AD-A139 994 A STUDY OF THE EFFECTIVENESS OF THE ARMY'S NATIONAL ADVERTISING EXPENDITURES VOLUME 2 MAIN REPORT(U) AYER (N W) INC NEW YORK 31 AUG 81 USAREC-SR-81-1-VOL-2 1/1

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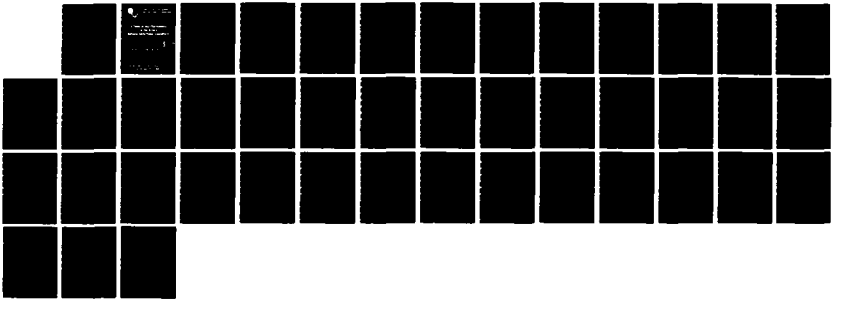

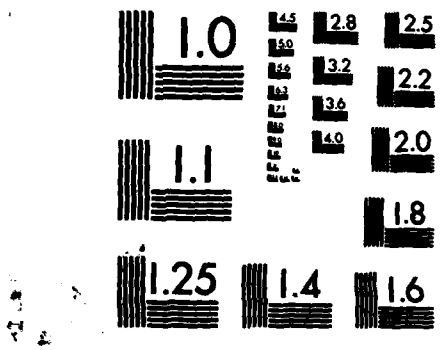

UNITED STATES ARMY RECRUITING COMMAND

Study Report 81-2 AD

A Study of the Effectiveness of the Army's National Advertising Expenditures

Volume II
Main Report

N W AYER INCORPORATED

AUGUST 1981

Approved for Public Release
Distribution Unlimited

Prepared for the

United States Army Recruiting Command
Fort Sheridan, Illinois 60037

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. A139994	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A STUDY OF THE EFFECTIVENESS OF THE ARMY'S NATIONAL ADVERTISING EXPENDITURES VOLUME II		5. TYPE OF REPORT & PERIOD COVERED Final Draft 27 Sept 79 - 31 Aug 81 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) N W AYER INCORPORATED		8. CONTRACT OR GRANT NUMBER(s) MDA903-79-D-0001
9. PERFORMING ORGANIZATION NAME AND ADDRESS N W Ayer Inc. 1345 Avenue of the Americas New York, NY 10105		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS United States Army Recruiting Command Ft. Sheridan, IL		12. REPORT DATE 31 Aug 81 13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) N/A		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

N/A

18. SUPPLEMENTARY NOTES

Volume II of three volumes.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

ADVERTISING, ACCESSIONS, CONTRACTS, ACCESSIONS AS CONTRACTED, ARMY, RECRUITING, EFFECTIVENESS, COST, MODEL, BOX-JENKINS, ECONOMETRIC, ASVAB, EXAMS, CONVERSION, LINKAGE.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

ARMY ADVERTISING COST EFFECTIVENESS MODEL

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FOREWORD

The U.S. Army Recruiting Command (USAREC) has asked N W Ayer Incorporated to study the effectiveness of the Army's national recruitment advertising. N W Ayer's Marketing Services Department undertook this task in September, 1979, with guidance from USAREC's Program Analysis and Evaluation Division. In addition, their assistance in acquiring, providing, and checking data and data sources was essential.

Volume I is the Executive Summary and is intended for the general reader who wants an overview of the project's objectives, methods, and key findings. This summary highlights the marketing and financial aspects of the analysis.

Volume II is the Main Report and is intended for the reader who wants to fully understand the details of the project: its inception, methodology, data, results, validation, and economic implications.

Volume III is comprised of Appendices intended for the specialist who wants to thoroughly analyze the methods and data used in the analysis. A step by step description of how the model was built is documented in the Appendix entitled "Essential Elements of Analysis."

At our request our methodology and conclusions have been reviewed by Professor Martin K. Starr of the Graduate School of Business of Columbia University. He judged our statistical procedures sound and the conclusions acceptable on a statistical and analytic basis.

The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

A STUDY OF THE EFFECTIVENESS OF
THE ARMY'S NATIONAL ADVERTISING EXPENDITURES
VOL. II
MAIN REPORT

A STUDY OF THE EFFECTIVENESS OF
THE ARMY'S NATIONAL ADVERTISING EXPENDITURES

LIST OF TABLES

VOLUME II
MAIN REPORT

A STUDY OF THE EFFECTIVENESS OF
THE ARMY'S NATIONAL ADVERTISING EXPENDITURES

LIST OF FIGURES

VOLUME II
MAIN REPORT

CHAPTER 1

INTRODUCTION

Section I. PROBLEM

Is U.S. Army advertising paying off? Does it help recruiting or not? Should Army advertising levels be increased or decreased relative to Army pay or the level of the Army's recruiting force?

These are questions of accountability. How can N W Ayer more fully justify its expenditures to its client? How can the Army in turn better explain this portion of its budget to the Pentagon and to Congress?

These appropriations have been challenged in the past. In 1976 the General Accounting Office (GAO) investigated the effectiveness of military advertising and found that the accession of "...few recruits can be traced to advertising and that the attitudes toward and images of the military have not changed greatly for better or for worse." Cuts in advertising budgets followed the publication of the GAO report. Recruiting then plummeted. Why? Because advertising was cut back? We think part of the drop in recruiting was due to the drop in advertising. The full story is complex, and we were led to consider many other factors. This study is directly aimed at resolving the issue.

Section II. HISTORY OF THE APPROACH

N W Ayer's interest in demonstrating the effectiveness of its Army advertising goes back a long time. In 1971, four years after N W Ayer acquired the account, the Marketing Services Department of N W Ayer developed a proposal for measuring advertising effectiveness for the Army.

This early proposal was not accepted for two reasons. First, the Army did not have a large recruiting task in 1971: the draft was still in effect, so there was little need for the research. Second, since recruiting information was not kept as systematically as it is now, the Army did not have the data to easily support the research.

In 1978 N W Ayer reapproached the Army. Conditions had changed. The all-volunteer Army had replaced the draft Army. Enlistment bonuses supplanted draft boards. Recruiting quotas had to be met. By 1978 it was clear that the success of the first years of the all-volunteer Army was not being sustained, and there was increased pressure to improve the effectiveness of the Army's recruiting tools.

Also by 1978, recruiting data was being kept more systematically. Data on accessions (enlistments) had been collected since 1971. This historical record invited us to re-pursue the question of advertising's effectiveness. Since 1978 we have become very familiar with the recruiting data stored at the Defense Manpower Data Center (DMDC).

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[1] "Advertising for Military Recruiting: How Effective Is It?" Report to the Congress by the Comptroller General, FPCD-76-168, March, 1976.

In this analysis, we discuss the effects of advertising on exam-taking by Army prospects. DMDC began collecting exam-taking data in a uniform manner during 1976, and this project started to flourish once we discovered the data on exams. The importance of this data is discussed later in this chapter.

We will try to put this project into perspective in two ways: first, we will identify a range of general methods for establishing the effectiveness of advertising and then identify which one we chose; second, we will describe how our study differs from others that have been used to establish the effectiveness of advertising as a recruiting tool for the military.

Section III. GENERAL METHODS

Selection of a Criterion.

The first issue to consider when trying to measure advertising's effectiveness is to decide on a criterion. Several criteria make sense when we consider Army advertising. Examples follow:

Awareness - do young men and women know that the Army is actively seeking enlistments and offering jobs?

Interest - how interested are the target groups in the specifics of the Army job?

Attitude - how does the Army job rate relative to other post-high school options?

Behavior - what does the prospect do?

We did not choose to measure awareness because we felt that general awareness was already so high that it would be a meaningless criterion.

We also did not choose interest or attitude as a criterion because existing surveys on interest and attitudes are not very numerous: Market Facts tracks the attitudes of youth only twice a year, and we do not believe these surveys are frequent enough to pick up the effects of advertising.

We had hoped to find a behavioral criterion sensitive to advertising, since changing behavior is the ultimate measure of advertising effectiveness. Several behavioral criteria were considered:

- REACT Leads.
  N W Ayer already has an elaborate system for tracking responses to direct response advertising. We wanted a criterion that would measure the effectiveness of all media.

- Station Visits.
  An old adage of advertising is that the ads bring the prospect in the door. From then on the salesman and the product itself takes over. Counting the number of visits to a recruiting station would be an ideal criterion, except that many prospects do not visit their local recruiting station. For example, some recruiters go to prospects' homes.

- Exams.
  The Army asks all prospects to take mental and physical exams, which are used to match prospects to jobs for which they qualify. Since these exams are very time-consuming, exam-taking demonstrates a significant interest in the Army. As such, it is close to an ideal criterion.

- Contracts.
  Everyone who joins the Army must sign a contract. The major problem with choosing this behavior as a criterion for advertising is that a host of other factors intervene at this point in the process: the job the prospect wants may be filled for 6 months; the prospect may not qualify for a job he likes; he may not want to go to Army school in the South in the summer or in the North during the winter.

- Accessions.
  When a prospect accesses is largely determined by the school year and by when the Army has job openings. As a result, this criteria is heavily influenced by seasonality as well as by the other factors that impact contracts.

To summarize, we wanted a behavioral criterion and chose exam-taking as best criterion available.[1]

Experimentation or Econometrics.

We next addressed the question of how to measure the effect of advertising on exams. There are two basic choices: experimentation or statistical analysis of historical data.

Experimentation is clearly preferable whenever one can dramatically vary advertising in sensitive markets under controlled conditions; however, it has not been tried. It was considered in 1971 but rejected on grounds that the Vietnam War precluded tampering with recruiting activities in any part of the country.

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[1] As discussed in Chapter 2, we will link exam-taking to accessing in order to better measure the ultimate effect of advertising.

The current project tried the second course, econometrics, to try to deduce the effectiveness of advertising by observing how historical changes in advertising affected changes in recruiting. Our methodology is described in Chapter 2.

Section IV. OTHER STUDIES OF MILITARY RECRUITMENT ADVERTISING

How does our methodology fit with other studies addressing military advertising? We will first compare our study to the GAO study referred to earlier. Second, we will compare our study to an econometric study of the effectiveness of Navy advertising that was recently published by Professors Morey and McCann of Duke University.[1]

The GAO Study.

The conclusions of the GAO study rest upon two separate analyses.

1. THE ATTITUDES AND IMAGE ANALYSIS

   The GAO found that numerous studies showed little variation in attitudes toward and images of the military services between 1970 and 1974, even though advertising expenditures had increased substantially during that time.

   Our study, in contrast, measures behavioral rather than attitudinal response. Advertising does not have to produce a large shift in the attitudes of all young men and women to be cost-effective. If it influences only a small percentage of the population, but does so with enough strength to get them to see a recruiter, take an exam and eventually enlist, it has done a cost-effective job. Small percentage changes in attitudes are difficult to measure. Finally, attitudes measured in 1970-1974 were no doubt heavily influenced by the Vietnam War.

2. THE LEADS ANALYSIS

   The GAO found few enlistments traceable to advertising leads: only 4% of 900,000 leads traced to an enlistment and only 2% enlisted in the service to which they sent their lead. The GAO went on to show that less than 10% of 550,000 enlistees sent in a lead. We hypothesize that the counting system itself was inefficient and inaccurate, since the counting of leads failed to reflect the effect of media that don't provide lead cards. In contrast, the data input into our study is far more accurate, since all potential recruits taking exams have been carefully counted since 1976.

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[1] Richard C. Morey and John M. McCann, "Evaluating and Improving Resource Allocation for Navy Recruiting" in Management Science, Vol. 26, No. 12, December, 1980

The Morey and McCann Study.

The Morey and McCann article is an econometric study similar in philosophy to this study. Both studies analyze historical recruiting success in the context of key controllable and noncontrollable factors in the environment. The differences between the two modeling procedures are listed below:

1. The Morey and McCann analysis measures effectiveness of advertising in terms of enlistment rather than exams. They do refer to the potential benefits of multi-stage modeling, however, and we speculate that they would have modeled exams had they had the data available.

2. Morey and McCann analyzed high school degree enlistees as a single group. Our analysis considers potential recruits by mental groupings as well as by high school status.

3. Morey and McCann use a Koych autoregression term to represent the dynamic effects of advertising. We use Box Jenkins transfer function procedures to select the dynamic effect. The latter procedures are more flexible and they could have led to the Koych specification, but did not.

4. Morey and McCann use leads as an independent variable in addition to an advertising expenditure variable. We do not employ leads as either an independent or a dependent variable.

5. Morey and McCann model across 43 recruiting districts and across 24 months. In contrast we model aggregates across 54 months. This geographical detail provides Morey and McCann with much more data than we have available to us.

Section V. ASSUMPTIONS

The purpose of this section is to list the key assumptions that underpin the modeling effort.

1. Historical analysis brings useful information to bear on current policy issues. Our analysis covers the period from April 1976 to September 1980. We assume that the relationships between recruiting and advertising have not changed substantially since that time.

2. We have discussed our modeling effort with numerous researchers and administrators in and out of the Army, and we believe that we have considered modeling all of the important factors.

3. Lastly, we assume that levels of monthly advertising are not systematically determined by levels of recruiting success in prior months. Such relationships, commonly referred to as "feedback loops", require that two relationships be

modeled simultaneously — one explaining the determinates of advertising and the second explaining the current and delayed effects of advertising. Such a feedback relationship is not uncommon, since many commercial and industrial markets routinely set advertising budgets as a percentage of their prior year's revenues.

Army budgets, in contrast, are not set in routine manner. A host of military and political factors interact, with the final decision being a Congressional one. In addition, the eventual monthly allocation of the budget is structured well in advance and is difficult to change. As a result of both of these factors, we have adopted statistical methods which preclude feedback.

Section VI. SCOPE AND LIMITATIONS

Our study analyzes the effect of advertising on exam-taking and on eventual accessions nationwide from the period July 1976 to September 1980: 54 data points. The study would have been improved if regional detail had been available so that data pooling techniques could be employed.

Chapter 2 will describe our methodology and Chapter 3 our data. Chapter 4 will present the results, Chapter 5 will discuss the validity of our models, and finally Chapter 6 will analyze the economic implications of the models.

CHAPTER 2

METHODOLOGY

The methodology used to develop the models needed to effectively measure the impact of advertising spending levels can be outlined in eight steps:

1. Identification of the basic procedural structure;
2. Identification of assumptions and hypotheses regarding the number of, the form of, and the variables in each model;
3. Inspection of the data on exam-taking;
4. Estimation of the immediate and delayed effects of variables other than advertising on exam-taking;
5. Estimation of the current and lagged effects of advertising on exam-taking;
6. Joint estimation of advertising and non-advertising effects on exam-taking;
7. Linkage of exam-taking and accessions, and
8. Implementation of diagnostic checks to insure model robustness.

Each of the first seven steps is elaborated upon in the following pages of this chapter. The eighth step is discussed in Chapter 5, "Validation".

Section I. IDENTIFICATION OF THE BASIC PROCEDURAL STRUCTURE

As outlined below, careful consideration of the procedural structure led us to the construction of a two-stage model of the recruiting process.

The Process Flow.

The first step in structure identification is the development of a process flow. The objective of developing this process perspective is not to incorporate into it every element of the recruiting system, but to outline those elements which are critical to developing a measurement of the influence of advertising spending levels. With this measurement based on a sound perspective of the process dynamics, the risk of confounding the impact of advertising spending with the changes in other system factors is considerably lessened.

The process flow must identify the key variables in the system, as well as the causal patterns connecting them. The Process Overview seen in Figure 2-1 provides this broad perspective of the system's dynamics.

This overview of the recruiting process specifies that the pool of eligible enlistment candidates receives a continuous flow of information that affects attitudes toward enlisting in the Army. This flow comes from both the Recruiting Command in the form of advertising, which provides information about the Army as a product offer (pay, benefits, and training opportunities), and from the general economic environment, with information about alternative employment, education, and other military service opportunities.

The information varies in the intensity with which it is delivered (e.g. advertising pressure), and also reflects changing environmental states (e.g. increased unemployment). The quantity and quality of this information acts to impact both the level of awareness of Army opportunities and attitudes towards the Army.

These changes in awareness and perceptions create an atmosphere that affects responsiveness to contacts made by the recruiter force, and induces people to seek out recruiters on their own. The quality of the recruiters' "selling" of the Army, impacted somewhat by alternative service recruiting efforts, results in a number of candidates making a commitment to begin the enlistment process by going to the AFEES stations and taking the mental and physical exams.

Once the examination process has been completed, the percentage of signed contracts is heavily dependent on the manpower requirements of the Army, as well as on the effectiveness of the career counselling staff. Finally, the willingness of examinees to sign contracts is determined by a number of factors such as the availability of specific MOS slots, the timing and location of schools, the flexibility of the DEP policy, and the seasonality of the school year. These factors also affect the timing of accession by those who sign contracts.

Choice of a Two-Stage Model Building Procedure:

The second step in structure identification is the choice of a overall model building procedure. Careful consideration of the process flow makes it clear that the system payoff, the number of accessions each month, is considerably "downstream" from the level of advertising spending, which is the critical variable being investigated.

As discussed in Chapter 1, monthly data reflecting changes in awareness levels and attitudes of the target group toward the Army was not available, nor was monthly data available on the number of contacts made with the recruiting system. The number of ASVAB exams completed each month was available, however, and represents the system performance measure furthest "upstream" in the process.

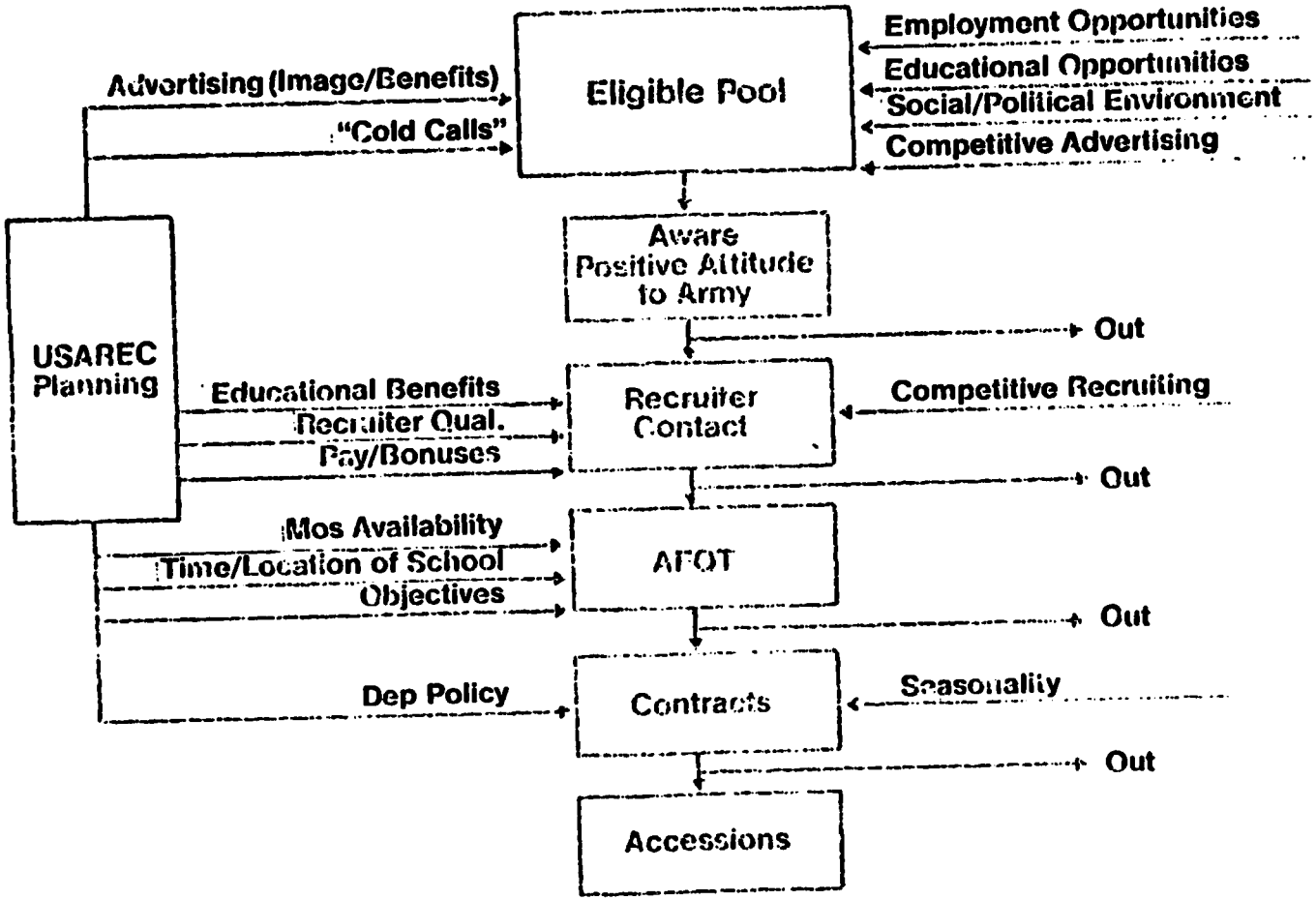

Figure 2-1. Process Overview

In order to measure the system's response at the point most sensitive to changes in the level of advertising (exam counts), as well as to track variations in the key payoff measure (accession levels), we used a two-stage model of the process. Accession records were reviewed, and each accession was allocated to the month in which the enlistment contract was signed. This is effectively a contract series, exclusive of those contracts that do not result in final accession. To our knowledge, this is the first time that recruiting performance has been measured using a criterion so far "upstream" in the enlistment process. Stage 1 relates exam levels to changes in advertising, other policy variables, and critical non-controllable environmental influences, and Stage 2 relates accession levels to changes in exam levels.

Figures 2-2 below simplifies the process perspective in terms of the two stages:

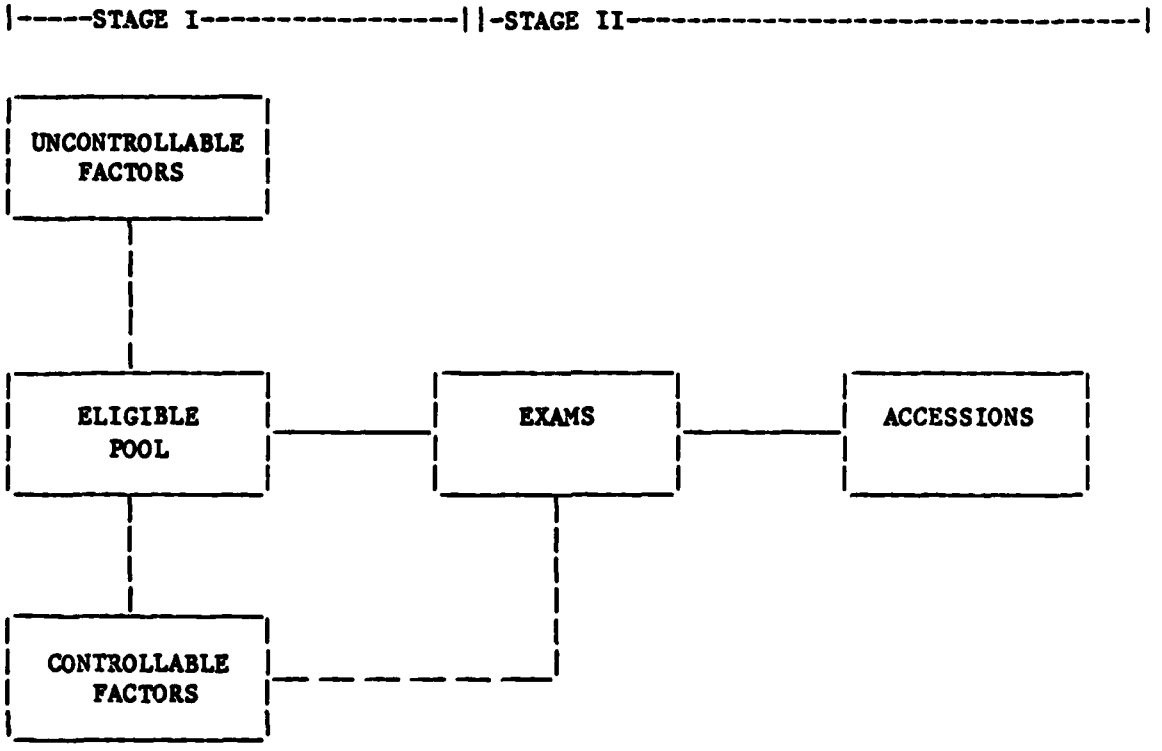

Figure 2-2. The Two-Stage Process

Section II. IDENTIFICATION OF ASSUMPTIONS AND HYPOTHESES

The implementation of the two-stage process required specifying two types of models: exam models (monthly exam levels explained by advertising, other policy variables and environmental factors), and accession models (linking accessions to exam levels).

The Number of Exam Models.

Army priorities for the quality of the recruit mix required investigating the differential impact of advertising on key market segments. Market segmentation was based on high school degree status and test scores by mental category groups:

High School Degree - Category I - IIIA
High School Degree - Category IIIB-IV
Non-Degree - Category I-IIIA
Non-Degree - Category IIIB-IV

The appropriate degree status could not be specified in the exam data, since the records reflect the status at the time of examination, not at the time of accession, and therefore underrepresent the number of graduates. With this restriction in mind, the exam data was partitioned by mental test scores into two groups, Category I-IIIA and Category IIIB-IV, and an exam model was built for each.

The Form of and Variables in the Exam Models.

Based on the theoretical perspective outlined earlier and on the availability of appropriate monthly data, each exam model specified that monthly variation in ASVAB exam levels is determined by variation in the factors listed below.

Uncontrollable environmental factors include

- youth unemployment (16-19)
- civilian minimum wage rate
- structural seasonality
- alternative service advertising levels.

U.S. Army Advertising spending levels considers individual media expenditures.

Other controllable policy factors include

- monthly recruiting objectives
- number of recruiters on production
- E-1 pay levels.

The Number of Accession Models.

The accession data was partitioned into the four specified market segments, and accessions were modeled separately for each of the first three groups—

High School Degree - Category I-IIIA
High School Degree - Category IIIB-IV
Hon - Degree - Category I-IIIA

The last group was considered to be more constrained by the demands of the Army than by the supply of candidates, and was not subjected to the same analysis detail, because it was felt that accession variation reflected administrative pressures, as much as the response to marketing efforts.

The Form of and Variables in the Accession Models.

The key issue in determining the form of the accession models was whether the model should be linear or non-linear. If accessions increase at a diminishing rate as exam-taking increases, then the accession model must be a linear function of exams. We investigated this issue by plotting the level of exam-taking on a given month against the ratio of exams to accessions in that month. This ratio is an estimate of the conversion rate from exams to accessions.

All of the variables hypothesized for the exam model were considered for inclusion in the accession model, because we felt that it was important to investigate the possibility that variation in one or more of the key system variables would impact the mix of people who came in to take exams, with respect to their propensity to eventually enlist.

Section III. INSPECTION OF THE DATA ON EXAM-TAKING

We analyzed plots of the exam-taking data before modeling the effects of the hypothesized variables, in order to determine if there were any dramatic patterns in the data that would need explanation before proceeding. We also performed a Box Jenkins univariate analysis of the exam data to see if additional seasonal or first-order auto-regressive factors would be needed in the exam model.*

*The Box Jenkins univariate analysis is discussed in detail by George E.P. Box and Gwilym M. Jenkins in Time Series Analyses, published by Holden Day (San Francisco, 1976).

Section IV. ESTIMATION OF THE IMMEDIATE AND DELAYED EFFECTS OF VARIABLES OTHER THAN ADVERTISING ON EXAM-TAKING

To properly address advertising, we split monthly exam variations into two parts: the first part explained exam variation by the key non-advertising factors, and the remaining part, or residual variation, explained any remaining variation by changes in advertising spending patterns. This was done in order to neither overstate the efects of advertising nor miss an advertising effect buried under the effects of a more dominant variable. Removing the effects of non-advertising variables was particularly important since our eventual goal was to measure the impact of potentially subtle individual media effects.

Box Jenkins cross-correlation analysis* was then used to determine if the impact of any of the hypothetical factors on exam levels had a long enough delay to warrant including lagged values of that factor as an independent variable. The cross-correlations were computed between the current value of the exam series and the current value (as well as up to twelve lagged periods for each) of the independent variables. The Box-Jenkins technique of "pre-whitening" each of the series before computing the cross-correlation was used.** This technique is designed to reduce the chance of making spurious cross-correlation estimates due to the presence of an auto-correlation structure in the variables.

Once the relevant delay structure for each of the non-advertising factors was established, the coefficients of an equation that specified exams as a linear function of the current and appropriate lagged values of the non-advertising factors were estimated, using multiple regression. With the "non-advertising" model thus specified, and parameters estimated, the residual effects could be computed.

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*The Box Jenkins univariate analysis is discussed in detail by George E.P. Box and Gwilym M. Jenkins in Time Series Analysis, published by Holden Day (San Francisco, 1976).

**"Pre-whitening" each variable before computing cross-correlations is equivalent to concentrating on the effects of a variable when it assumes unusually high and low levels.

Section V. ESTIMATION OF THE CURRENT AND DELAYED EFFECTS OF ADVERTISING

The objective here is to identify correlations in the response patterns of exam levels to changes in each of the media, so that the eight media components could be combined into a smaller number of media aggregates. This reduced the variety of the advertising response, while maintaining any essential differences in the nature of the delay structure.

The cross-correlations between the residuals of the pre-advertising exam model and the advertising spending levels for each of eight major media components were developed.* Again, the Box Jenkins "prewhitening" technique was used before computing the cross-correlations.** The structure of the relationship between residual exam variations and the media components was examined to determine the strength of relationship and the structure of the delays.

Section VI. JOINT ESTIMATION OF THE EFFECTS OF THE ADVERTISING AND NON-ADVERTISING VARIABLES

The combined effects of non-advertising and advertising variables were jointly estimated, using distributed lag analyses to refine the estimates of advertising's delayed effects. Then all of the foregoing information was taken into account in estimating final models. The parameters of a model, including all variables, delay structures, and key media aggregates were specified using regression analysis.

Section VII. LINKING EXAMS TO ACCESSIONS

The last stage before validation in the model-building process is to determine which factors link exams to accessions. Multiple regression was used to determine whether any of the hypothesized factors affected the linkage.

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*Time Series Analysis, by Box and Jenkins, also describes cross-correlational analysis.

**"Prewhitening" each variable before computing cross-correlations is equivalent to concentrating on the effects of a variable when it assumes unusually high and
levels.

CHAPTER 3

DATA

The data used in the analysis can be classified into four sets:*

- Measures of recruiting performance
- Measures of advertising expenditure activity
- USAREC-controllable policy variables
- Non-controllable environmental influences

The data span the time period from July 1976 to September 1980.

Section I. MEASURES OF RECRUITING PERFORMANCE

Recruiting performance was measured by two variables: the number of ASVAB exams completed each month in the AFEES stations, and the number of contracts signed each month that actually turned into accessions. The source of this data is the Defense Manpower Data Center (DMDC).

Section II. MEASURES OF ADVERTISING EXPENDITURE ACTIVITY

The advertising data used in the analysis reflects historical monthly expenditures as reported by the N W Ayer Media Department. These expenditures were made to purchase advertising space directed toward the non-prior service market segment.

Three key considerations were made in specifying the advertising variables:

- Individual media components were analyzed to account for differing responses.
- The reported dollar expenditures for each medium were adjusted by the appropriate media deflator so that all expenditure levels throughout the analysis are reported in constant dollars (December 1978 = $1.00). The deflators were developed using data from Marketing and Media Decisions.
- Reported gross expenditures (including agency commissions) were adjusted to reflect net expenditures (exclusive of agency commissions) where necessary.

The eight media types considered are television, radio, newspaper, outdoor, regular magazines, special magazines, local advertising, and direct mail.

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* Listings and plots of the variables in each data set are included in the data appendix.

Section III. USAREC-CONTROLLABLE POLICY VARIABLES

Recruiter Accession Objectives are the monthly objectives for male non-prior service accessions. This variable did not track the exact performance measures used, but did reflect a measure of "pressure" on the system, both long and short term. General Research Corporation provided the data.

E1 Pay is the entry level pay for new recruits. This variable was used in the analysis as a component of the ratio comparing the level of E1 Pay to the civilian minimum wage. The source of this data is the United States Army Recruiting Command (USAREC).

Production Recruiters comprise a variable that represents the number of recruiters and commanders on station each month. This variable reflects variations in the size of the recruiter force. USAREC provided this data as well.

Section IV. NON-CONTROLLABLE ENVIRONMENTAL INFLUENCES

Youth Unemployment is estimated by the seasonally adjusted monthly unemployment rate for 16 to 19 year olds. The U.S. Department of Labor provided this data.

Civilian Minimum Wage is the monthly minimum wage as legislated by Congress, and was provided by the U.S. Department of Labor.

Navy Advertising is represented by the total monthly advertising expenditures by the U.S. Navy. The U.S. Navy confirmed the accuracy of this data.

CHAPTER 4

RESULTS

Results for the exam models and results for the accession models will be presented separately in this chapter, to parallel the model development of the two-stage process. We will begin with the results of inspecting the exam data and follow the methodological steps of Chapter 2 through to the last accession models.

Section I. INSPECTION OF THE CATEGORY I-IIIA EXAM DATA

Seasonality And Auto-Correlation.

The univariate examination of the data structure indicated a seasonal pattern in the exam series. The exam data showed a higher than average rate of exam completions in January, and lower than average completion rates in April-May and September-October. There was also first order auto-correlation in the exam data.

Adjustment For GI Bill Termination.

A plot of the monthly exam series clearly shows a drop in the monthly rate beginning January 1977 (See Figure 4-1). This change in the process level coincides with the termination of the GI Bill of Rights as of the end of 1976, as well as with an overall lowering of resources applied to the recruiting process. In addition to the January 1977 drop in exam level, the number of exams processed in December 1976 was extraordinarily high. It is reasonable to assume that this represented a last minute system "loading" to take advantage of the GI Bill. As such it was reasonable to treat this period as an "outlier," and to replace the number representing exams processed by the pre-1977 process mean.

We estimated the GI Bill effect by regressing exams against a 0-1 indicator variable which signaled when the GI Bill was in effect. The residuals of this regression estimate levels of exam-taking caused by factors other than the GI Bill. These residual exams were then used as the criteria in determining the immediate and delayed effects of the non-advertising variables.

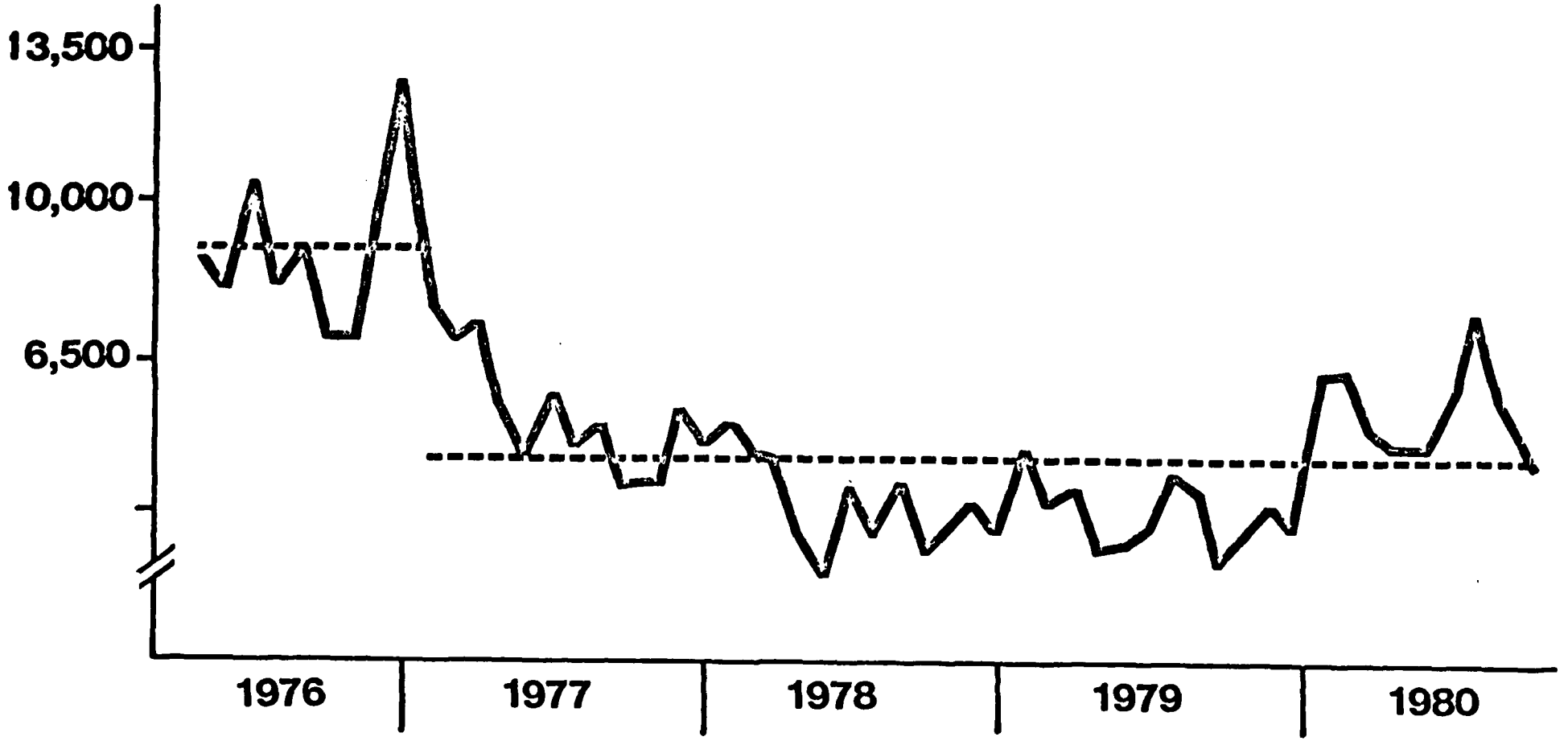

Figure 4-1. Category I-IIIA Exams

Section II. ESTIMATION OF THE IMMEDIATE AND DELAYED EFFECTS OF VARIABLES OTHER THAN ADVERTISING ON CAT I-IIIA EXAMS

In analyzing each non-advertising variable, one at a time, we found that no variable showed convincing evidence of long-delayed effects on exams that could not be explained by other factors. For example, the cross-correlation for pay indicates a positive effect on exams in the month of the pay increase, three months later, and eight months later. Although the immediate effect was not two standard deviations above the mean, it conformed to our expectations and was accepted. The effect three months later was not attributed to pay change: since pay increases for the military occur every October, the three-month delayed effect would always occur in January, a month known to be a strong exam-taking month from the seasonality analysis. We therefore considered the three month pay effect to be spurious, and considered the positive effect eight months later, in June, to be spurious as well.

Among the non-advertising variables, only youth unemployment was found to have any delayed effect at all, and this effect was short-lived: it started in the month of increased youth unemployment and lasted one additional month. This dynamic response to changing economic conditions was considered reasonable.

The decisions we made regarding pay and unemployment are clearly judgemental, as is usual when dealing with volatile criteria over a fairly brief time span. The first check on these judgements was to jointly estimate the hypothesized effects.

Joint estimation confirmed most of the hypothesized effects for the non-advertising variables. Only two hypotheses failed: accounting for the drop in exam levels in April-May by a seasonal factor and inclusion of a correction of the auto-correlation were no longer needed when all of the factors were jointly estimated.

The model that contains only the confirmed non-advertising effects is called the pre-advertising model and is seen in Table 4-1. Multiple regression was used to estimate this model. The computed "t" statistics are greater than 2.0 for all variables and the computed Durbin-Watson statistic (1.9) indicates no problem with auto-correction in the residuals.

Section III. ESTIMATION OF THE CURRENT AND DELAYED EFFECTS OF ADVERTISING ON CAT I-IIIA EXAMS

The results of analyzing the effects of each medium, one at a time, on the residuals of the pre-advertising model are summarized as follows:

1) TV, newspapers, and local advertising affect I-IIIA exams immediately (in the month of exposure or one month later).

2) All measured media generated some delayed response up to 11 months after exposure.

Table 4-1. Mental Category I-IIIA Exam Model (Pre-Advertising)

VARIABLE	COEFFICIENT	"t"
Constant	-16,860	-6.6
GI Bill Indicator	2,702	8.8
Youth Unemployment	402	8.1
Objectives	.070	3.5
Relative Pay	7,535	4.3
Production Recruiters	1.79	4.8
January	1,233	4.0
September-October	-732	-3.2
Durbin Watson	1.9	
Multiple R Squared	.92	

These patterns suggested specifying advertising as two aggregate "pressure" variables:

(1) Total Media Aggregate with long-term delay - This is a moving sum of all media lagged four to eleven periods. This was utilized because the advertising pressure affecting current period exam levels is the result of the spending inventory built up from 11 months ago through three months ago. The total media aggregate identified with the long delay structure can be viewed from two perspectives:

- The level of exam activity in any given month is directly related to the level of advertising inventory, reflecting total advertising spending for the eight month period that started 11 months ago and continued until four months ago.

- If there is an increase in advertising pressure in a specific month, the resulting impact on processed exams will not be seen for three months, and then the increased activity will continue at the same level for another nine months.

(2) Immediate Response - This is the sum of current period spending for newspapers and local advertising, plus the most previous period spending for television.

Section IV. JOINT ESTIMATION OF ADVERTISING AND NON-ADVERTISING EFFECTS ON EXAM-TAKING

These variable specifications were checked by estimating alternative distributed lag structures. The result of this analysis was to consider the long-term delay to start four months after exposure and to last eight months.

Final CAT I-IIIA Exam Model.

The final CAT I-IIIA exam model specifications include all of the key factors identified in the pre-advertising model, as well as the two advertising pressure variables. Multiple regression was used to estimate the coefficients of the model. Interpretation of these coefficients and analysis of their economic implications are discussed in detail in Chapter 6. The coefficients and "t" statistics are presented in Table 4-2, below. Note that all of the statistics are greater than 2.0 and that the Durbin Watson is not significant. Chapter 5 will discuss the validity of this model in further detail.

Final CAT IIIB-IV Exam Model.

The CAT IIIB-IV exam series was analyzed in the same manner as the I-IIIA series, with the following results:

- The same pre-advertising variable specification was identified (The September - October seasonal impact was only marginally significant, but was included to provide for consistent structure).
- A single advertising pressure variable was identified that reflected a much shorter delay structure: a moving sum of all media for the current period through a five-period lag.

The resulting model is presented in Table 4-3, below.

Table 4-2. Mental Category I-IIIA Exam Model

VARIABLE	COEFFICIENT	"t"
Constant	-13,841	-4.4
GI Bill Indicator	2,948	8.9
Youth Unemployment (current plus lag)	366	7.1
Objectives	0.070	3.2
Relative Pay	6,832	3.4
Production Recruiters	1.05	2.4
January	1,289	4.5
September-October	-695	-3.3
Long Term Advertising Aggregate	.10	2.2
Immediate Response Advertising Aggregate	.49	2.5
Durbin Watson	1.9	
Multiple R Squared	.93	

Table 4-3. Mental Category IIIB-IV Exam Model

VARIABLE	COEFFICIENT	"t"
Constant	-35,781	-5.6
GI Bill Indicator	5,713	7.8
Youth Unemployment (0-1)	543	4.1
Objectives	.247	5.2
Relative Pay	13,846	3.3
Production Recruiters	3.8	4.0
January	3,435	4.7
September-October	-781	-1.5
Advertising Aggregate (0-5 period lag)	.47	4.9
Durbin Watson	1.6	
Multiple R Squared	.90	

Section V. LINKING EXAMS TO ACCESSIONS

The second stage in the two-stage process is the determination of the monthly variation in accession levels, based on the monthly variation in exam levels. The translation of exams to accessions is developed by market segments, and is outlined in the following diagram.

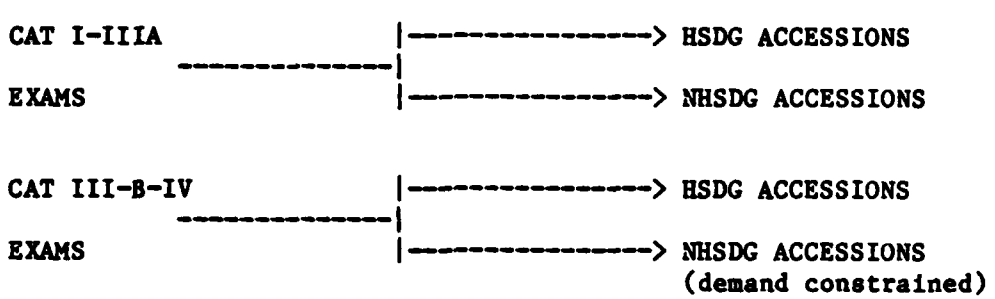

Figure 4. The Linkage Structure

Accessions and Exams.

Examination of the patterns relating monthly variations in exam levels to monthly variation in accession levels revealed the following relationships for the market segments under consideration:

- HSDG/Category I-IIIA - The pattern of accession variation follows the pattern of exam variation closely both in terms of long-term trends and month-to-month variation. There is very substantial evidence that changes in accession levels are closely tied to changes in exam levels.

- HSDG/Category IIIB-IV - The pattern of accession variation has the same shape as exam variation in terms of month-to-month variation, but there is a clear pattern of varying returns with respect to the long-term trend. The level of exams dropped sharply from the 1976 level through 1977 to a low period in 1978, and rose through 1979 and 1980. In contrast, while the contract level dropped a little through the 1977 period, it did not increase through 1979 and 1980. These patterns suggest that HSDG/Category IIIB-IV accessions show diminishing returns to increases in the level of exams.

- NON-HSDG/Category I-IIIA - Exam and accession variations have similar patterns in month-to-month variation; however, the general long-term patterns were not as similar.

This analysis suggested that multiplicative models allowing for diminishing returns would be appropriate in modeling the linkage between accession levels and exam levels.

Manpower Needs and Conversion Rates.

We hypothesized that variation in the level of manpower needs is a key determinant of variations in the monthly conversion rate. The recruiter objectives variable, which was the only available quantitative measure of manpower needs, was transformed to express those needs as

(1) long-term objectives - a twelve-month average of objectives, and

(2) short-term objectives - a ratio of monthly objectives to the smoothed series.

An examination of the time series plots relating conversion rates to the two objective specifications led to the following key observations:

- The conversion rate varies inversely with the level of long-term objectives for both of the High School Degree market segments.
- The conversion rate varies directly (but weakly) with the level of short-term objectives for both of the High School Degree market segments.
- The conversion rate varies independently of the level of both the long- and short-term objectives for the Non Degree/Category I-IIIA market segment.

It was clear from these observations that "pressure" on the recruiting system had differing impacts on the number of prospects brought into the process through the examination stage, and on the number of those prospects who eventually enlist in the Army.

Impact of the Other System Variables on the Level of Exams.

It was important to investigate the possiblity that variation in one or more of the other key system variables would impact the mix of people who came in to take exams, with respect to their propensity to eventually enlist.

This was tested by specifying a multiplicative model relating accession variation to exam levels and to all of the policy and environmental variables already identified as key to describing variations in the recruiting process.

Because of the complexity of the exam model specification, the hypothesis that a variable had an effect on accessions beyond its effect on exams was rejected, unless there was strong evidence to the contrary (t-statistics well over 2.0). We found that the termination of the GI Bill had a negative impact on the conversion of accessions to exams for the HSDG/CAT I-IIIA market segment, but that no other variables affected accessions more than they affected exams for any of the market segments.

Final Linkage Models.

The key observations regarding the linkage between exam levels and accession levels (diminishing returns of accessions to exams, the importance of objectives, and adjustment for the GI Bill) led to the following linkage model specifications for each of the market segments (Tables 4-4, 4-5 and 4-6). The estimated models were linear in the logarithms of the dependent variable (accessions) and the independent variables, in order to specify the multiplicative models required. The estimated coefficients are the elasticities. There was strong indication of auto-correlation in the residual series when ordinary least squares were used. Therefore, the Cochrane-Orcutt algorithm, which adjusts the estimates based on the assumption of a first-order auto-correlation in the residuals, was used to estimate the equations.

TABLE 4-4. HSDG/Category I-IIIA Accessions (in Logarithms) Model

VARIABLE	COEFFICIENT	"t" STATISTIC
Constant	6.97	3.4
Log (CAT I-IIIA Exams)	.86	8.7
Log (Long-Term Objectives)	-.71	-2.9
Log (Short-Term Objectives)	.078	2.0
GI Bill Indicator	.27	3.5
Auto-Correlation Coefficient	.35	2.6
R^2	.88	

TABLE 4-5. HSDG/Category IIIB-IV Accessions (in Logarithms) Model

VARIABLE	COEFFICIENT	"t" STATISTIC
Constant	11.4	4.8
Log (Cat IIIB-IV Exams)	.61	4.7
Log (Long-Term Objectives)	-.97	2.9
Log (Short-Term Objectives)	.17	3.3
Auto-Correlation Coefficient	.47	3.7
R^2	.62	

TABLE 4-6. NHSDG/Category I-IIIA Accessions (in Logarithms) Model

VARIABLE	COEFFICIENT	"t" STATISTIC
Constant	1.9	1.1
Log (Cat I-IIIA Exams)	.61	3.2
Auto-Correlation Coefficient	.81	9.5
R^2	.77	

CHAPTER 5
VALIDATION

The validity check consisted of the following procedures:

- Review of the goodness of fit of the models.
- Review of the structural sensitivity of the fitted exam models to excluded variables and to re-estimated the model structure over a split-half time frame.

As outlined below, the results of executing these steps show that the developed models track the actual accession data well, and were robust with respect to the tests used.

Section I. GOODNESS OF FIT

Fitting Procedure.

The fitted accessions from the two-stage model for each target group were calculated in two steps. First, exam levels were calculated using advertising, other controllable variables, and non-controllable environmental factors. Then accessions for each segment were determined using the calculated exams (for the appropriate mental category) in the appropriate linkage models.

Evaluation of Fit.

The goodness of fit evaluated how well the model structure tracked the monthly recruiting performance data over the time frame used to estimate the models. The fit was examined for each of the two exam models, for the accession models of each of the three key market segments (based on the two-stage procedure), and for aggregates of the accession market segments.

The squared correlation between the actual and fitted exam and accession series indicates good fits. For the aggregate accession series, the components were added for the actual and fitted series, and the correlation between the fitted and actual aggregates was computed. The squared correlations range between 64% and 93%, which indicates a high degree of accuracy in explaining the series variations.

The Fits are presented in Table 5-1, below.

Table 5-1. Goodness of Fit

EXAM MODELS	R^2
I-IIIA EXAM	.93
IIIB-IV EXAM	.90
2-STAGE ACCESSION MODELS	
High School Degree/Category I-IIIA	.88
High School Degree/Category IIIB-IV	.64
Non-Degree/Category I-IIIA	.72
All Market Segments Combined	.86
Total High School Degree	.86

Section II. STRUCTURAL SENSITIVITY OF FITTED EXAM MODELS

Variable Exclusion.

In evaluating the robustness of the multivariate structure specified in the exam models, it was important to determine whether the structural implications of each of the independent variables (coefficient sign and order of magnitude of coefficient size) had been strongly biased by the inclusion of one of the other variables in the model specification.

Dropping each of the variables from the model specification individually, and re-estimating the coefficients of the remaining variables provides a test of this structural sensitivity. In executing this procedure, particular attention was paid to the impact on the advertising variables.

This procedure was carried out for both of the exam models with the following results:

- The advertising variables in both of the exam model specifications maintain consistent signs and sizes when each of the other variables is removed.
- The other variables all maintain consistency with respect to sign when other variables are removed, although the size of the coefficients is less stable for some of the variables.
- The overall system structure is highly stable for both models.

Split-Half Analysis.

The time frame examined was split into two parts, and the coefficients in each of the specified exam model structures were re-estimated. The purpose of this exercise was to verify that the basic model structure provides an appropriate description of the process that is consistent across different time spans.

Each of the resulting split time frames had 27 observations. These samples were clearly too small to attach any degree of statistical significance to the results; however, in a directional sense, the results provided clear evidence of the stability in the model structure.

The resulting analysis showed a high degree of structural robustness. With the exception of the production recruiter variable, each of the estimated variable coefficients kept the same sign in both samples. There was variation in the magnitude of the coefficients, most notably in the relative pay variable, but this would be expected given the small sample sizes.

Overall, the basic structure of the estimated system showed little sensitivity to the change in time frame.

CHAPTER 6
ECONOMIC IMPLICATIONS

The purpose of this chapter is to investigate the economic implications of the model results that were described in Chapter 4 and validated in Chapter 5.

Section I. PROCEDURES

All of the economic implications described in this chapter are based on a simple procedure: we tested what would have happened to recruiting in Fiscal Year 1980 if we had increased any of the key factors in the model by 10% over the FY80 level, while not altering any other factors. Key factors that were tested one by one in this manner include youth unemployment, civilian minimum wage, starting pay, the number of recruiters, total accession objectives, and media expenditures in FY80 dollars.

Testing the impact of a 10% increase in a factor required two steps. First, we calculated the increase in FY80 exams resulting from a 10% increase for any given factor. Since the two exam models are linear, we computed the increase in exams by multiplying the factor's coefficient in each exam model by 10% of the factor's FY80 level.

We then computed the eventual change in accessions by using the linkage models. In testing most of the variables, the impact of a 10% change on accessions is accomplished by first adding the incremental exams calculated in Step 1 to the FY80 exam levels, and then running the linkage models to predict the impact on accessions in FY80.

Section II. RESULTS

The results of testing a 10% increase in each of the key factors one by one is shown in Table 6-1. The first column of numbers indicates the magnitude of a 10% change in each key factor. For example, youth unemployment was 17% in 1980. The second column indicates any incremental cost to the Army (The incremental cost of a 10% increase in pay is set at $72MM. This figure assumes that only new accessions receive the increase in pay. The incremental cost of a recruiter is assumed to be $30,000. Media expenditures during FY80 were $27MM in dollars deflated to December 1978 levels. These expenditures in 1980 dollars would equal about $31MM. We then adjusted this figure down to $30MM to reflect the fact that FY80 recruiting was impacted by the delayed effect of advertising in FY79, a year in which inflation-adjusted media expenditures were less than they were in FY80).

The third and fourth columns represent incremental accessions on prime and HSDG accessions respectively. For example, if FY80 youth unemployment had been 1.7% higher, the models detailed in Chapter 4 predict that the Army would have gained approximately 2,400 more prime accessions.

Table 6-1. Incremental Accessions Due To Increasing Key Factors 10% Beyond Their 1980 Levels

	Amount of Change		Incremental Accessions		
	change	cost ($MM)	CAT I-IIIA HSDG	any HSDG	CAT I-IIIA NHSDG or any HSDG
Unemployment	1.7 points	—	2,400	4,200	5,200
Minimum Wage	+31¢/hr.	—	-2,300	-4,400	-5,400
Starting Pay	$44/mo.	$72*	2,300	4,400	5,400
Recruiter Force	533 bodies	$16**	2,200	5,800	6,700
Total Objectives	1,100/mo.	—	-1,800	-5,200	-5,000
Advertising (in 1980 dollars)	—	$ 3	900	2,000	2,400

* A budget increase of $72MM is required to give new accessions a 10% increase in real starting pay. The cost of increasing pay throughout the Army is not included.

** The incremental cost of a recruiter is assumed to be $30,000.

The effect on total high school accessions (Column four), was computed by combining the effects on CAT I-IIIA and CAT IIIB-IV HSDG accessions. The last column indicates the full incremental effect on all accessions by adding the effect on CAT I-IIIA HSDG accessions to the incremental HSDG accessions.

The effects of these changes upon CAT IIIB-IV NHSDG accessions were not considered, since this group is primarily a filler group. For example, while more IIIB-IV prospects would want to enlist if youth unemployment increased, more would not necessarily have been accessed. As discussed in Chapter 4, the conversion of NHSDG/IIIB-IV exams is not determined by the supply of NHSDG/IIIB-IV exams but by the Army's total accession objectives and success in converting better qualified prospects.

Implications of a 10% Increase in Advertising.

A $3MM increase in media expenditures would have gained the Army approximately 900 incremental prime accessions, 2,000 incremental HSDG accessions, or 2,400 incremental accessions in full.

Implications of Increasing Advertising Expenditures by $1,000,000.

Figure 6-1 presents a graphic representation of a $1.0MM increase in the advertising budget. One million dollars attracts approximately 300 prime recruits, 370 other HSDG recruits and 130 smarter than average males without a high school degree, adding up to 800 incremental accessions.

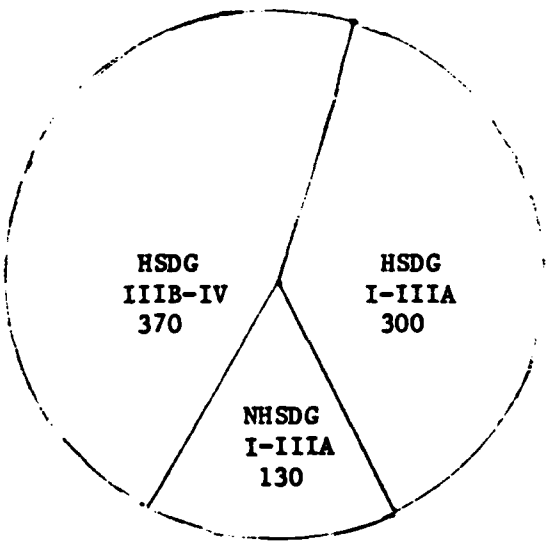

Figure 6-1. Effects Of An Additional $1.0MM In Advertising

These figures were calculated by simply dividing the effects of a $3MM increase by three. While simple division ignores the issue of diminishing returns to advertising implied by the multiplicative linkage model, we felt comfortable in simplfying the analysis, since the number of additional accessions we would have added to the pie chart in Figure 6.1 is so small that we cannot reliably report such differences.

Advertising Costs Per Recruit.

The advertising costs per recruit of adding $1.0MM to the advertising budget are presented in Table 6-2. A prime incremental accession costs $3,300 while an incremental accession in general has an average cost of $1,250.

A cost of $3,300 per prime recruit may sound high, but one must remember that we are not discussing the advertising costs of attracting a trial user of toothpaste: this is the incremental advertising cost to attract a smarter than average young man with a high school degree who will commit three years of his life, or perhaps his entire life, to his country.

Table 6-2. Advertising Costs Per Recruit*

	Best Estimate	67% Confidence Range
CAT I-IIIA, HSDG	$3,300	$2,500-$6,200
Any HSDG	$1,500	$1,200-$2,200
Any HSDG or I-IIIA, NHSDG	$1,250	$ 900-$1,900

* Assuming 1980 media mix, 1980 dollars

Relative Cost-Efficiency Of Advertising.

Increasing advertising is a more cost-effective way of increasing enlistments than increasing either recruiters or starting pay. The relative costs per recruit are seen in Table 6-3. Increasing advertising is approximately ten times more cost-effective than increasing starting pay, and is approximately twice as cost-effective as a comparable increase in the recruiter force.

Table 6-3. Relative Cost Efficiencies

	Incremental Cost Per Recruit*		
	CAT I-IIIA HSDG	any HSDG	CAT I-IIIA NHSDG or any HSDG
Relative Pay (Starting Pay/Min. Wage)	$31,000	$16,000	$13,000
Recruiter Force	7,200	2,800	2,900
Advertising	3,300	1,500	1,250

*Based on increasing each variable by 10%.

Increased Objectives.

Increasing pressure on the recruiting system has historically been counter-productive, as Table 6.4 below shows. A 10% increase in total objectives has a negative overall effect on all accessions (except for the CAT IIIB-IV/NHSDG market segment: if the increased quantity objectives are met, but they result in a decrease in the accession of the recruits from the three quality groups, then the accession of CAT IIIB-IV/NHSDG recruits must increase). The models show that pressure increases the number of exam-takers, but depresses conversion rates enough to make the overall result negative.

Table 6-4. Effect of Increasing Total Objectives By 10%

Market Segment	Effect on Accessions
CAT I-IIIA/HSDG	- 5%
Any HSDG	-10%
Any HSDG or CAT I-IIIA	- 5%

Effect of GI Bill Termination.

The termination of the GI Bill had a major impact on recruiting, as seen in Table 6-5 below. Nevertheless, we wish to emphasize that we do not believe that restoration of the GI Bill will result in recouping these recruits in the short run, since its termination coincided with major policy changes and budget cuts. In addition, the program's 30-year history contributed to its universal awareness, and government loans and grants to educational assistance have tripled since the bill's termination, further complicating attempts at projecting restoration effects.

Table 6-5. Effect of Terminating the GI Bill

Market Segments	Effect on Accessions
CAT I-IIIA/HSDG	down 11,000/year
Any HSDG	down 22,000/year
Any HSDG or CAT I-IIIA	down 27,000/year