase with different payback levels. The results were similar with a significant difference occurring at the low level of uncertainty and no significant difference occurring at the high level of uncertainty. These results are seen in Table 4.39 and 4.40.

This procedure was again performed for a 40% incentive with a 20% sales increase at different payback levels. As seen in Tables 4.41 and 4.42 there was a significant difference at the .05 level for a low level of uncertainty, and no significant difference at a high level of uncertainty.

Within this hypothesis, a final comparison was made for the 40% incentive with a 40% sales increase at different payback levels. In this case both levels of uncertainty resulted in a significant difference at the $\alpha = .05$ level. These results are seen in Tables 4.43 and 4.44.

In summary, Hypothesis Three was accepted. Comparisons of incentive versus non incentive scenarios did result in a substantial and statistically significant shift in shipments by category. In addition, within the incentive scenarios the degree of sales response did result in a significant difference in one out of the four comparisons made. Sales payback had a significant impact in five of the eight comparisons made. Further discussion of the causes implications of this hypothesis are discussed in Chapter V.

TABLE 4.38

SHIPMENT SUMMARY FOR 20% INCENTIVE WITH 20% SALES RESPONSE
INCREASE WITH DIFFERENT PAYBACK LEVELS
AT HIGH LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
20% Payback 015	57	476	124	20	30	707
Zero Payback 019	57	457	131	33	30	708
Total:	114	933	255	53	60	1415

Expected Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
20% Payback 015	57.0	466.2	127.4	26.5	30.0	707
Zero Payback 019	57.0	466.8	127.6	26.5	30.0	708
Total:	114	933	255	53	60	1415

Chi-Square statistic 3.767 with d.f. = 4 CV = 9.488

TABLE 4.39
SHIPMENT SUMMARY FOR 20% INCENTIVE WITH 40% SALES RESPONSE
INCREASE WITH PAYBACK LEVELS AT
LOW LEVEL OF UNCERTAINTY

		Observed Frequencies					
Testing Condition		Shipment Categories					Total
		4000	20000	30000	40000	100000	
40% Payback	004	87	446	87	17	30	667
20% Payback	003	86	437	105	24	30	682
Zero Payback	007	88	384	109	54	30	665
Total:		261	1267	301	95	90	2014

		Expected Frequencies					
Testing Condition		Shipment Categories					Total:
		4000	20000	30000	40000	100000	
40% Payback	004	86.4	419.6	99.7	31.5	29.8	667
20% Payback	003	88.4	429.0	101.9	32.2	30.5	682
Zero Payback	007	86.2	418.3	99.4	31.4	29.7	665
Total:		261	1267	301	95	90	2014

Chi-Square statistic = 32.434 with d.f. = 8 CV = 15.507

TABLE 4.40

SHIPMENT SUMMARY FOR 20% INCENTIVE WITH 40% SALES
RESPONSE INCREASE WITH DIFFERENT PAYBACK
LEVELS AT HIGH LEVEL OF UNCERTAINTY

Testing Condition	Observed Frequencies					Total:
	4000	20000	30000	40000	100000	
40% Payback 017	61	482	117	20	30	710
20% Payback 016	53	461	139	25	30	708
Zero Payback 020	46	447	154	32	30	709
Total:	160	1390	410	77	90	2127

Testing Condition	Expected Frequencies					Total:
	4000	20000	30000	40000	100000	
40% Payback 017	53.4	464.0	136.9	25.7	30.0	710
20% Payback 016	53.3	462.7	136.5	25.6	30.0	708
Zero Payback 020	53.3	463.3	136.7	25.7	30.0	709
Total:	160	1390	410	77	90	2127

Chi-Square statistic = 11.340 with d.f. = 8 CV = 15.507

TABLE 4.41

SHIPMENT SUMMARY FOR 40% INCENTIVE WITH 20% SALES
INCREASE WITH DIFFERENT PAYBACK LEVELS AT
LOW LEVEL OF UNCERTAINTY

		Observed Frequencies					
Testing Condition		Shipment Categories					Total:
		4000	20000	30000	40000	100000	
20% Payback 008							
		88	452	85	10	30	665
Zero Payback 012							
		83	420	95	28	30	656
Total:		171	872	180	38	60	1321

		Expected Frequencies					
Testing Condition		Shipment Categories					Total:
		4000	20000	30000	40000	100000	
20% Payback	008	86.1	439.0	90.6	19.1	30.2	665
Zero Payback	012	84.9	433.0	89.4	18.9	29.8	656
Total:		171	872	180	38	60	1321

Chi-Square statistic = 10.342 with d.f. = 4 CV = 9.488

TABLE 4.42

SHIPMENT SUMMARY FOR 40% INCENTIVE WITH 20% SALES INCREASE
WITH DIFFERENT PAYBACK LEVELS AT
HIGH LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
20% Payback 021	59	484	109	21	30	703
Zero Payback 025	61	460	138	18	30	707
Total:	120	944	247	39	60	1410

Expected Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
20% Payback 021	59.8	470.7	123.1	19.4	29.9	703
Zero Payback 025	60.2	473.3	123.9	19.6	30.1	707
Total:	120	944	247	39	60	1410

Chi-Square statistic = 4.268 with d.f. = 4 CV = 15.507

TABLE 4.43

SHIPMENT SUMMARY FOR 40% INCENTIVE WITH 40% SALES
INCREASE WITH DIFFERENT PAYBACK LEVELS
AT LOW LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
40% Payback 010	100	452	74	12	30	668
20% Payback 009	93	433	89	22	30	667
Zero Payback 013	88	411	105	31	30	665
Total:	281	1296	268	65	90	2000

Expected Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
40% Payback 010	93.9	432.9	89.5	21.7	30.1	668
20% Payback 009	93.7	432.2	89.4	21.7	30.0	667
Zero Payback 013	93.4	430.9	89.1	21.6	29.9	665
Total:	281	1296	268	65	90	2000

Chi-Square statistic = 16.441 with d.f. = 8 CV = 15.507

Hypothesis Four: The use of an incentive results in an increase in the total number of shipments from the manufacturer to the distribution center.

In order to test this hypothesis, total number of shipment data was compared between testing conditions. The sequence utilized in Hypotheses One through Three was followed. Each testing condition produced a total number of shipments at the end of each year. A chi-square analysis was made of the number of shipments for each of the three years by specific testing conditions.

Results of the testing environment caused this hypothesis to be rejected. As seen in Tables 4.45 and 4.46 no significant difference occurred in the number of shipments between the non-incentive and incentive testing conditions at both a high and low level of uncertainty. Following the procedure in the previous three hypotheses, Tables 4.47 through 4.50 reflect the impact of sales response increase within the given incentive scenario. In all of these comparisons, no significant difference occurred at $\alpha = .05$ between testing conditions.

Tables 4.51 through 4.58 reflect the impact of sales payback on total number of shipments. No significant differences were found. Regardless of the presence or absence of an incentive, level of sales increase, level of sales response payback, or degree of uncertainty no significant differences were seen to occur. This hypothesis was rejected. A discussion of the causes and implications of this effect may be seen in Chapter V.

TABLE 4.44

SHIPMENT SUMMARY FOR 40% INCENTIVE WITH 40% SALES
INCREASE WITH DIFFERENT PAYBACK LEVELS
AT HIGH LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
40% Payback 023	55	507	103	12	30	707
20% Payback 022	54	484	121	19	30	708
Zero Payback 026	50	450	142	38	28	708
Total:	159	1441	366	69	88	2123

Expected Frequencies

Testing Condition	Shipment Categories					Total:
	4000	20000	30000	40000	100000	
40% Payback 023	53.0	479.9	121.9	23.0	29.3	707
20% Payback 022	53.0	480.6	122.1	23.0	29.3	708
Zero Payback 026	53.0	480.6	122.1	23.0	29.3	708
Total:	159	1441	366	69	88	2123

Chi-Square statistic = 25.765 with d.f. = 8 CV = 15.507

TABLE 4.45

TOTAL SHIPMENTS FOR DIFFERENT INCENTIVE
LEVELS AT LOW LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Incentive 013	214	224	227	665
20% Incentive 006	216	222	223	661
Non-Incentive 001	223	229	238	690
Total:	653	675	688	2016

Expected Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Incentive 013	215.4	222.7	226.9	665
20% Incentive 006	214.1	221.3	225.6	661
Non-Incentive 001	223.5	231.0	235.5	690
Total	653	675	688	2016

TABLE 4.46

TOTAL SHIPMENTS FOR DIFFERENT INCENTIVE
LEVELS AT HIGH LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Incentive 026	229	237	242	708
20% Incentive 019	230	239	239	708
Non-Incentive 014	236	242	242	720
Total:	695	718	723	2136

Expected Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Incentive 026	230.4	238.0	239.6	708
20% Incentive 019	230.4	238.0	239.6	708
Non-Incentive 014	234.3	242.0	243.7	720
Total:	695	718	723	2136

Chi-Square statistic = 0.067 with d.f. = 4 CV = 9.488

TABLE 4.47

TOTAL SHIPMENTS FOR 20% INCENTIVE WITH
DIFFERENT SALES INCREASES AT LOW
LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Increase 007	218	220	227	665
20% Increase 006	216	222	223	661
Zero Increase 005	213	222	226	661
Total:	647	664	676	1987

Expected Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Increase 007	216.5	222.2	226.2	665
20% Increase 006	215.2	220.9	224.9	661
Zero Increase 005	215.2	220.9	224.9	661
Total:	647	664	676	1987

Chi-Square statistic = 0.093 with d.f. = 4 CV = 9.488

TABLE 4.48

TOTAL SHIPMENTS FOR 20% INCENTIVE WITH
DIFFERENT SALES INCREASES AT
HIGH LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Increase 020	229	239	242	710
20% Increase 019	230	239	239	708
Zero Increase 018	229	239	239	707
Total:	688	717	720	2125

Expected Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Increase 020	229.9	239.6	240.6	710
20% Increase 019	229.2	238.9	239.9	708
Zero Increase 018	228.9	238.6	239.5	707
Total:	688	717	720	2125

Chi-Square statistic = 0.021 with d.f. = 4 CV = 9.488

TABLE 4.49

TOTAL SHIPMENTS FOR 40% INCENTIVE WITH
DIFFERENT SALES INCREASES AT
LOW LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Increase 013	214	224	227	665
20% Increase 012	213	222	221	656
Zero Increase 011	212	217	226	655
Total:	639	663	674	1976

Expected Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Increase 013	215.0	223.1	226.8	665
20% Increase 012	212.1	220.1	223.8	656
Zero Increase 011	211.8	219.8	223.4	655
Total:	639	663	674	1976

Chi-Square statistic = 0.127 with d.f. = 4 CV = 9.488

TABLE 4.50

TOTAL SHIPMENTS FOR 40% INCENTIVE WITH
DIFFERENT SALES INCREASES AT
HIGH LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Increase 026	229	237	242	708
20% Increase 025	229	239	239	707
Zero Increase 024	228	238	239	705
Total:	686	714	720	2120

Expected Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Increase 026	229.1	238.4	240.5	708
20% Increase 025	228.8	238.1	240.1	707
Zero Increase 024	228.1	237.4	239.4	705
Total:	686	714	720	2120

Chi-Square statistic = 0.030 with d.f. = 4 CV = 9.488

TABLE 4.51

TOTAL SHIPMENTS FOR 20% INCENTIVE WITH
20% SALES INCREASE WITH DIFFERENT
PAYBACK LEVELS AT LOW LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Year			Total:
	1	2	3	
20% Payback 002	216	226	230	672
Zero Payback 006	216	222	223	661
Total	432	448	453	1333

Expected Frequencies

	Year			Total:
	1	2	3	
20% Payback 002	217.8	225.8	228.4	672
Zero Payback 006	214.2	222.2	224.6	661
Total:	432	448	453	1333

Chi-Square statistic = 0.053 with d.f. = 2 CV = 5.991

TABLE 4.52

TOTAL SHIPMENTS FOR 20% INCENTIVE WITH
20% SALES RESPONSE INCREASE WITH
DIFFERENT PAYBACK LEVELS AT
HIGH LEVEL OF UNCERTAINTY

Testing Condition	Observed Frequencies			
	Year			Total:
	1	2	3	
20% Payback 015	230	237	240	707
Zero Payback 019	230	239	239	708
Total:	460	476	479	1415

Testing Condition	Expected Frequencies			
	Year			Total:
	1	2	3	
20% Payback 015	229.8	237.8	239.3	707
Zero Payback 019	230.2	238.2	239.7	708
Total:	460	476	479	1415

Chi-Square statistic = 0.010 with d.f. = 2 CV = 5.991

TABLE 4.53

TOTAL SHIPMENTS FOR 20% INCENTIVE WITH 40%
SALES RESPONSE INCREASE WITH DIFFERENT
PAYBACK LEVELS AT LOW
LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Payback 004	217	222	228	667
20% Payback 003	225	225	232	682
Zero Payback 007	218	220	227	665
Total:	660	667	687	2014

Testing Condition	Expected Frequencies			Total:
	1	2	3	
40% Payback 004	218.6	220.9	227.5	667
20% Payback 003	223.5	225.9	232.6	682
Zero Payback 007	217.9	220.2	226.8	665
Total:	660	667	687	2014

Chi-Square statistic = 0.034 with d.f. = 4 CV = 9.488

TABLE 4.54

TOTAL SHIPMENTS FOR 20% INCENTIVE WITH 40%
SALES RESPONSE INCREASE WITH DIFFERENT
PAYBACK LEVELS AT HIGH
LEVEL OF UNCERTAINTY

Testing Condition	Observed Frequencies			
	Year			Total:
	1	2	3	
40% Payback 017	231	239	240	710
20% Payback 016	231	238	239	708
Zero Payback 020	229	239	242	710
Total:	691	716	721	2128

Testing Condition	Expected Frequencies			
	Year			Total:
	1	2	3	
40% Payback 017	230.5	238.9	240.6	710
20% Payback 016	229.9	238.2	239.9	708
Zero Payback 020	230.5	238.9	240.6	710
Total:	691	716	721	2128

Chi-Square statistic = 0.030 with d.f. = 4 CV = 9.488

TABLE 4.55

TOTAL SHIPMENTS FOR 40% INCENTIVE WITH 20%
SALES RESPONSE INCREASE WITH DIFFERENT
PAYBACK LEVELS AT LOW
LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Year			Total:
	1	2	3	
20% Payback 008	213	224	228	665
Zero Payback 012	213	222	221	656
Total	426	446	449	1321

Testing Condition	Expected Frequencies			Total:
	1	2	3	
20% Payback 008	214.5	224.5	226.0	665
Zero Payback 012	211.5	221.5	223.0	656
Total:	426	446	449	1321

Chi-Square statistic = 0.057 with d.f. = 2 CV = 5.991

TABLE 4.56

TOTAL SHIPMENTS FOR 40% INCENTIVE WITH 20%
SALES RESPONSE INCREASE WITH DIFFERENT
PAYBACK LEVELS AT HIGH
LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Year			Total:
	1	2	3	
20% Payback 021	228	237	238	703
Zero Payback 025	229	239	239	707
Total:	457	476	477	1410

Expected Frequencies

Testing Condition	Year			Total:
	1	2	3	
20% Payback 021	227.9	237.3	237.8	703
Zero Payback 025	229.1	238.7	239.2	707
Total:	457	476	477	1410

Chi-Square statistic = 0.001 with d.f. = 2 CV = 5.991

TABLE 4.57

TOTAL SHIPMENTS FOR 40% INCENTIVE WITH 40%
SALES RESPONSE INCREASE WITH DIFFERENT
PAYBACK LEVELS AT LOW
LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Payback 010	214	225	229	668
20% Payback 009	215	224	228	667
Zero Payback 013	214	224	227	665
Total:	643	673	684	2000

Expected Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Payback 010	214.8	224.8	228.5	668
20% Payback 009	214.4	224.4	228.1	667
Zero Payback 013	213.8	223.8	227.4	665
Total:	643	673	684	2000

Chi-Square statistic = 0.008 with d.f. = 4 CV = 9.488

TABLE 4.58

TOTAL SHIPMENTS FOR 40% INCENTIVE WITH 40%
SALES RESPONSE INCREASE AT DIFFERENT
PAYBACK LEVELS AT HIGH
LEVEL OF UNCERTAINTY

Observed Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Payback 023	230	237	240	707
20% Payback 022	230	237	241	708
Zero Payback 026	229	237	242	708
Total:	689	711	723	2123

Expected Frequencies

Testing Condition	Year			Total:
	1	2	3	
40% Payback 023	229.5	236.8	240.8	707
20% Payback 022	229.8	237.1	241.1	708
Zero Payback 026	229.8	237.1	241.1	708
Total:	689	711	723	2123

Chi-Square statistic = 0.010 with d.f. = 4 CV = 9.488

Hypothesis Five. The use of an incentive results in a decreased level of financial performance for the distribution center/retail network.

In order to test this hypothesis, costs were assigned to each measure of distribution performance. These costs were then totaled for that testing condition, resulting in a single dependent variable for each testing condition. As part of this procedure, revenue was calculated based on the level of sales times the gross margin per product. The resulting figure was one of absolute revenue reflecting only those factors that were examined in this research. These costs and revenue assignments are seen in Table 4.59 below.

Table 4.59
Distribution Cost Assignments

<u>Dependent Variable</u>	<u>Cost Assignment</u>	
Inventory Level	Inventory cost based on ¹ 25% of product cost per year.	
Shipment Size/Number of Shipments	Rates based on category of shipment size. ²	
	Category 1	\$12.87/# wt (LTL)
	2	\$10.29/# wt (LTL)
	3	\$ 6.06/# wt (TL)
	4	\$ 6.06/# wt (TL)
	5	\$ 4.56/# wt (CL)
Customer Service Level	Each 1% reduction in customer service level results in a .5% ³ reduction in future sales.	
Product Revenue ⁴	(No Pass Thru)	(Pass Thru)
(A) Without Incentive	<u>Option One</u>	<u>Option Two</u>
(Level 1.)		
Cost	1.00	N/A
Resale	1.25	
Margin (\$)	.25	
Margin (%)	.20	
(B) Under Incentive (Levels 2 and ³)		
Cost	.90	.90
Resale	1.25	1.13
Margin (\$)	.35	.23
Margin (%)	.28	.20

Table 4.59

Distribution Cost Assignments

<u>Dependent Variable</u>	<u>Cost Assignment</u>	
Inventory Level	Inventory cost based on ¹ 25% of product cost per year.	
Shipment Size/Number of Shipments	Rates based on ² category of shipment size.	
	Category 1	\$12.87/# wt (LTL)
	2	\$10.29/# wt (LTL)
	3	\$ 6.06/# wt (TL)
	4	\$ 6.06/# wt (TL)
	5	\$ 4.56/# wt (CL)
Customer Service Level	Each 1% reduction in customer service level results in a .5% ³ reduction in future sales.	
Product Revenue ⁴	(No Pass Thru)	(Pass Thru)
(A) Without Incentive	<u>Option One</u>	<u>Option Two</u>
(Level 1.)		
Cost	1.00	N/A
Resale	1.25	
Margin (\$)	.25	
Margin (%)	.20	
(B) Under Incentive (Levels 2 and ³)		
Cost	.90	.90
Resale	1.25	1.13
Margin (\$)	.35	.23
Margin (%)	.28	.20

Utilizing the above cost assignments each testing condition produced a financial performance figure based on the following formula on an individual product and distribution center basis:

Economic Performance Under Incentive/
Non Incentive Scenarios:

I = Average Inventory
 S = Sales Per Year
 C = Customer Service Level
 M = Ideal Customer Service Level to Maintain Market Share
 L₁ ... L₅ = Shipment Category Cost
 H₁ = Inventory Holding Cost Per Year
 U = Unit Cost
 D = Discount Off Unit Cost For Incentive
 R = Resale Price Per Unit
 P = Resale % Discount Due to Incentive Pass Thru + Selling Expenses
 V₁ ... V₅ = Volume of Shipments in Each Category

Cost Calculation:

$$\begin{aligned}
 & [I * H * U(1-D)] + [L_1V_1 + L_2V_2 + L_3V_3 + \\
 & \text{(Inventory Carrying Cost)} \quad \text{(Cost of Shipments)} \\
 & L_4V_4 + L_5V_5] + [(M-C) * .5 * S (R-U)] \\
 & \quad \quad \quad \text{(Cost of Stockouts)}
 \end{aligned}$$

Revenue Calculation:

$$\begin{aligned}
 & [S * R (1-P)] - [S * U * (1-D)] \\
 & \text{(Sales Revenue)} \quad \text{(Cost of Goods Sold)}
 \end{aligned}$$

Net Performance = Revenue - Cost

This calculation was performed on a per product, per distribution center basis, resulting in the same number of cases as utilized in hypotheses one and two.

In addition to the variables utilized up to this point in the research, another variable was introduced. This consisted of two options in each incentive scenario. In the first option, there was no price reduction at the retail level. In the second option there was a reduction in the retail price level equal to the reduction in cost from the manufacturer to the distribution center.⁴

Results of the testing environment caused this hypothesis to be rejected under conditions of incentives where sales were equal to the incentive level, and no sales pay-back occurred. However under many testing conditions, there were substantial reductions in financial performance. These results are detailed in the discussion which follows, and are expanded upon in Chapter V.

As seen in Figure 4.15, at both levels of uncertainty, financial performance was improved as the testing condition was changed from the non-incentive scenario, TC 001 to incentive scenarios TC 006 and 013, under Option One. This improvement in performance was substantial and significant at $\alpha = .01$. Under the low level of uncertainty, product revenue changed from \$2416.48 to \$23,843.09 from TC 001 to TC 013. However, under Option Two the improvement, although still statistically significant was not as great. Under this option, product revenue improved from \$2416.48 to \$5604.45. This indicated that policies of the distribution center/retail network to pass on to the final consumer the dollar discount may have a substantial impact on the

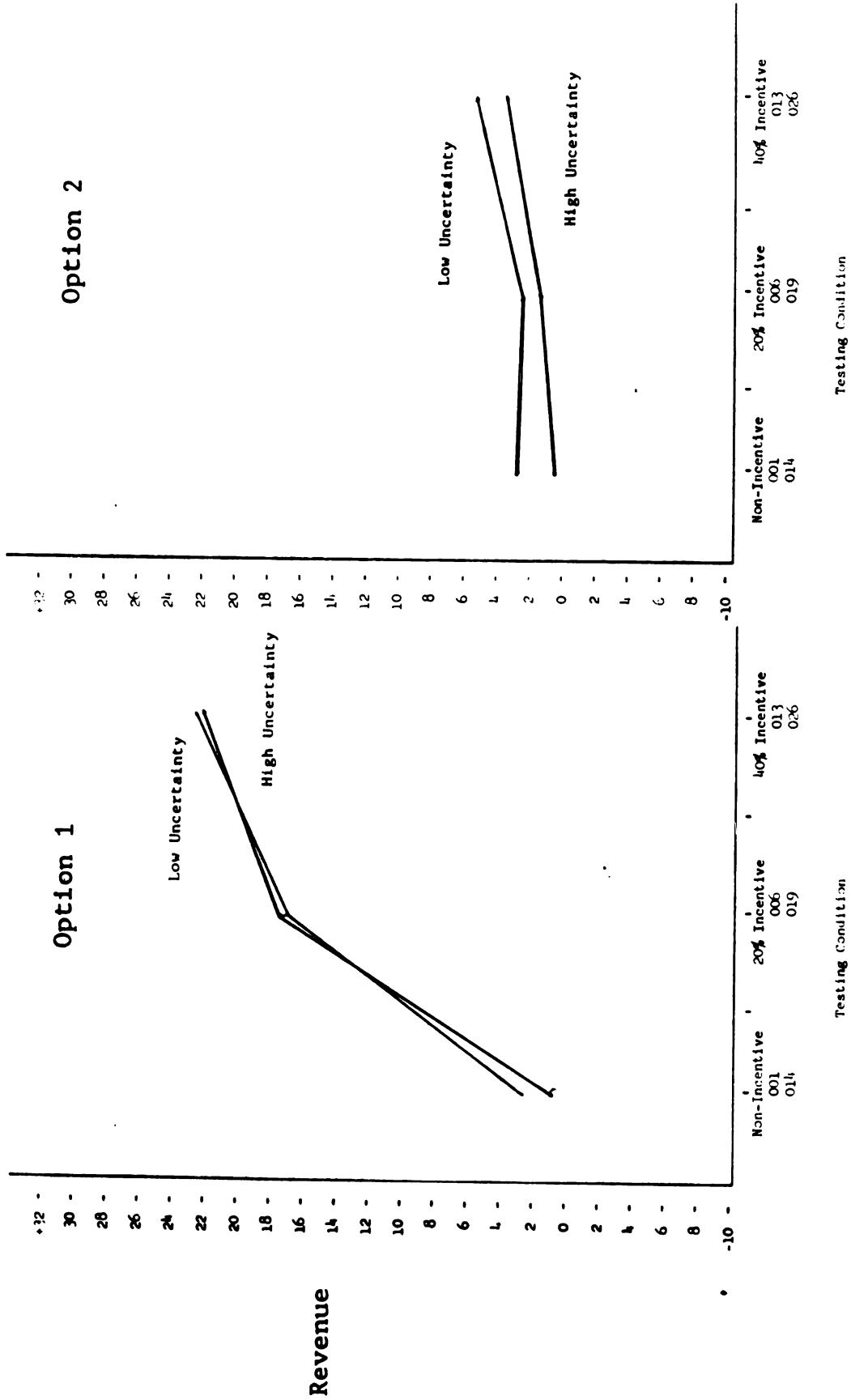


Figure 4.15 Comparison of financial performance for incentive and non-incentive testing conditions.

TABLE 4.60

Analysis of Variance of Financial Performance by Incentive
Level at Low Level of Uncertainty (Option 1)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	17937110266.2065	8968555133.1033	1862.528	0
Within Groups	222	1068987618.2944	4815259.5419		
Total	224	19006097884.5009			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
001	75	2416.4800	1887.1715	217.9118	-3799.0000	7691.0000	1982.2813 to 2850.6787
006	75	16926.8080	2202.1209	254.2790	11888.8000	22584.4000	16420.1460 to 17433.4700
013	75	23843.0939	2456.6289	283.6671	16778.7000	30918.0400	23277.8749 to 24408.3129
TOTAL	225	14395.4606	9211.3328	614.0889			13185.3304 to 15605.5909

TABLE 4.61
Analysis of Variance of Financial Performance by Incentive
Level at Low Level of Uncertainty (Option 2)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	516555653.1205	258277826.5602	66.858	.0000
Within Groups	222	857605430.9326	3863087.5267		
Total	224	1374161084.0531			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
001	75	2416.4800	1887.1715	217.9118	-3799.0000	7691.0000	1982.2813 to 2850.6787
006	75	2364.6397	1918.1827	221.4927	-1967.4000	7273.5600	1923.3060 to 2805.9735
013	75	5604.4512	2085.2869	240.7882	-432.7800	11607.4000	5124.6702 to 6084.2322
TOTAL	225	3461.8570			-3799.0000	11607.4000	

TABLE 4.62
Analysis of Variance of Financial Performance by Incentive
Level at High Level of Uncertainty (Option 1)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	20540676067.2454	10270338033.6227	606.570	0
Within Groups	222	3758864338.6230	16931821.3451		
Total	224	24299540405.8684			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
014	75	443.2000	2740.8282	316.4836	-6987.0000	6138.0000	-187.4073 to 1073.8073
019	75	17279.4672	3473.5241	401.0880	4743.3600	25020.9600	16480.2819 to 18078.6525
026	75	22940.3464	5587.3030	645.1662	4285.9200	33213.8800	21654.8247 to 24225.8681
TOTAL	225	13554.3379			-6987.0000	33213.8800	

TABLE 4.63
 Analysis of Variance of Financial Performance by Incentive
 Level at High Level of Uncertainty (Option 2)

SOURCE		D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups		2	332924505.4348	166462252.7174	13.463	.0000
Within Groups		222	2744804254.5415	12363983.1286		
Total		224	3077728759.9763			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
014	75	443.2000	2740.8282	316.4836	-6987.0000	6138.0000	-187.4073 to 1073.8073
019	75	1350.0147	2949.0928	340.5319	-9445.7600	7924.0400	671.4900 to 2028.5393
026	75	3354.6056	4569.7552	527.6699	-11973.5600	11694.6000	2303.2004 to 4406.0108
TOTAL	225	1715.9401			-11973.5600	11694.6000	

financial gain or loss of an incentive. This result held true for the higher level of uncertainty also. These results by category are depicted in Tables 4.60 through 4.63.

Under the condition of an incentive producing sales equal to the incentive amount, without any payback, the assigned costs subtracted from revenues produced a positive and significant gain. Under these conditions, hypotheses five would be accepted.

Additional comparisons were made in the same sequence as hypotheses one through four, to examine the impact of sales response increases, and sales response paybacks within a given incentive scenario.

Figure 4.16 depicts the impacts of various sales responses, without payback on a 20% level incentive. Under Option One, product revenue increased substantially and significantly as the level of incentive increased. All of these levels of performance are above the figure for the non-incentive scenario also. This result held true for both levels of uncertainty. Under Option Two, however, results were higher than the original level of performance only in the case of the incentive producing a sales response equal to the incentive level. This was true for a low level of uncertainty. At a high level of uncertainty, results were higher than the non-incentive scenario in testing condition 019 also. These results are seen in Tables 4.6 through 4.67.

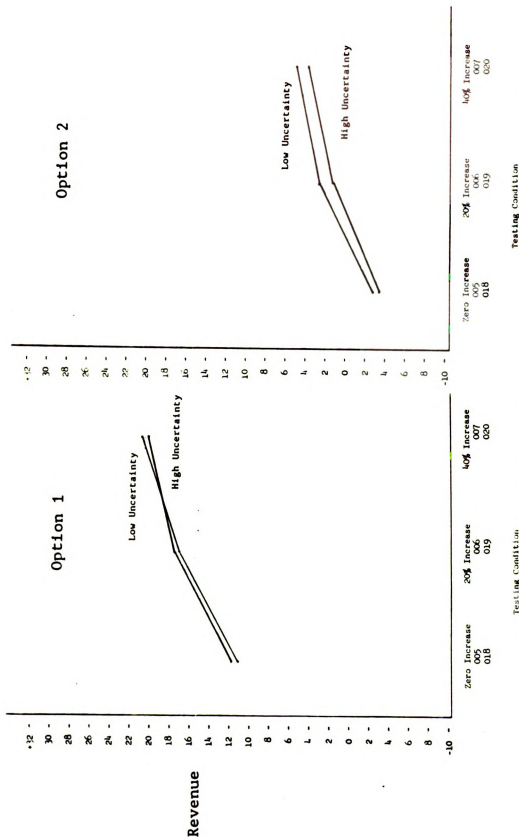


Figure 4.16 Comparison of financial performance for 20% incentive with different sales response levels.

TABLE 4.64

Analysis of Variance of Financial Performance for 20% Incentive with
Different Sales Response Increases at Low Level of Uncertainty (Option 1)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	3517856454.0837	1758928227.0419	362.613	.0000
Within Groups	222	1076857111.0084	4850707.7072		
Total	224	4594713565.0921			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
005	75	11065.8912	1992.8370	230.1130	6916.4400	15016.9200	10607.3810 to 11524.4014
006	75	16926.8080	2202.1209	254.2790	11888.8000	22584.4000	16420.1460 to 17433.4700
007	75	20674.2512	2394.0316	276.4390	15643.3600	29258.6800	20123.4345 to 21225.0679
TOTAL	225	16222.3168			6916.4400	29258.6800	

TABLE 4.65

Analysis of Variance of Financial Performance for 20% Incentive with
Different Sales Response Increases at Low Level of Uncertainty (Option 2)

SOURCE		D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups		2	2398282824.6880	1199141412.3440	326.623	.0000
Within Groups		222	815035563.2949	3671331.3662		
Total		224	3213318387.9829			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
005	75	-2574.3864	1736.1533	200.4737	-6156.7600	816.2000	-2973.8390 to -2174.9338
006	75	2364.6397	221.4927	1918.4927	-1967.4000	7273.5600	1923.3060 to 2805.9735
007	75	5342.1600	2078.5431	240.0095	962.9800	12784.3600	4863.9307 to 5820.3893
TOTAL	225	1710.8044			-6156.7600	12784.3600	
UNGROUPED DATA			3787.5020	252.5001			1213.2249 to 2208.3840

TABLE 4.66
Analysis of Variance of Financial Performance for 20% Incentive with
Different Sales Response Increases at High Level of Uncertainty (Option 1)

SOURCE		D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups		2	2640918351.4048	132059175.7024	96.070	.0000
Within Groups		222	3051342820.7950	13744787.4811		
Total		224	5692261172.1998			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
018	75	11894.4176	3374.6627	389.6725	4340.6400	18506.7600	11117.9782 to 12670.8570
019	75	17279.4672	3473.5241	401.0880	4743.3600	25020.9600	16480.2819 to 18078.6525
020	75	20160.9264	4216.7101	486.9037	7254.0800	30037.5200	19190.7495 to 21131.1033
TOTAL	225	16444.9371			4340.6400	30037.5200	

TABLE 4.67
 Analysis of Variance of Financial Performance for 20% Incentive with
 Different Sales Response Increases at High Level of Uncertainty (Option 2)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	2640918351.4048	1320459175.7024	96.070	.0000
Within Groups	222	3051342820.7950	13744787.4811		
Total	224	5692261172.1998			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
018	75	-3078.1509	2865.3957	330.8674	-9372.3000	2660.7200	-3737.4186 to -2418.8832
019	75	1350.0147	2949.0928	340.5319	-9445.7600	7924.0400	671.4900 to 2028.5393
020	75	3599.4131	3575.7681	412.8941	-7515.0400	11877.7200	2776.7035 to 4422.1226
TOTAL	225	623.7589			-9445.7600	11877.7200	
UNGROUPED DATA			4187.9908	279.1994			73.5656 to 1173.9523

This comparison was also made for the 40% incentive with different sales responses, without payback. The results as depicted in Figure 4.17 indicate that again, under Option One, all testing conditions results were higher than the original non-incentive scenario and that these results were significantly different from each other at the $\alpha = .01$ level. These results held true for both high and low levels of uncertainty, and are depicted in Tables 4.68 and 4.70.

Under Option Two, the results were quite different. At the low uncertainty level, only in the case of the incentive at 40% with an equal sales response, TC013, were the performance results greater than the original non incentive testing condition. Under the high uncertainty level, results were greater for both the 40% incentive with 40% and 20% sales increase. These results are depicted in Tables 4.69 through 4.71.

These results would indicate that within a given incentive scenario that a financial benefit may or may not occur based on the level of sales increase, and based on the degree of demand uncertainty.

In order to examine the impact of sales payback, comparisons were made within incentive levels with a given sales increase. Figure 4.18 depicts the results of a 20% incentive with a 20% sales response increase at payback levels of zero and 20%. Under Option One, the level of payback had a significant negative impact on performance at

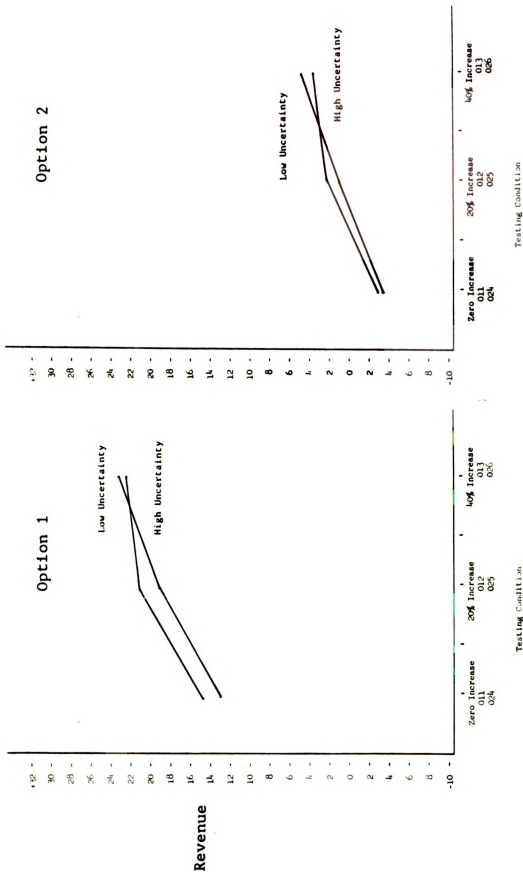


Figure 4.17 Comparison of financial performance for 40% incentive with different sales response levels.

TABLE 4.68

Analysis of Variance of Financial Performance for 40% Incentive with
Different Sales Responses at Low Level of Uncertainty (Option 1)

SOURCE		D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups		2	4413014084.9297	2206507042.4648	455.710	0
Within Groups		222	1074904654.9321	4841912.8601		
Total		224	5487918739.8618			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
011	75	12999.7848	1908.0711	220.3251	8934.6200	18271.9600	12560.7775 to 13438.7921
012	75	18699.4107	2202.2665	254.2958	12712.8000	23938.8000	18192.7152 to 19206.1062
013	75	23843.0939	2456.6289	283.6671	16778.7000	30918.0400	23277.8749 to 24408.3129
TOTAL	225	18514.0964			8934.6200	30918.0400	
UNGROUPED DATA			4949.7108	329.9807			17863.8328 to 19164.3601

TABLE 4.69

Analysis of Variance of Financial Performance for 40% Incentive with
Different Sales Responses at Low Level of Uncertainty (Option 2)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	2876009917.9508	1438004958.9754	412.591	.0000
Within Groups	222	773737571.7739	3485304.3774		
Total	224	3649747489.7247			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
011	75	-3148.0845	1621.3242	187.2144	-6661.8600	1331.1200	-3521.1174 to -2775.0517
012	75	1483.2069	1865.1540	215.3694	-3645.2800	5869.8400	1054.0740 to 1912.3399
013	75	5604.4512	2085.2869	240.7882	-432.7800	11607.4000	5124.6702 to 6084.2322
TOTAL	225	1313.1912			-6661.8600	11607.4000	

TABLE 4.70
Analysis of Variance of Financial Performance for 40% Incentive with
Different Sales Responses at High Level of Uncertainty (Option 1)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	2678927125.0688	1339463562.5344	63.432	.0000
Within Groups	222	4687878953.4353	21116571.8623		
Total	224	7366806078.5041			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
024	75	14838.7032	3900.5100	450.3921	5926.5600	22522.3800	13941.2773 to 15736.1291
025	75	20975.4480	4113.1231	474.9425	8933.1200	30771.1400	20029.1043 to 21921.7917
026	75	22940.3464	5587.3030	645.1662	4285.9200	33213.8800	21654.8247 to 24225.8681
TOTAL	225	19584.8325			4285.9200	33213.8800	

TABLE 4.71

Analysis of Variance of Financial Performance for 40% Incentive with
Different Sales Responses at High Level of Uncertainty (Option 2)

SOURCE		D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups		2	1651308716.6493	825654358.3246	57.894	.0000
Within Groups		222	3166062289.2096	14261541.8433		
Total		224	4817371005.8589			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
024	75	-2937.3944	3214.7962	371.2127	-10393.4400	3482.3800	-3677.0518 to -2197.7370
025	75	2034.5920	3401.0364	392.7179	-7824.1200	10275.2600	1252.0846 to 2817.0994
026	75	3354.6056	4569.7552	527.6699	-11973.5600	11694.6000	2303.2004 to 4406.0108
TOTAL	225	817.2677			-11973.5600	11694.6000	

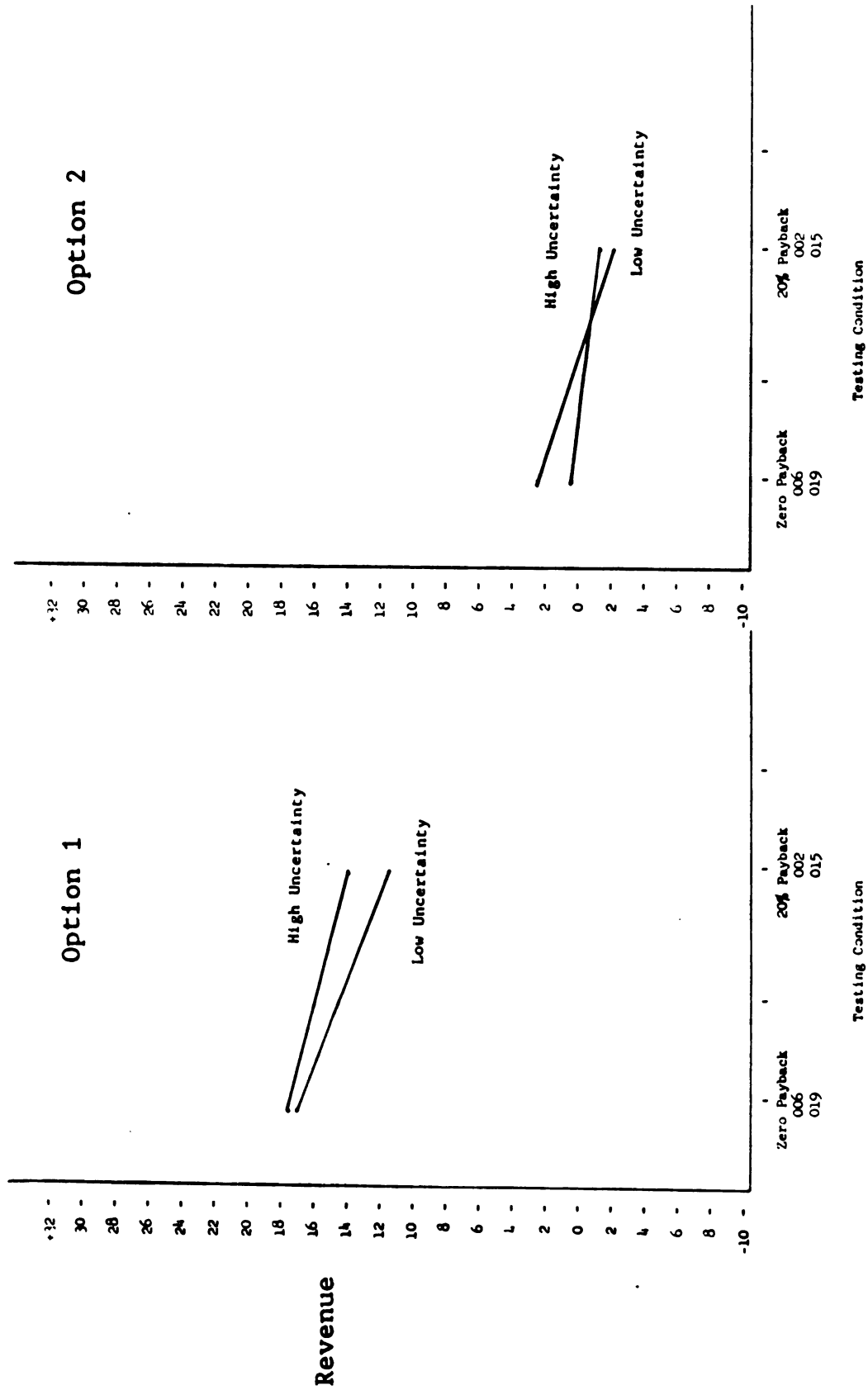


Figure 4.18 Comparison of financial performance for 20% incentive with 20% sales response increase with different payback levels.

the $\alpha = .01$ level at both levels of uncertainty. In the lower level of uncertainty results were higher than the non-incentive scenario in the case of a sales payback equal to the incentive amount. In the case of higher uncertainty this did not hold true. Under Option Two, the presence of a payback function had a substantial and significant negative impact on performance. These results are seen in Table 4.72 through Table 4.75.

This procedure was followed for a 20% incentive with a 40% sales increase at different payback levels as depicted in Figure 4.19. Under Option One, all testing conditions produced results greater than the original testing conditions, for both levels of uncertainty. Under Option Two at a low level of uncertainty this held true for only the testing condition where no payback occurred. At the high level of uncertainty, results were below the non incentive level only in the case of the full payback level. The impact of sales payback within this incentive and sales response comparison was significant in all cases at the $\alpha = .01$ level. These results are seen in Tables 4.76 through 4.79.

An additional comparison was made within a 40% incentive with a 20% sales increase at a zero and 20% payback level. These results are depicted in Figure 4.20 and Tables 4.80 through 4.83. Again Option One produced results higher than the original testing condition under both conditions of uncertainty. Option Two produced results below the original

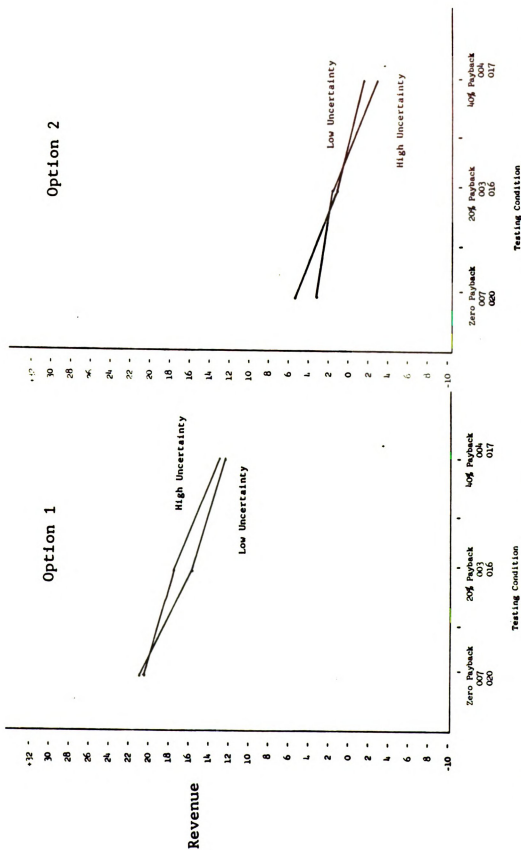


Figure 4.19 Comparison of financial performance for 20% incentive with 40% sales response increase with different payback levels.

TABLE 4.72

Analysis of Variance of Financial Performance for 20% Incentive with 20% Sales Response
Increase with Different Payback Levels at Low Level of Uncertainty (Option 1)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	1	958447725.9265	958447725.9265	250.879	.0000
Within Groups	148	565412621.4528	3820355.5504		
Total	149	1523860347.3793			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
006	75	16926.8080	2202.1209	254.2790	11888.8000	22584.4000	16420.1460 to 17433.4700
002	75	11871.2560	1670.9205	192.9205	8281.4000	15839.7200	11486.8535 to 122255.6585
TOTAL	150	14399.0320			8281.4000	22584.4000	

TABLE 4.73
 Analysis of Variance of Financial Performance for 20% Incentive with 20% Sales Response
 Increase with Different Payback Levels at Low Level of Uncertainty (Option 2)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	1	705044960.3658	705044960.3658	242.776	.0000
Within Groups	148	429806782.4971	2904099.8817		
Total	149	1134851742.8628			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
006	75	2364.6397	1918.1827	221.4927	-1967.4000	7273.5600	1923.3060 to 2805.9735
002	75	-1971.3952	1459.0322	168.4745	-5058.6000	1389.6000	-2307.0880 to -1635.7024
TOTAL	150	196.6223			-5058.6000	7273.5600	

TABLE 4.74

Analysis of Variance of Financial Performance for 20% Incentive with 20% Sales Response
Increase with Different Payback Levels at High Level of Uncertainty (Option 1)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	1	354159501.7886	354159501.7886	28.064	.000
Within Groups	148	1867695300.1213	12619562.8387		
Total	149	2221854801.9099			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
019	75	17279.4672	3473.5241	401.0880	4743.3600	25020.9600	16480.2819 to 18078.6525
015	75	14206.3168	3629.5669	419.1063	4876.4400	22351.5600	13371.2293 to 15041.4043
TOTAL	150	15742.8920			4743.3600	25020.9600	

TABLE 4.75

Analysis of Variance of Financial Performance for 20% Incentive with 20% Sales Response
Increase with Different Payback Levels at High Level of Uncertainty (Option 2)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	1	210879353.5531	210879353.5531	23.435	.0000
Within Groups	148	1331784096.2021	8998541.1906		
Total	149	1542663449.7552			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
019	75	1350.0147	2949.0928	340.5319	-9445.7600	7924.0400	671.4900 to 2028.5393
015	75	-1021.3667	3049.5794	352.1351	-9043.5600	5966.5600	-1723.0112 to -319.7222
TOTAL	150	164.3240			-9445.7600	7924.0400	

TABLE 4.76

Analysis of Variance of Financial Performance for 20% Incentive with 40% Sales Response
Increased with Different Payback Levels at Low Level of Uncertainty (Option 1)

SOURCE		D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups		2	2749295587.9097	1374647793.9548	301.983	.0000
Within Groups		222	1010559951.9391	4552071.8556		
Total		224	3759855539.8488			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
007	75	20674.2512	2394.0316	276.4390	15643.3600	29258.6800	20123.4345 to 21225.0679
003	75	15714.4048	2145.6234	247.7553	10023.4400	21020.7200	15220.7417 to 16208.0679
004	75	12149.8384	1822.3963	210.4322	6875.6800	17253.1600	11730.5431 to 12569.1337
TOTAL	225	16179.4981			6875.6800	29258.6800	

TABLE 4.77

Analysis of Variance of Financial Performance for 20% Incentive with 40% Sales Response
Increased with Different Payback Levels at Low Level of Uncertainty (Option 2)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	1819534922.1488	909767461.0744	266.405	.0000
Within Groups	222	758124234.6235	3414974.0298		
Total	224	2577659156.7723			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
007	75	5342.1600	2078.5431	240.0095	962.9800	12784.3600	4863.9307 to 5820.3893
003	75	1109.8965	1856.6285	214.3850	-3847.2600	5632.7400	682.7251 to 1537.0680
004	75	-1565.2824	1574.0112	181.7512	-6086.1600	2771.1400	-1927.4295 to -1204.1353
TOTAL	225	1628.9427			-6086.1600	12784.3600	

TABLE 4.78

Analysis of Variance of Financial Performance for 20% Incentive with 40% Sales Response
Increased with Different Payback Levels at High Level of Uncertainty (Option 1)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	2337112985.3789	1168556492.6895	78.992	.0000
Within Groups	222	3284103648.9565	14793259.6800		
Total	224	5621216634.3354			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
020	75	20160.9264	4216.7101	486.9037	7254.0800	30037.5200	19190.7495 to 21131.1033
016	75	17503.4384	3652.3748	421.7399	7592.8800	28459.6800	16663.1033 to 18343.7735
017	75	12394.3584	3641.3312	420.4647	4038.8000	24571.4000	11556.5642 to 13232.1526
TOTAL	225	16686.2411			4038.8000	30037.5200	

TABLE 4.79

Analysis of Variance of Financial Performance for 20% Incentive with 40% Sales Response
Increased with Different Payback Levels at High Level of Uncertainty (Option 2)

SOURCE		D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups		2	1480206512.6282	740103076.3141	69.918	.0000
Within Groups		222	2349929529.5827	10585268.1513		
Total		224	3830135682.2109			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
020	75	3599.4131	3575.7681	412.8941	-7515.0400	11877.7200	2776.7035 to 4422.1226
016	75	1595.3763	3078.3018	355.4517	-6907.1200	10799.8400	887.1233 to 2303.6292
017	75	-2559.3485	3081.1922	355.7854	-9713.5800	7730.5200	-3268.2665 to -1850.4306
TOTAL	225	878.4803			-9713.5800	11877.7200	

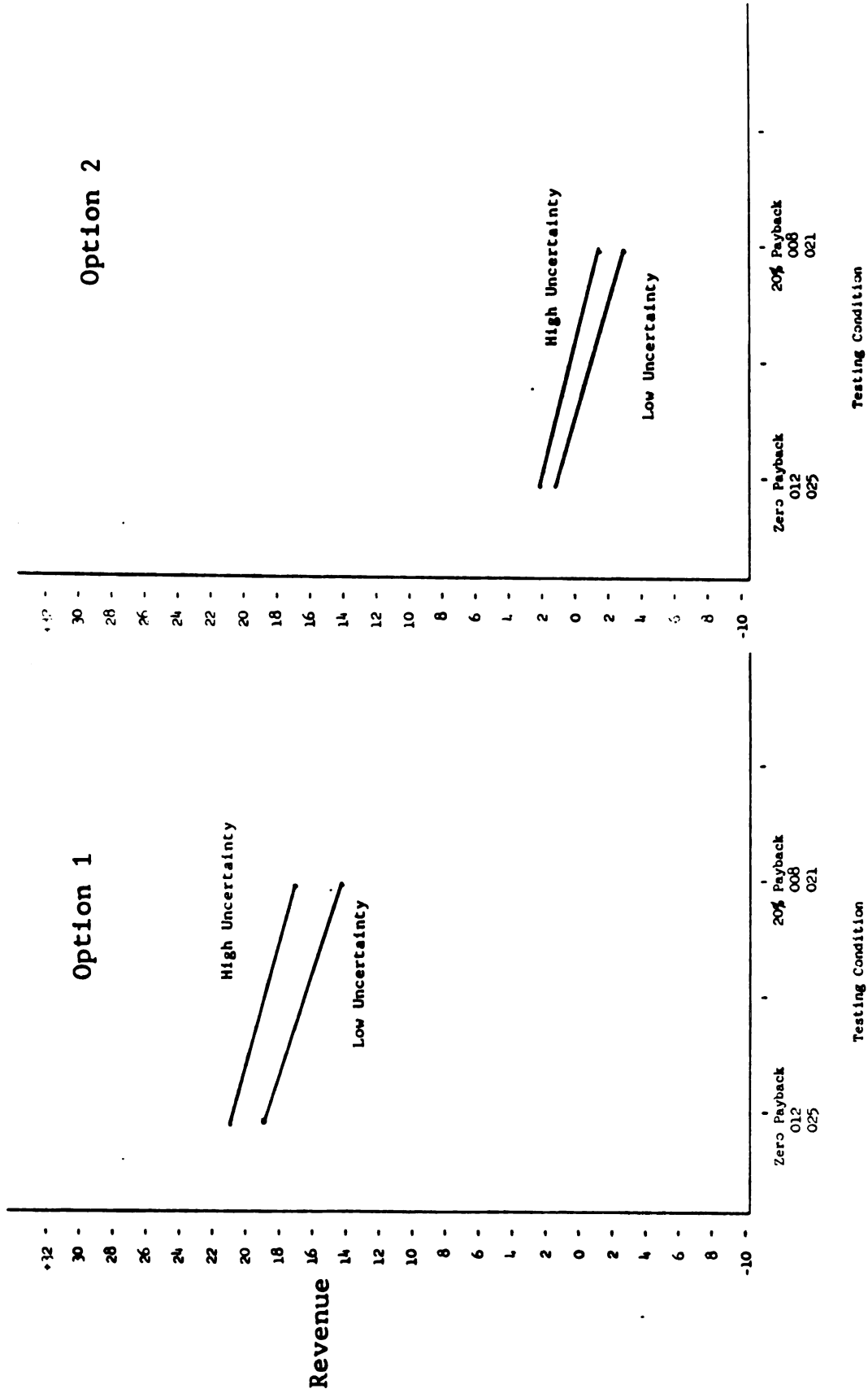


Figure 4.20 Comparison of financial performance for 40% incentive with 20% sales increase with different payback levels.

TABLE 4.80

Analysis of Variance of Financial Performance for 40% Incentive with 20% Sales Increase with Different Payback Levels at Low Level of Uncertainty (Option 1)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	1	813439687.4209	813439687.4209	215.685	.0000
Within Groups	148	558171611.7479	3771429.8091		
Total	149	1371611299.1688			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
012	75	18699.4107	2202.2665	254.2958	12712.8000	23938.8000	18192.7152 to 19206.1062
008	75	14041.9731	1641.0003	189.4864	10004.1600	17866.7600	13664.4132 to 14419.5330
TOTAL	150	16370.6919			10004.1600	23938.8000	

TABLE 4.81

Analysis of Variance of Financial Performance for 40% Incentive with 20% Sales Increase with Different Payback Levels at Low Level of Uncertainty (Option 2)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	1	518079920.6646	518079920.6646	190.931	.0000
Within Groups	148	401589340.9422	2713441.4929		
Total	149	919669261.6068			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
012	75	1483.2069	1865.1540	215.3694	-3645.2800	5869.8400	1054.0740 to 1912.3399
008	75	-2233.7091	1395.7377	161.1659	-5635.8400	990.5200	-2554.8391 to -1912.5790
TOTAL	150	-375.2511			-5635.8400	5869.8400	

TABLE 4.82

Analysis of Variance of Financial Performance for 40% Incentive with 20% Sales Increase with Different Payback Levels at High Level of Uncertainty (Option 1)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	1	454018486.5295	454018486.5295	25.126	.0000
Within Groups	148	2674291119.9481	18069534.5942		
Total	149	3128309606.4776			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
025	75	20975.4480	4113.1231	474.9425	8933.1200	30771.1400	20029.1043 to 21921.7917
021	75	17495.9136	4384.2089	506.2448	7784.8400	28524.7000	16487.1987 to 18504.6285
TOTAL	150	19235.6808			7784.8400	30771.1400	

TABLE 4.83

Analysis of Variance of Financial Performance for 40% Incentive with 20% Sales Increase with Different Payback Levels at High Level of Uncertainty (Option 2)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	1	269150396.5798	269150396.5798	21.896	.0000
Within Groups	148	1819284347.5796	12292461.8080		
Total	149	2088434744.1595			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
025	75	2034.5920	3401.0364	392.7179	-7824.1200	10275.2600	1252.0846 to 2817.0994
021	75	-644.4645	3608.0292	416.6193	-8787.4400	8448.3800	-1474.5967 to 185.6676
TOTAL	150	695.0637			-8787.4400	10275.2600	

level in all cases except TC025. When a payback occurred these levels were negative at both uncertainty levels. In the absence of payback, the low level of uncertainty produced a value less than the non-incentive scenario, whereas the high level of uncertainty produced greater amount. Within this comparison, the impact of payback on financial performance was significant in all cases at the $\alpha = .01$ level.

A final comparison was made for a 40% incentive with a 40% sales increase with different payback levels. As seen previously, under Option One improved performance over the non-incentive scenario occurred. These results were significantly different from each other at the $\alpha = .01$ level. Under Option Two, under a low level of uncertainty, these results were above the original level, only in the condition of a zero sales payback. Under a high level of uncertainty these results were above the original level for both a zero and 20% payback level. The results are depicted in Figure 4.21 and Tables 4.84 through 4.87.

The comparisons made within this hypothesis would indicate that 1.) Under ideal conditions of a sales response increase equal to the incentive level and without any sales payback occurring that an incentive would improve financial performance. 2.) Under Option One, where the incentive discount is not passed on to the consumer performance is improved. 3.) A sales increase not equal to the level of the incentive may reduce financial performance. 4.) The

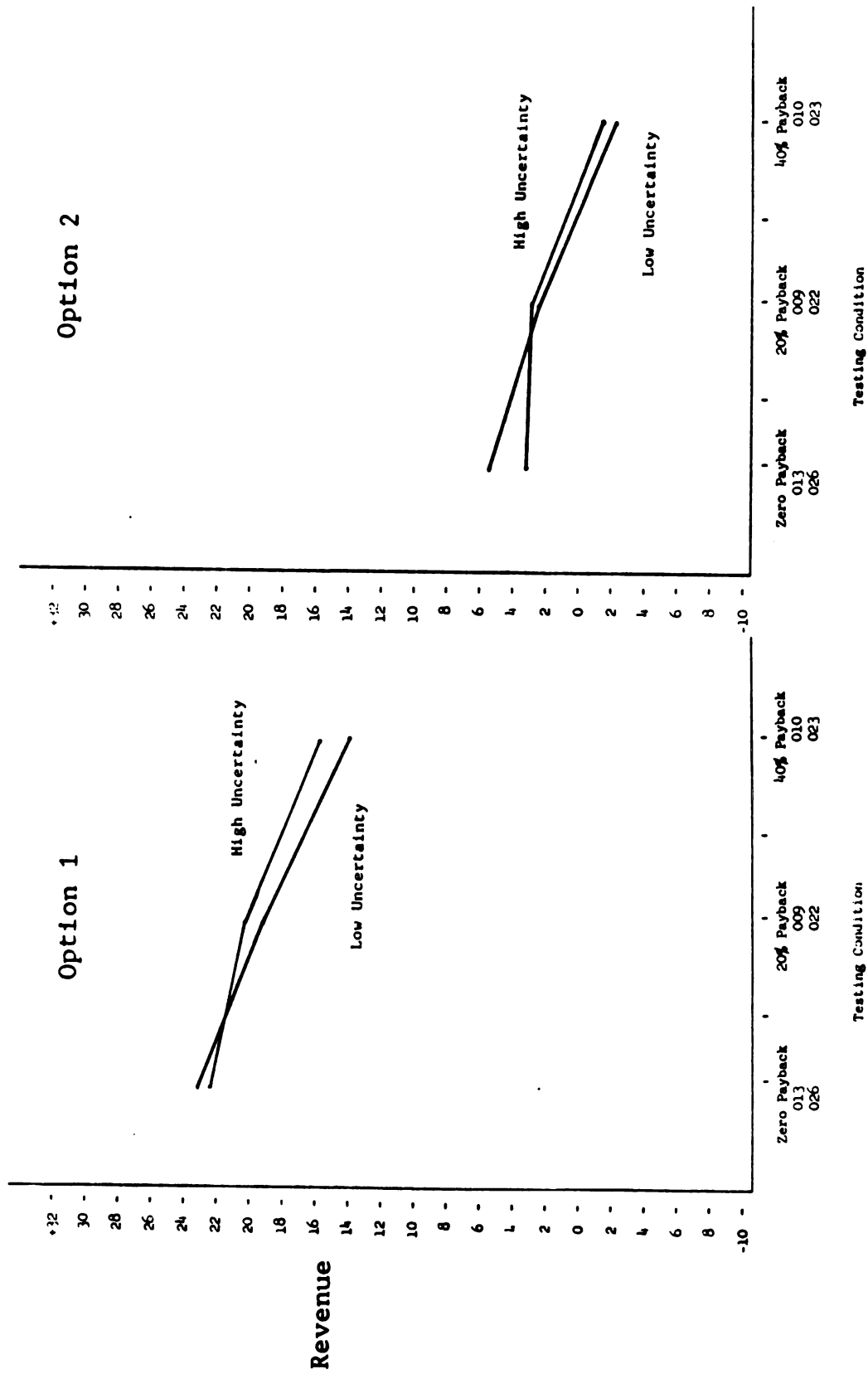


Figure 4.21 Comparison of financial performance for 40% incentive with 40% sales increase with different payback levels.

TABLE 4.84

Analysis of Variance of Financial Performance with 40% Incentive with 40% Sales Increase with Different Payback Levels at Low Level of Uncertainty (Option 1)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	3499412018.4849	1749706009.2424	385.148	.0000
Within Groups	222	1008534850.0618	4542949.7751		
Total	224	4507946868.5467			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
013	75	23843.0939	2456.6289	283.6671	16778.7000	30918.0400	23277.8749 to 24408.3129
009	75	19630.3440	2042.8807	235.8916	15022.6400	23890.4000	19160.3198 to 20100.3682
010	75	14208.3533	1849.4491	213.5560	8369.4400	18964.2200	13782.7337 to 14633.7729
TOTAL	225	19227.2304			8369.4400	30918.0400	

TABLE 4.85

Analysis of Variance of Financial Performance with 40% Incentive with 40% Sales Increase with Different Payback Levels at Low Level of Uncertainty (Option 2)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	2144917254.1934	1072458627.0967	329.471	.0000
Within Groups	222	722630092.5665	3255090.5071		
Total	224	2867547346.7600			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
013	75	5604.4512	2085.2869	240.7882	-432.7800	11607.4000	5124.6702 to 6084.2322
009	75	2337.0645	1729.4856	199.7038	-1519.0400	5856.8000	1939.1460 to 2734.9830
010	75	-1936.1435	1557.4753	179.8418	-6827.2000	1985.3000	-2294.4860 to -1577.8009
TOTAL	225	2001.7908			-6827.2000	11607.4000	

TABLE 4.86

Analysis of Variance of Financial Performance with 40% Incentive with 40% Sales Increase with Different Payback Levels at High Level of Uncertainty (Option 1)

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	1509439107.0205	754719553.5103	34.701	.0000
Within Groups	222	4828267540.3818	21748952.8846		
Total	224	6337706647.4023			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
026	75	22940.3464	5587.3030	645.1662	4285.9200	33213.8800	21654.8247 to 24225.8681
022	75	21440.1768	4408.2494	509.0208	7630.0800	32688.2000	20425.9307 to 22454.4229
023	75	16851.6381	3820.5027	441.1536	6450.1800	27748.2200	15972.6203 to 17730.6560
TOTAL	225	20410.7204			4285.9200	33213.8800	

TABLE 4.87

Analysis of Variance of Financial Performance with 40% Incentive with 40% Sales Increase with Different Payback Levels at High Level of Uncertainty (Option 2)

SOURCE		D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups		2	861143201.7287	430571600.8643	29.546	.0000
Within Groups		222	3235199558.4166	14572970.9839		
Total		224	4096342760.1453			

TC	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN
026	75	3354.6056	4569.7552	527.6699	-11973.5600	11694.6000	2303.2004 to 4406.0108
022	75	2403.6493	3616.1317	417.5549	-8997.9600	11583.7200	1571.6530 to 3235.6457
023	75	-1188.3811	3124.0746	360.7371	-9655.6200	7700.4600	-1907.1654 to -469.5968
TOTAL	225	1523.2913			-11973.5600	11694.6000	

presence of sales payback at the conclusion of the incentive may reduce financial performance and 5.) passing on the incentive discount may compound the effects of number three and four above, resulting in financial performance substantially below the non-incentive scenario. Results of all testing conditions are depicted in Table 4.88.

Overall, hypothesis five was rejected, however, it must be noted that under less than ideal conditions, in many cases financial performance was diminished. Clearly the cost impacts of logistical changes due to an incentive can be substantial.

This chapter has described the results and conclusions of the research. Chapter V which follows, contains the implications of the research findings.

Table 4.88

TESTING ENVIRONMENT OUTPUT									
HYPOTHESIS FIVE, TESTING OUTPUT, ALL CONDITIONS									
INC	SRP	SRI	SLSU	FINANCIAL PERFORMANCE Option 1		FINANCIAL PERFORMANCE Option 2		S.D.	S.D.
				MEAN	S.D.	MEAN	S.D.		
001	1	1	1	\$2416.48	\$1887.17	\$2416.48	\$1887.17		
002	2	2	1	11871.26	1670.74	(1971.40)	1459.03		
003	2	3	1	15714.40	2145.62	1109.90	1856.63		
004	2	3	1	12149.84	1822.39	(1565.28)	1574.01		
005	2	1	1	11065.89	1992.84	(2574.39)	1736.15		
006	2	2	1	16926.81	2202.12	2364.64	1918.18		
007	2	3	1	20674.25	2394.03	5342.16	2078.54		
008	3	2	1	14041.97	1641.00	(2233.71)	1395.74		
009	3	3	1	19630.34	2042.88	2337.06	1729.49		
010	3	3	1	14208.35	1849.45	(1936.14)	1557.48		
011	3	1	1	12999.78	1908.07	(3148.08)	1621.32		
012	3	2	1	18699.41	2202.27	1483.21	1865.15		
013	3	3	1	23843.09	2456.63	5604.45	2085.29		
014	1	1	2	443.20	2740.83	443.20	2740.83		
015	2	2	2	14206.32	3629.57	(1021.37)	3049.58		
016	2	3	2	17503.44	3652.37	1595.38	3078.30		
017	2	3	2	12394.36	3641.33	(2559.35)	3081.19		
018	2	1	2	11894.42	3374.66	(3078.15)	2865.40		
019	2	2	2	17299.47	3473.52	1350.01	2949.09		
020	2	3	2	20160.93	4216.71	3599.41	3575.76		
021	3	2	2	17495.91	4384.21	(644.46)	3608.03		
022	3	3	2	21440.18	4408.25	2403.65	3616.13		
023	3	3	2	16851.64	3820.50	(1188.38)	3124.07		
024	3	1	2	14838.70	3900.51	(2937.39)	3214.80		
025	3	2	2	20975.45	4113.12	2034.59	3401.04		
026	3	3	2	22940.35	5587.30	3354.61	4569.76		

CHAPTER IV - FOOTNOTES

¹For a review of inventory costs and costing methodology see: Lambert, Douglas M. and James R. Stock, Strategic Physical Distribution Management. Richard D. Irwin, Inc. 1982. pp. 241-271.

²Rates for this calculation was based on a relative rate per hundred weight as follows:

Cat 1	4,000 LBS	\$12.87 per hundred wt (LTL)
2	20,000 LBS	10.29 per hundred wt (LTL)
3	30,000 LBS	6.06 per hundred wt (TL)
4	40,000 LBS	6.06 per hundred wt (TL)
5	100,000 LBS	4.56 per hundred wt (CL)

Adapted from: Donald F. Wood and James C. Johnson. Contemporary Transportation. Penwell Publishing Company. 1983. pp. 548-553.

³Based on: Harvey M. Shycon, "How Customer Service Impacts Sales Growth and ROI and How Distribution Can Help Increase Corporate Success." Proceedings of the National Council of Physical Distribution Management, Annual Meeting, San Francisco, California, October 10-13, 1982. Volume II.

⁴Based on discussion with Michelle Green, Promotions Manager, Dow Chemical Company, Consumer Products Division, Indianapolis, Indiana. Also refer to Appendix D for a summary of margins by products in the supermarket industry.

CHAPTER V

IMPLICATIONS OF THE RESEARCH

This chapter discusses the research findings in terms of conclusions drawn by hypothesis, implications of the research in total, limitations of the research, and finally, future research that is warranted.

Review of Hypotheses

Hypothesis One: The use of an incentive increases inventory level for the product under the incentive at the distribution center.

This hypothesis focused on the impact of incentives on inventory level. The findings of the present research would strongly suggest that inventory level is dramatically affected by the presence of an incentive. Inventory levels were seen to increase with the introduction of an incentive, and to be relatively less sensitive to other variables such as the degree of sales increase or payback. Inventory level was seen to increase with the use of an incentive, even in the case of the incentive having a sales increase equal to the incentive, and no sales payback whatsoever. The degree of increase in inventory level was significant when non-incentive and incentive scenarios were compared.

Within incentive scenarios, differences in sales response levels caused inventory levels to be significantly different. As the level of sales response increased, the level of inventory decreased. Differences in sales response payback generally did not cause a significant change in inventory level, which was higher as the level of payback increased.

The increase in inventory level between incentive and non-incentive scenarios would indicate that even in the best possible set of circumstances, where the level of sales increase equalled the incentive level and no payback took place, a higher inventory cost would occur. The significant change in inventory level that occurred when the sales response level was changed would also indicate that this factor would result in substantial cost changes. The level of inventory change due to the different levels of payback which were not significant would imply that this factor would have considerably less impact on cost changes for the firm and channel involved. The difference in the sensitivity of inventory level to these two factors may be due to the fact that the payback factor occurred further away in time from the initial inventory loading, thus the impact of that change was introduced after the inventory level was modified by the degree of sales increase.

The research findings indicate that the use of incentives should be monitored closely by firm and channel management as they do result in dramatic inventory changes. The

areas that need to be examined in this context include the degree of initial incentive inventory loading, and the degree of sales forecast accuracy for the incentive period. The importance of accurately assessing the degree of sales payback, based on the research findings, should carry a lower level of managerial concern.

The industry examined had a relatively fast inventory turnover, causing the incentive impact on inventory to be less than what it would be in a slow turnover situation. In an industry with slow inventory turnover an incentive inventory loading might take months to deplete if sales did not occur at the anticipated level during the incentive. The industry examined had a relatively low cost of inventory causing the financial impact of inventory changes to be less than they would be in an industry with higher inventory costs.¹ The financial disadvantages caused by a higher inventory level associated with incentive usage would also be greater in industries with a higher degree of shrinkage or obsolescence.²

Overall, the research findings strongly indicate that management considering involvement in an incentive with a forward buy should carefully consider the inventory load effect. This effect was found to be detrimental to the financial performance of the distribution center/retail network studied even under optimal conditions. These optimal conditions were where the sales increase

was equal to or greater than the incentive level and no reduction in sales occurred following the incentive. Non-optimal conditions, which are likely to occur in an actual situation, produced results with an even larger negative impact due to the forward buy. Firm and channel management should carefully measure these impacts for their own operating systems and act accordingly.

Hypothesis Two: The use of an incentive decreases the overall customer service level from the distribution center to the retailer for products under the incentive.

The research findings indicated that the customer service level at the distribution center was improved when an incentive was introduced. This was due to the larger inventory carried during incentive scenarios. The comparisons between non-incentive and incentive scenarios resulted in a significant increase in customer service level. Within incentive scenarios, the degree of sales response increase caused a significant decrease in customer service level as that factor increased. The impact of sales payback was also significant, with customer service level increasing as the level of payback became larger.

The changes in customer service level, although positive when taken alone, occurred due to the increase in inventory level in conjunction with the sales patterns examined in the study. Thus the cost of the inventory loading may more than offset any benefit derived from the customer service level

increase. In addition, the presence of an incentive could result in a decreased customer service level. This could occur where there was a sales increase exceeding the incentive level. Two scenarios examined in this study where this was the case did not produce this result, however. These scenarios depicted a 20% differential between the level of sales increase and incentive level. The level where negative customer service level ramifications occur must therefore exist beyond this point.

In the industry examined in this research project the cost of stock-outs was considered relatively low, as consumers would purchase another product in most cases without any undue negative impact on the product stocked out. In other industries, where a relatively higher cost of a stock-out would be expected³ the cost impact might be substantially higher, if this were to occur.⁴

Under the conditions tested in this research, the use of incentives resulted in an improvement in customer service level. This would indicate that a limited degree of managerial concern and action should be placed on this logistical impact of incentive activity. This holds true under the conditions tested, however in other circumstances this might not be the case. Additionally the increase in customer service levels is reflective of the increase in inventory level, which should be a major concern of management.

Hypothesis Three: The use of an incentive results in increased variation in shipment sizes between the manufacturer and the distribution center.

The research findings indicated that there was a significant change in the pattern of shipments as incentive activity was introduced. Incentive versus non-incentive scenarios resulted in larger shipments occurring as the incentive shipments were released. Within incentive scenarios the degree of sales increase generally did not produce a significant change in shipment size. Changes in the level of payback in incentive scenarios did in some cases produce significantly smaller shipment categories. The larger shipment sizes observed from non-incentive scenarios to incentive scenarios were due to the incentive shipments taking place at the beginning of the incentive periods. These larger shipments resulted in lower transportation costs overall as the lower rate breaks were encountered. This reduction in transportation costs due to the incentive would serve to offset the increase in inventory carried observed in Hypothesis One.

The level of sales response within incentive scenarios in most cases did not significantly change the pattern of shipment sizes. It would appear that the initial inventory load due to the incentive made the major difference, whereas the change in sales response had little impact. This could be due to the fact that the initial inventory load was adequate to minimize shipment size differences due

to sales response within the incentive. The impact of payback levels was significant in the majority of cases. This response, which is opposite that observed with sales response, would also appear to be due to the timing of the change in sales level relative to the initial inventory loading. In the case of payback level the change in sales level occurred further out in time from the inventory loading than did the initial sales response. It would follow that given the depletion of inventory within the incentive, the change in sales level during the payback period would have a larger impact on shipment size, as the inventory level at this point would be running at a closer to normal level.

The research findings would indicate that management should be concerned with the cost ramifications of shipment size due to incentive usage, which in this case was seen to result in lower costs. Possibilities exist for further cost reduction within incentive usage. These include the coordinating of incentive shipments either from the same manufacturer or from different manufacturers where the possibility exists for order consolidation. The level of sales response, based on the research findings, would be of lesser concern to management as its impact on shipment size within incentive scenarios was not as substantial. The degree of sales payback, however, should be of concern to management as its impact was substantial and resulted in negating the cost savings made possible by the incentive

shipments originally.

In the industry examined in this research, transportation costs were relatively high compared to the product cost. Inventory costs were relatively low. In this situation the tradeoff between transportation and inventory costs was relatively larger favoring incentive usage. In a situation where transportation costs are relatively low, this positive tradeoff would not be as great. Also, in the situation where there are no cost reductions associated with larger shipments this benefit would be eliminated.⁵

Hypothesis Four: The use of an incentive results in an increase in the total number of shipments from the manufacturer to the distribution center.

The research findings indicated that although there was a substantial shift in the size of shipments, the total number of shipments remained relatively constant. The testing environment included a mix of products, some on the incentive, and others not subject to the incentive. As order sizes were increased for products under the incentive, in some cases regular shipments were included in this larger shipment. After this shipment took place however, reorders on non-incentive products occurred, resulting in close to the same number of total shipments. In the testing environment, no attempt was made to plan ahead on non-incentive products in an attempt to consolidate shipments within the incentive shipment.

In industries where incentive and non-incentive shipment order consolidation is possible, substantial cost

savings could be realized, given the results seen in this Hypothesis and in Hypothesis Three. This would have the result of increasing shipment size and reducing the total number of shipments at the same time. Although not observed in the present research environment, it is possible for the use of incentives to increase the number of shipments from the distribution center to the retail locations. If this were to occur it would be of additional concern in the cost ramifications of incentive usage.

Hypotheses Five: The use of an incentive results in a decreased level of profitability for the distribution center/retail network.

The findings of the research project indicated that the use of an incentive resulted in improved profitability when the market response to the incentive was optimal. This included testing conditions where the sales response was equal to or greater than the incentive level, and where no payback took place. This held true under both options tested. The first option depicted a scenario where the incentive discount was not passed along by the distribution center/retail network. In the second option, the incentive discount was passed along.

In the remainder of the scenarios tested, a dramatic change in results occurred. As seen in Table 5.1, when the incentive discount was not passed along, under the first option, profitability was still improved in all scenarios tested. When the incentive discount was passed along, under the second option, profitability was decreased in

Table 5.1

FINANCIAL PERFORMANCE SUMMARY

Percent Change in Profitability From Non-Incentive Scenario

Testing Condition	<u>OPTION ONE</u> ¹		<u>OPTION TWO</u> ²	
	Low Uncertainty	High Uncertainty	Low Uncertainty	High Uncertainty
20% Incentive, Zero Payback, 40% Sales Response Increase TC007/TC020	+855.7%	+4550.7%	+221.1%	+812.4
20% Incentive, 20% Payback, 40% Sales Response Increase TC003/TC016	+650.4	+3951.0%	(54.1)	+360.0
20% Incentive, 40% Payback, 40% Sales Response Increase TC004/TC017	+502.9	+2797.7	(164.8)	(677.6)
20% Incentive, Zero Payback, 20% Sales Response Increase TC006/TC019	+700.6	+3900.5	(2.2)	+304.7
20% Incentive, Zero Payback, 20% Sales Increase TC002/TC015	+491.3	+3206.8	(181.6)	(330.5)
20% Incentive, Zero Payback, Zero Sales Increase TC005/TC018	+458.0	+2684.9	(206.5)	(794.8)
40% Incentive, Zero Payback, 40% Sales Response Increase TC013/TC026	+986.9	+5178.3	+232.0	+757.1
40% Incentive, 20% Payback, 40% Sales Response Increase TC009/TC022	+812.5	+4839.7	(3.2)	+542.43
40% Incentive, 40% Payback, 40% Sales Increase TC010/TC023	+588.1	+3803.8	(180.1)	(368.2)
40% Incentive, Zero Payback, 20% Sales Response Increase TC012/TC025	+774.0	+4734.7	(38.6)	(559.1)
40% Incentive, 20% Payback, 20% Sales Response Increase TC008/TC021	+581.2	+3949.2	(192.4)	(245.4)
40% Incentive, Zero Payback, Zero Sales Increase TC011/TC024	+538.0	+3349.4	(230.3)	(763.0)

1. Incentive discount not passed on.

2. Incentive discount passed on.

all less than optimal scenarios. In any situation where the sales response was less than the incentive level and/or a sales payback occurred, a reduction in profitability took place. Even in one optimal scenario there was a slight reduction in profitability. This indicates strongly that the use of incentives, given the conditions tested and cost assignments made, are detrimental to profitability when less than optimal conditions exist and the incentive discount is passed along.

This would further indicate that a firm being offered a trade incentive would be inclined to not pass on the discount. If the past experience of the firm were similar to the results identified in this research, it would realize that by passing on the discount, it would gain financially only under optimal conditions. By not passing on the discount it would be assured improved financial performance.

The results of the testing environment indicated that in addition to the significant difference seen in profitability between incentive and non-incentive scenarios, there was a significant difference in profitability due to changes in the level of both sales response increase and payback. This would indicate that a great deal of management attention should be given to all aspects of trade incentive activity tested in this research project. This includes careful attention to price reduction and corresponding demand elasticity, sales forecast accuracy within the

incentive, and assessment of the degree of payback factor to be expected.

As noted in previous hypotheses a number of considerations must be made within each measure of logistical performance relative to their impact on profitability. A summary of these issues appears in Table 5.2.

Implications of the Research

Based on the findings of the present research, substantial logistical impacts occur when a trade incentive is utilized. These impacts have previously not been known. The results produced in this research project indicate that depending upon the exact policies employed and level of market performance attained, an incentive may or may not be beneficial to the firm and channel system involved.

This represents a significant finding in view of the widespread use of trade incentives. Negative financial performance impacts as seen under many scenarios would possibly result in higher consumer prices over a period of time. This would conceivably put the channel engaging in these incentive activities at a competitive disadvantage. The short term gain in sales and market share might be totally negated by the longer term cost ramifications. The present research has indicated that under the conditions encountered in this industry setting that this phenomena may in fact occur.

The implications of the findings of this research project are substantial given the widespread use of trade incentives. Their use has increased at a rapid rate in many industries without a corresponding increase in the knowledge of their logistical and profitability impacts. This research project has shown that the logistical impacts of incentive activity are substantial and that in many cases they result in reduced profitability for the firms involved. The primary implication of this finding is that the widespread use of trade incentives may be damaging to the firms and channels involved. The desire to optimize sales and market share in the short term has created a competitive environment where longer term gains may be sacrificed. These include the logistical impacts as translated into cost and profitability measures, and the expenditures and managerial effort that could be placed in other areas of the marketing mix.

Based on the research findings, incentive usage would be most profitable in channels with a fast assured turnover of inventory without any fear of shrinkage or obsolescence. Lower costs of carrying inventory would also reinforce this improved profitability. Channels would benefit where there were cost savings with larger shipments, or where incentive shipments could be combined with non-incentive shipments. Favorable results of incentive usage would be more likely to occur in cases where the

transportation costs are high relative to inventory costs, thus producing a favorable tradeoff between the two. Firms that have a high cost of stockouts would also tend to realize improved financial performance with incentive usage, based on the research findings. The opposite result would hold true however if the sales response were to exceed the incentive level. In that case incentive usage would be most favorable where the potential damage of sales response exceeding available inventory would be less. Industries that have experienced relatively low amounts of consumer payback would also tend to perform better than industries with a high payback function. The accuracy of sales forecasts for the incentive are also vitally important to the successful usage of an incentive as it minimizes the costs associated with inventory load and possible stockouts. Accurate forecasting would also identify the degree of payback to be expected, which would help the firm to control for this variable, or not to participate in the incentive at all. Firms that carry products with large margins relative to logistical costs would also tend to experience improved profitability with incentives as the potential for increased volume would more than offset the increased logistical costs. Unfortunately, as margins are to a large degree determined by inventory turn, this ideal firm would probably face equal negative impacts of incentive participation. Finally,

firms within a channel that can retain all, or a portion of the incentive discount would tend to realize improved performance. This, of course, places the cost burden on the manufacturer for a more limited sales response by the marketplace, which again raises the issue of the overall logic of incentive usage.

Conversely, incentive usage would be least desirable for firms and channels which have traditionally slower moving inventory, high inventory carrying costs, little or no cost savings due to larger or combined shipments, high or unpredictable payback functions, inaccurate sales forecasts, lower margins, and the inability to retain all or a portion of the incentive discount.

The research findings and their managerial implications have implications for the economy in total as well. Due to the use of trade incentives in many major industries, it is entirely possible that there is an increase in total distribution costs due to this activity without any direct benefit to the economy. The findings of this research would support this possibility.

Limitations of the Research

The findings of the research are based on a wide range of testing conditions. These testing conditions although encompassing 78 years of simulated distribution activity are not exhaustive. Many possible combinations and levels of

input parameters, with their respective impacts on logistical performance were not examined in this research. In addition, many factors were held constant, in order to make the research design manageable. These factors could be examined at different levels in various scenarios.

The results obtained in this project are clearly limited to the nature and levels of the independent variables utilized. These inputs were designed to provide results as generalizable as possible. Numerous other testing conditions warrant investigation.

Future Research

Within each of the hypotheses tested, numerous other policy and performance inputs warrant further research. This includes the levels of the variables utilized in the testing environment, in addition to the channel structure and processes which remained constant during the research. Due to the complexity of the problem these could not be incorporated in the present research. They, however, provide the basis for substantial future research.

Within each of the hypotheses tested, numerous other independent variable, process, and structure inputs warrant future research. These include additional degrees and combinations of the level of the incentive, level of sales response to the incentive, level of sales payback after the incentive, and degree of demand uncertainty. A wide range

of process variables that were held constant during the research also warrant further investigation. These include incentive timing, inventory policies, and transportation system factors. Structural inputs that warrant further research include the channel echelon structure and the product configuration and mix.

The final hypothesis relating to the financial impacts of the factors examined in this study perhaps offers the most expansive area for future research. Numerous additional cost and revenue assignments warrant future research. The possible combinations are limited only to the number of firms utilizing trade incentives.

CHAPTER V - FOOTNOTES

¹These costs may be substantial; see: Douglas M. Lambert and James R. Stock, Strategic Physical Distribution Management. Richard D. Irwin, Inc. 1982. pp. 261-263.

²Ibid.

³This would probably occur in higher involvement purchases and products with higher technical complexity; see: Harvey N. Shycon, "How Customer Service Impacts Sales Growth and ROI and How Distribution Can Help Increase Corporate Success." Proceedings of the National Council of Physical Distribution Management, Annual Meeting, San Francisco, California, October 10-13, 1982. Volume II.

⁴The author has seen several instances in Ford Motor Company where an incentive with a low level of inventory resulted in severe dealer and customer relations problems.

⁵For example, shipping automobiles via truck. The discrete units shipped are so large that volume increases result only in additional full truckload shipments.

APPENDIX A

APPENDIX ATrade Incentive Definitions

1. Case Allowances are discounts on each case ordered during a specified time period. Case allowance offers sometimes require a minimum purchase quantity. For example, a fifty-cent case allowance might be offered on a minimum purchase of one dozen cases. Case allowances are typically deducted from the manufacturer's invoice to the trade.

Other types of allowance related to purchase quantity include:

Free goods allowances. An additional amount of product is offered to the trade free, conditional upon the purchase of a minimum quantity.

Carload and truckload prices. To reflect savings on freight and handling, a special price is offered on the purchase of the product in rail carload or truckload quantities. Often applicable to bulky products such as paper towels and tissues.

Base contract allowances. A fixed off-invoice allowance is given on each order over a minimum quantity or dollar volume.

Annual volume rebates. Usually designed so that larger percentage rebates are associated with larger purchase totals for the year. Independent retailers and wholesalers have formed buying groups to qualify for the higher percentage rebates.

2. Merchandising allowances compensate the retailer for prescribed merchandising support in the form of extra

in-store display or special featuring of the brand in the retailer's advertising. Some performance contracts specify the size, timing, and placement of the advertising feature or display required to qualify for an allowance.

Like case allowances, merchandising allowances are usually offered as a percentage deduction from the list case price. Frequently, off-invoice case allowances and merchandising payments are usually based on the quantity of cases purchased during the promotion period. The preceding week may also be included to discourage retailers from letting shelf stocks run down in anticipation of the promotion. Unlike standard case allowances, merchandising allowances are not paid by manufacturers until they receive evidence of performance. The evidence might be in the form of a retailer affidavit, display photograph, or advertising tear sheet.

A qualifying advertising feature may range from a single line "obituary" mention to a dominant position in the retailer's advertisement. By arrangement with the retailer, a manufacturer can sometimes have a cents-off coupon included in the advertisement. This guarantees a consumer price reduction at least equal to the coupon value. The manufacturer reimburses the retailer for the value of coupons redeemed plus the per-coupon handling allowance.

Generally, merchandising allowances can be paid only to retailers since only retailers are in a position to perform the required service, whereas standard case allowances can

be paid to wholesalers as well as retailers. However, it is possible for merchandising allowances to be paid to a wholesaler when the firm is acting as an agent of the retailer. For example, wholesalers like Associated Druggists, which puts together a common advertising program for the independent retailers it represents, can collect co-op advertising allowances from manufacturers as the retailers' authorized representative.

As an alternative or additional incentive to the retailer, a manufacturer may offer car stock, free goods which the salesforce distributes to qualifying accounts after the promotion period in return for merchandising services.

3. Financing allowances represent compensation to retailers for financial losses associated with the use of trade promotions or for their assumption of financing costs which the manufacturer would otherwise have to bear. These include:

Floor stock protection. To prevent shelf stocks from running down before a promotion, the manufacturer pays the retailer the case allowance on cases already in his warehouse at the start of the promotion period. Related to floor stock protection is the count-recount procedure for determining the cases which qualify for the allowance. The retailer receives an allowance for each case of product moved out of the warehouse inventory during the promotion period, regardless of whether it was purchased before or during the deal period. Although expensive, this procedure permits rapid implementation of a promotion, since the trade does not have to await the arrival of products bought on deal. It also discourages the trade from merely buying for inventory during a promotion, and ensures that allowances are paid only on units sold to the consumer during the promotion

period. The count-recount procedure is also used when a manufacturer wishes to flush retailer inventories before introducing a new product package or before deleting a product.

Early booking and dating allowances. Used for products with seasonal demand, early booking allowances give customers per-case discounts for purchases made before a specified date. Dating lets the retailer defer payment for products ordered during the deal period, and effectively gives it an interest-free loan at the expense of the manufacturer's working capital. However, the manufacturers can produce more evenly over the year and saves on his warehousing costs once the product is shipped to the retailer.

Cash discounts are usually presented as a sliding scale of off-invoice percentages, with the level depending on how soon the manufacturer receives payment.

Freight allowances compensate retailers who are willing to collect orders direct from the manufacturer's warehouse.

Leaks and swells allowances are offered by canners to retailers as a means of simplifying faulty can claims.

4. Listing allowances for new products. Because retailers assume a risk in allocating their limited shelf space have to generate a new stockkeeping number, they may ask for a listing allowance from the manufacturer. Such allowances are usually tied to the number of cases placed on the shelves. Thus, to encourage rapid distribution, the manufacturer generally must offer a case allowance in addition to the listing allowance, because a listing allowance is typically a one-time offer, it does not tend to bring about competitive retaliation.

5. Sales incentives. These are incentives directed at trade personnel. They include dealer leaders for store and

department managers and contests for trade salespersons. A dealer leader is a sample of a premium displayed at the point of purchase until the end of the promotion, when it typically becomes the property of the store or department manager.

Source: Adapted from the Grocery Products Manufacturers of Canada (1979, pp. 9-11) and the American Association of Advertising Agencies (1978).

APPENDIX B

APPENDIX B

Market Response to Promotions and Incentives

Author(s)

Blattberg, et al.

Major Findings

- Price dealing exists as retailers have higher inventory holding costs than consumers. The cost of inventory has two primary components 1) the value of capital invested in inventory and 2) the value of space committed to holding inventory. The cost of space is much greater for the retailer than the consumer.
- The benefit of a price deal may be overstated, as the sales increase may be based on consumer stockpiling rather than brand switching activity. The payback period at the end of a promotion would thus be larger than had the sales increase originated from brand switching.
- Promotional deals result in substantial increases in the level of purchase, during the period of the deal.
- Response to promotional deals is much greater than for a reduction in price alone.
- The response to deals is lower for products that are more familiar to the consumer.
- In store specials are less effective than for those that originate outside the store.

Babb and Cotton

Brown

- Brand loyal buyers are less responsive to dealing than non-loyal buyers.
- Promotions yield faster responses than advertising, however they do not produce new long term buyers.
- Brand loyal buyers are not likely to respond to a promotion, consequently promotions are not effective in modifying buying patterns.
- Advertising was seen as capable of building a brands "prime franchise", which promotion was not able to do.

Chavalier

- Products that are in a mature stage of the product life cycle are more likely to have sales increased by in store display than products that are in the growth stage.
- Competitive structures where no on particular product has a clear market share advantage results in increased market response to in store display.
- No relationship appears to exist between the advertising to sales ratio of a product and the effectiveness of in store displays.
- There is no significant difference between a deep price cut (12%) and a threshold price cut (6%) on sales response. It appears that the tradition for low prices for displays leads people to believe that products on display are price reduced.
- Family units not loyal to brands had a much higher reaction to changes in price than for those that were loyal to a given brand.

Massey and Frank

- Price elasticity was found to be larger for larger-sized packages.
- Price elasticity was found to be higher in chain stores as opposed to independent dealers.

McCann

- Medium and light users of a product respond less to price dealing than do heavy users.
- Households paying a higher price were more responsive to price dealing than households paying a lower price. (The author believes that the price consciousness of the low price paying household may be satisfied by the adaptation of the lower priced brand; the households that are paying the high price may believe that they are "splurging" and that they are therefore sensitive to the price changes within their evoked set.)
- Innovators were found to be more responsive to price dealing than noninnovators.
- Households that seldom make multiple brand purchases are not as sensitive to dealing activities as those that make many multiple brand purchases.
- Households that limit their purchases to a small number of brands are not as sensitive to dealing activities than those that distribute their purchases over a larger assortment of brands.
- Households that were loyal to a given store were found to be more responsive to dealing activities than nonloyal households.

- Responsiveness to dealing activities was higher for older housewives (over 55) than for younger age groups.
- Households in small towns appeared to be more responsive to dealing activities than households in large cities. Both were more responsive than households in medium sized cities.
- Smaller households had a higher responsiveness to dealing activities than did larger households.
- Employment status of the housewife had a minor impact upon response to dealing activities.

Sexton

- Pricing, dealing and print media have a higher impact on brand share than does advertising.

Webster

- Older housewives are more prone to dealing than younger ones. (The author believes that perhaps the older individual is a more expert shopper and knows how to search out deals in the marketplace, or that the older housewife has a more flexible budget and is able to purchase and store larger quantities.)
- Deal proneness is inversely negatively related to the amount purchased.
- High deal prone consumers tend to buy more brands and devote a smaller share of their total purchases to favored brands.

Woodside and Waddle

- Consumers respond at a higher level to point of sale promotion than to a price reduction. In combination the response is at a higher level than either one alone.

APPENDIX C

APPENDIX C
INITIAL CUSTOMER SERVICE LEVEL REVIEW

PRODUCT/YR	NON-INCENTIVE SCENARIOS		FULL INCENTIVE SCENARIOS WITHOUT SALES INCREASE ON PAYBACK	
	001 (.3cfv)	014 (.7cfv)	011 (.3cfv)	024 (.7cfv)
1/1	.919	.840	.954	.912
2/1	.926	.837	.959	.919
3/1	.925	.844	.976	.923
4/1	.908	.836	.969	.894
5/1	.907	.808	.968	.891
6/1	.920	.839	.920	.839
7/1	.914	.850	.914	.850
8/1	.924	.844	.924	.844
9/1	.915	.811	.915	.811
10/1	.925	.841	.925	.841
1/2	.907	.848	.960	.906
2/2	.923	.828	.962	.901
3/2	.902	.823	.964	.910
4/2	.897	.817	.955	.894
5/2	.922	.817	.948	.893
6/2	.913	.844	.913	.844
7/2	.914	.836	.914	.836
8/2	.891	.821	.891	.821
9/2	.916	.812	.916	.812
10/2	.924	.861	.924	.861
1/3	.899	.866	.956	.912
2/3	.902	.841	.965	.909
3/3	.916	.814	.959	.893
4/3	.906	.846	.967	.898
5/3	.909	.822	.963	.900
6/3	.896	.837	.896	.837
7/3	.900	.839	.900	.839
8/3	.912	.848	.912	.848
9/3	.891	.812	.891	.812
10/3	.910	.835	.910	.835

**INITIAL INVENTORY LEVEL REVIEW
(INVENTORY PLUS IN-TRANSIT)**

PRODUCT/YR	NON-INCENTIVE SCENARIOS				INCENTIVE SCENARIO WITHOUT SALES INCREASE			
	001	(.3cfv)	014	(.7cfv)	011	(.3cfv)	024	(.7cfv)
1/1	2892	3711	2740	3803	12038	3751	10610	4217
2/1	3051	3542	2705	3920	12255	3695	11250	4289
3/1	2957	3610	2746	3908	12570	3675	9937	4353
4/1	2796	3739	2674	3904	12096	3673	10138	4337
5/1	2839	3578	2592	3940	11975	3679	10000	4341
6/1	2832	3590	2616	3968	2832	3590	2616	3968
7/1	2998	3574	2848	3823	2998	3574	2848	3823
8/1	2906	3514	2614	3960	2906	3514	2614	3960
9/1	2915	3602	2564	4004	2915	3602	2564	4004
10/1	2953	3570	2582	3916	2953	3570	2582	3916
1/2	2639	3848	2648	4004	11324	3860	10737	4232
2/2	2676	3832	2542	3992	12263	3864	10731	4424
3/2	2583	3796	2497	4072	11707	3924	10213	4540
4/2	2571	3776	2467	4064	11847	3940	10166	4372
5/2	2646	3784	2569	4060	12307	3880	9730	4436
6/2	2632	3880	2647	4064	2632	3880	2647	4064
7/2	2709	3760	2563	4052	2709	3760	2563	4052
8/2	2659	3808	2572	4048	2659	3808	2572	4048
9/2	2691	3736	2552	4052	2961	3736	2552	4052
10/2	2582	3832	2467	4092	2585	3832	2467	4092
1/3	2720	3832	2661	4004	11842	3980	10638	4252
2/3	2630	3764	2614	3948	11593	4048	10659	4268
3/3	2718	3780	2595	3940	11843	4012	11032	4336
4/3	2718	3728	2467	4088	12094	4080	10318	4344
5/3	2578	3820	2452	4152	11713	4008	9828	4416
6/3	2816	3724	2542	3972	2816	3724	2542	3972
7/3	2703	3860	2459	4032	2703	3860	2459	4032
8/3	2728	3692	2413	4120	2728	3692	2413	4120
9/3	2562	3800	2450	4148	2562	3800	2450	4148
10/3	2535	3772	2707	3988	2535	3772	2707	3988

CUSTOMER SERVICE LEVEL BY TIME PERIOD
TESTING CONDITION 001

ANALYSIS OF VARIANCE

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
BETWEEN GROUPS	2	.0013	.0007	1.973	.1465
WITHIN GROUPS	72	.0241	.0003		
TOTAL	73	.0254			

CUSTOMER SERVICE LEVEL BY TIME PERIOD
TESTING CONDITION 010

ANALYSIS OF VARIANCE

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
BETWEEN GROUPS	2	.0003	.0001	.683	.5084
WITHIN GROUPS	72	.0148	.0002		
TOTAL	74	.0150			

CUSTOMER SERVICE LEVEL BY TIME PERIOD
TESTING CONDITION 013

ANALYSIS OF VARIANCE

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
BETWEEN GROUPS	2	.0009	.0004	1.461	.2387
WITHIN GROUPS	72	.0218	.0003		
TOTAL	74	.0227			

APPENDIX D

APPENDIX D

MARGINS OF SELECTED FOOD ITEMS

	<u>% Margin</u>	<u>Assortment At Warehouse</u>	<u>% of Super- market Volume</u>
Baby Food	9.6	191	.52
Bakery Foods	20.4	N/A	3.48
Baking Needs	18.4	398	2.22
Beer and Wine	21.9	N/A	3.20
Breakfast Foods	21.2	292	1.99
Candy and Gum	32.4	625	1.18
Canned & Dry Soup	21.9	150	.72
Canned Fish	22.0	82	.88
Canned Fruit	23.1	132	.57
Canned Juice	22.4	193	1.32
Specialty Foods	24.3	146	.60
Canned Vegetables	22.6	286	1.26
Coffee & Tea	13.5	156	1.98
Dairy Products	24.3	583	9.84
Desserts & Toppings	23.9	117	.26
Diet & Low Cal Foods	26.8	104	.38
Frozen Foods	31.9	808	6.20
Household Supplies	21.8	729	3.62
Nuts	28.5	89	.39
Paper, Plastics, Foil	20.5	372	3.70
Pet Foods	22.2	358	2.13
Pickles & Olives	28.9	162	.45
Sauces & Dressings	22.0	401	1.55
Snacks	29.2	45	1.36
Soft Drinks & Mixes	18.3	171	3.76
Spices & Extracts	37.0	197	.37
Spreads & Syrups	23.6	172	.74
Tobacco Products	14.2	218	3.83
General Merchandise	37.0	N/A	4.41
Health & Beauty Aids	26.8	1993	3.71

Source: Progressive Grocer, July, 1984, Vol. 63, no. 7, pp. 47-210.

BIBLIOGRAPHY

BIBLIOGRAPHY

BOOKS

- Bartels, Robert. The History of Marketing Thought. Second Edition (Grid Series in Marketing, 1976).
- Basic, E. Martin. Development and Application of a Gamma Based Inventory Management Theory. Ph.D. Dissertation, Michigan State University. (1965).
- Bowersox, Donald J., et al. Dynamic Simulation of Physical Distribution Systems, (1972).
- Bowersox, Donald J., Logistical Management, Macmillan Publishing Co., Inc. New York (1978).
- Bowersox, Donald J., et al. Simulated Product Sales Forecasting, M.S.U. Business Studies (1979).
- Breyer, Ralph F., Quantitative Systemic Analysis and Control: Study No. 1 - Channel and Channel Group Costing. Philadelphia: College Offset Press. (1949).
- Chamberlin, E.H., The Theory of Monopolistic Competition, Cambridge: Harvard University Press (1957).
- Forrester, Jay W. Industrial Dynamics, The M.I.T. Press and John Wiley and Sons, Inc. New York. (1961).
- Gold, Faye, et al. Modern Supermarket Operations. Third Edition, Fairchild Publications, New York (1981).
- Lewis, Howard T., James W. Culliton, and Jack D. Steel. The Role of Air Freight in Physical Distribution. Graduate School of Business Administration, Harvard University (1956).
- Marion, Bruce W., et al. The Food Retailing Industry-Market Structure, Profits, and Prices, Praeger Publishers, New York (1979).
- Nie, Norman H., et al. Statistical Package for the Social Sciences, McGraw Hill Book Company, New York (1975).

Orlicky, Joseph, Material Requirements Planning. McGraw Hill Inc. (1975).

Stock, James R. Strategic Physical Distribution Management. Richard D. Irwin, Inc. (1982).

The Twentieth Century Fund, Does Distribution Cost Too Much? New York. (1939).

Wood, Donald F. and James C. Johnson. Contemporary Transportation. Penwell Publishing Company. (1983).

PERIODICALS

"Channel Optimization in Complex Marketing Systems," Management Science, Volume 25, Number 10, October 1979.

"Computer Simulation Study for a Production Distribution System," International Journal of Physical Distribution and Materials Management, Volume 13.

"Consumer Response to Promotional Deals," Journal of Marketing, 42 (July 1978).

"Division of Labor is Limited by the Extent of the Market," Journal of Political Economy, 1951.

"The Deal-Prone Consumer", Journal of Marketing Research, 2 (May 1965).

"Estimating Marketing Policy Effects on Sales of a Frequently Purchased Product," Journal of Marketing Research, 7 (August 1970).

"Increase in Sales Due to In-Store Display," Journal of Marketing Research, 12:4 (November 1975).

"Increasing Distribution Efficiency by Better Organized Research," The Journal of Marketing, January, 1953.

"Introducing the Marketing Channel to Price Theory," Journal of Marketing, Vol. 28 (July 1964).

"Inventory Decisions by Trade-Off Analysis: A New Approach in Product-Oriented Marketing Strategies," Journal of Business Logistics, Vol. 1, Number 2.

"Logistics System Modeling," International Journal of Physical Distribution and Materials Management. Vol. 8, Number 4.

"Market Segment Response to Marketing Decision Variables," Journal of Marketing Research, 11 (November 1974).

- "Measuring Promotions Grows in Importance," Advertising Age, October 1, 1979, pp. 58-59.
- "A Model for Optimizing Retail Space Allocations," Management Science, 27:7 (July 1981).
- "Planning Physical Distribution Operations With Dynamic Simulation" Journal of Marketing, Vol. 36 (January 1972).
- "Room at the Top in Promotions," Advertising Age, March 23, 1981.
- "Sales Effects of In-Store Advertising," Journal of Advertising Research, 15:3 (June 1975).
- "Sales Promotion-Fast Growth, Faulty Management," Harvard Business Review 54:4 (July-August 1976).
- "Sales Response to Promotions and Advertising," Journal of Advertising Research, 14:4 (August 1974).
- "Short-Term Pricing and Dealing Effects in Selected Market Segments," Journal of Marketing Research, 11:2 (May 1965).
- "Simulation-Tool for Better Distribution," Harvard Business Review, Vol. 38. November-December 1960.
- "A Theoretical and Empirical Evaluation of Price Deals for Consumer Nondurables," Journal of Marketing 45 (Winter 1981).
- "When Do Volume Discounts Pay?" Purchasing Magazine.
- "When To Buy in Case Lot Quantities," ID, (November 1983).

PAPERS

- Chevalier, Michel and Ronald C. Curhan, "Temporary Promotions as a Function of Trade Deals: Descriptive Analysis," Working Paper, Marketing Science Institute, Cambridge, Mass., May 1975.
- Crowell, J.F., "Report of the Industrial Commission on the Distribution of Farm Products (Washington, D.C.: Government Printing Office, 1901).
- Kingsbury, Steve. "Industry Trends in Promotion," presentation to SPAR Annual Seminar, Garden Island, Vermont, June 23, 1980.

Quelch, John A., "Trade Promotion by Grocery Products Manufacturers: A Managerial Perspective," Marketing Science Institute Research Program, (August 1982).

Shycon, Harvey M. "How Customer Service Impacts Sales Growth and ROI and How Distribution Can Help Increase Corporate Success." Proceedings of the National Council of Physical Distribution Management, Annual Meeting, San Francisco, California, October 10-13, 1982. Volume II.