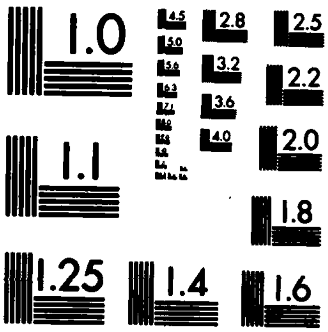
AD-A137 286 AN ANALYSIS OF COLA (COST OF LIVING ADJUSTMENT) ALLOCATION WITHIN THE UNITED STATES COAST GUARD(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA K G ROSS SEP 83 1/2

UNCLASSIFIED F/G 5/4 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

2

AD A 137286

NAVAL POSTGRADUATE SCHOOL

Monterey, California

THESIS

AN ANALYSIS OF COLA ALLOCATION WITHIN
THE UNITED STATES COAST GUARD

by

Kevin G. Ross

September 1983

Thesis Advisor: P.M. Carrick

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A132 286	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) An Analysis of COLA Allocation within the United States Coast Guard		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis; September 1983
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Kevin G. Ross		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943		12. REPORT DATE September 1983
		13. NUMBER OF PAGES 180
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

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)

18. SUPPLEMENTARY NOTES

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

Inflation Rate Models

Allocation Models

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

A model is developed for the allocation of a known fixed-amount of money to various financial accounts. Market baskets were defined for each of the accounts and models were developed to calculate estimated inflation rates for each account. These inflation rates were then used as inputs into the allocation model. The proposed allocation model distributed the funds to

DD FORM 1473 1 JAN 73 EDITION OF 1 NOV 65 IS OBSOLETE

S/N 0102-LF-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

#20 - ABSTRACT - (CONTINUED)

the accounts in a manner such that each account received an equal percentage of its cost of living increase.

Accession For	
NTIS GRA&I	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

DTIC COPY INSPECTED 2

Approved for public release; distribution unlimited.

An Analysis of COLA Allocation Within
The United States Coast Guard

by

Kevin G. Ross
Lieutenant, United States Coast Guard
B.S., United States Coast Guard Academy, 1978

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN OPERATIONS RESEARCH

from the

NAVAL POSTGRADUATE SCHOOL
September 1983

Author: Kevin G. Ross

Approved by: P. M. Carrick
Thesis Advisor

Second Reader

Chairman, Department of Operations Research

K. T. Marshall
Dean of Information and Policy Sciences

ABSTRACT

A model is developed for the allocation of a known fixed-amount of money to various financial accounts. Market baskets were defined for each of the accounts and models were developed to calculate estimated inflation rates for each account. These inflation rates were then used as inputs into the allocation model. The proposed allocation model distributed the funds to the accounts in a manner such that each account received an equal percentage of its cost of living increase.

TABLE OF CONTENTS

I. INTRODUCTION

A. IDENTIFICATION OF THE AREA OF INVESTIGATION

An important economic goal of the United States Coast Guard is to expend funds allocated by Congress in such a manner so as to achieve and maintain high standards of performance in all assigned missions and duties. An important step in attaining this goal is the efficient internal allocation of funds within the appropriation category of Operating Expenses. The financial accounts which distribute the funds in this appropriation at the Headquarters level are termed Operating Guides and are listed below with the operating funds that they are responsible for:

(a) OG-30 Operating and Maintenance

(b) OG-41 Aviation Maintenance

(c) OG-42 Electronic Maintenance

(d) OG-43 Structure Maintenance

(e) OG-45 Vessel Maintenance

(f) OG-46 Ocean Engineering Equipment

(g) OG-54 Small Arms and Ammunition

(h) OG-56 Personnel Training

(i) OG-57 Medical Equipment

(j) Fuel A Special Case

(k) OG-01 Housing and General Mess

(l) OG-20 Travel and Transportation (PCS)

The impact of inflation during any one year is not uniform throughout the economy, and since these individual accounts concentrate on different sectors of the economy they may encounter different rates of inflation. Each year the Coast Guard receives a lump-sum cost of living adjustment, COLA, for use in the approaching fiscal year. It is based on the anticipated rate of inflation as estimated by the Office of Management and Budget (OMB). Presently, the funds are internally allocated within the Coast Guard in a manner whereby each operating guide receives an identical percentage increase to its non-pay expenditure base from the previous fiscal year. This percentage is equal to the COLA rate provided by OMB. Although each account receives the same percentage of COLA, some accounts may see a greater erosion of their spending power in comparison to other accounts. The Office of Programs (G-CPA) at Coast Guard Headquarters requested that a study be conducted to determine if a method could be developed that would allocate the COLA funds in a manner whereby each account is allocated an equal amount of funds based on its estimated inflation rate.

The objective of this thesis is to propose a method as described above, and also show any differences between the COLA obtained and the COLA actually needed to totally counter the effects of inflation.

To provide the reader with necessary background, the remaining sections of Chapter I will investigate theory behind budgeting for inflation and price indices. Chapter II will provide background on the Coast Guard's budget system, and some of the figures involved. Chapter III contains models for each operating guide, and Chapter IV uses these models to determine the cost-of-living for each account. In Chapter V each cost-of-living measure is used as part of a model which allocates the COLA funds to the twelve operating guides.

B. BUDGETING FOR INFLATION

In order to perform in an efficient manner every agency and firm, be it private or public, big or small, must develop a method of resource planning and allocation. A budget is of major importance in this planning as it shows the distribution of dollars to the different divisions within an agency or firm. A misallocation of funds within any agency can lead to less profit, unemployment, and poor performance by both personnel and equipment.

A budget is both a record of the past and a statement about the future plans and goals of an agency, as it links past and proposed expenditures. To accomplish this linking, proposals, or strategies are developed which represent an organization's expectations and aspirations [Ref. 1: pp. 4]. Based on these strategies dollar resources are allocated to the various goals of the agency. As the rate of inflation affects various industries in different ways part of this dollar allocation pla[illegible]e task of measuring inflation.

During the 1970's an increasing inflation rate overtook the nation, and severe steps had to be taken to understand and limit the effects of the rising prices. These steps usually include a method of predicting an anticipated rate of inflation on which to base allocations on. Unfortunately, this anticipated rate is not always the same as the subsequent real rate of inflation. As the budget is executed and actual inflation is experienced, it is important for the agency to perform appropriate measurements to correct for any misallocations [Ref. 2: p. 2].

To reflect the rate of inflation that an individual agency expects to experience, the agency can disaggregate the budget and then match these budget categories to appropriate inflation measuring factors. Usually the level of disaggregation that an agency uses will depend on the commodities that they purchase and the inflation measures available. The important feature in predicting the impact of inflation on an agency involves representing the essential elements and missions of the agency and their interaction with the economic environment [Ref. 3: p. 35]. By theory, disaggregation should continue until the commodities and services have been divided into m mutually exclusive and exhaustive subsets within which the behavior of prices and changes in prices are similar and stable [Ref. 4: p. 27]. It is important that the market baskets developed through the disaggregation, represent the commodities and services used in performing the agency's missions and operations.

Over the years, economists have developed various models for predicting the effects of inflation on different segments of the economy. Familiar and useful measurements of inflation are the cost-of-living indexes, such as the Consumer Price Index [Ref. 5: p. 146]. These indices may be only approximations, but they are a highly useful tool for quantifying the degree of inflation experienced by the entire economy.

In this thesis two basic indexes are used, the Producer Price Index series (PPI), and the Consumer Price Index series (CPI). With the use of these two inflation measuring factors, market baskets are produced for the twelve operating guides within the Coast Guard.

Since these two index series will be utilized, the next section will deal with basic theory of price indices.

C. THEORY OF PRICE INDEXES

In general, an index is a ratio of one quantity to another, and expresses this ratio in terms of its value relative to a base period's value. Therefore a price index measures changes in the price of an item by forming the ratio of the price in one period to the price of that particular item in a different period of time, usually the base period.

An initial step in developing a price index is to select a market basket of commodities and services whose price measurement the price index is being designed to calculate.

The simplest form of a price index is one that involves only a single item, but this is too limited where the concern is over a market basket of many goods. At this point an aggregate price index must be developed.

At first, one may consider a simple averaging over the price indexes of the individual commodities and services. But such a technique would be affected by extremes and give heavier weights to those items that experience a large increase or decrease in prices between the selected periods. A suitable index is made of two main parts, the price relative and a corresponding set of weights.

The price relative is the ratio of prices between two periods for each item.

$$\frac{P_{1i}}{P_{0i}}$$

where 0, 1 are the two periods and i represents the individual items. Multiplying this equation by the appropriate quantity for each item (same quantity in each period), we obtain the inflation factor for each item [Ref. 6: p. 20]. Summing over all items we obtain the inflation rate for a given bundle of goods Q_0.

$$\frac{P_1 Q_0}{P_0 Q_0} \quad \text{(summed over i goods)}$$

Another method of obtaining this same equation is to multiply the price relatives of each individual item by the proportion

$$\frac{P_{0i}Q_{0i}}{\sum_i P_0Q_0}$$

This quantity is the expenditure of each good i, divided by the total expenditure for period 0, and is a weighting factor representing each individual good's expenditure in relation to the total expenditure. Multiplying the weights by the price relatives and then summing over all items produces the same format as before.

$$\frac{P_1Q_0}{P_0Q_0} \quad \text{(summed over i goods)}$$

This equation represents a fixed-weight, fixed-base index termed the Laspeyres Index, developed by Etienne Laspeyres in 1864 [Ref. 7: p. 23]. In this equation, the numerator represents the market basket expenditure at current prices. The denominator represents the expenditure on the same commodities at the base period's prices. This type of index informs the consumer of how much relatively more it will cost him/her to purchase a base year market basket in any subsequent year.

Another commonly discussed price index is the Paasche Index, developed by H. Paasche in the year 1874 [Ref. 8: p. 24].

$$\frac{P_1Q_1}{P_0Q_1} \quad \text{(summed over all items i = 1,N)}$$

The Paasche Index uses current period quantities, Q_1, as weights, and is a ratio of the current period expenditure to a base expenditure based on the current period's quantity of goods. This index informs the consumer of how much it will cost to purchase a present market in the current period relative to the amount that same basket cost in the base period.

Price indices are also found in other forms, some of which are: [Ref. 9, p. 9]

(a) geometric average of the Laspeyre and Paasche indexes.

$$100\left(\frac{P_1Q_0}{P_0Q_0} \cdot \frac{P_1Q_1}{P_0Q_1}\right)^{1/2}$$

(b) different forms of the average.

$$\frac{100}{2}\left(\frac{P_1Q_0}{P_0Q_0} + \frac{P_1Q_1}{P_0Q_1}\right)$$

$$100\left(\frac{[Q_0Q_1]^{1/2}P_1}{[Q_0Q_1]^{1/2}P_0}\right)$$

(c) Marshall-Edgeworth formula.

$$\frac{100(P_1(Q_0+Q_1))}{(P_0(Q_0+Q_1))}$$

Although these indexes are of different mathematical forms, they are similar in that they relate expenditures of one period to that of another period.

A composite index can be formed by using the Laspeyres form of the price index [Ref. 10: pp. 10-11]. The composite form of the index is as follows:

$$100\left(\frac{(P_1/P_0)P_0Q_0}{P_0Q_0}\right)$$

Denoting $100P_1/P_0$ for each item by r(i) and $P_0(i)Q_0(i)/P_0Q_0$ by w(i) one obtains r(i)w(i), summed over all i [Ref. 11: p. 11]. In this equation r(i) is the price relative of the i^{th} item, and w(i) is the weight for the i^{th} item. This weight is the proportion of an item's expenditure to the total expenditure of the consumer group. The formula for the price index in this form is

$$\frac{\sum r(i)w(i)}{\sum w(i)}$$

The weights are usually expressed so that their summation is one [Ref. 12: p. 11]. This form is useful for allowing agencies to develop their own indices as will be demonstrated in forming market baskets and a predictive model.

The Consumer Price Index (CPI) is a measure of the average change in prices over a period of time for a fixed basket of goods and services. There are two population groups for which the CPI is now published. CPI-U is a new index which covers approximately 80 percent of the total noninstitutional civilian population [Ref. 13: p. 81]. The other index is for Urban Wage Earners and Clerical Workers (CPI-W), which represents about half the population covered by CPI-U [Ref. 14: p. 81]. In calculating either index, weights are assigned to listed items in accordance with their importance as measured by the appropriate population group's spending patterns. Changes in prices of various commodities and services from different locations are averaged together with their weights to produce the index [Ref. 15: p. 81].

Another index of importance, that is published on a monthly basis, is the Producer Price index series. This index is considered to be a general purpose index designed to measure changes in the general price level in all markets except for retail [Ref. 16: p. 109]. Most of the prices are the selling prices of representative manufacturers or producers, but some prices are those quoted on organized exchanges or at central markets [Ref. 17: p. 110]. The Producer Price Index series covers primary markets of the United States such as manufactured and processed goods, output of industries classified as manufacturing, agriculture, forestry, fishing, mining, gas and electricity, public utilities and goods competitive with those made in the producing sector, such as waste and scrap material. These indexes are calculated in a manner similar to the method used on the Consumer Price Indexes.

These two index series are of great value in determining the inflation rate in different sectors of the economy. Their use will be demonstrated in Chapter III, when cost-of-living indexes are developed for each operating guide.

The next chapter outlines the Coast Guard's budget system and gives the reader an insight into the functions of the operating guides.

II. THE COAST GUARD BUDGET

A. THE SYSTEM

The budget of the United States Coast Guard is based on a planning, programming, and budgetary cycle that begins anew every twelve months. This 'budget cycle' consists of a sequence of events that require thirty-four months for completion. Due to the period of time for the cycle, several budgets will be in varying degrees of development at any given point in time. A budget begins its lengthy process in the planning stages of the PPB cycle in early February of BY+2. (BY+2 means two years before the budget year (BY), which is the annual budget that has been submitted to higher levels for review, authorization and appropriations.) Therefore at the BY+2 stage, the budget is some thirty months away from appropriation. At this time the Commandant states his goals and priorities for the Coast Guard through a document entitled "The Long Range View." This document initiates the budget process, providing a common foundation in which objectives and policy framework are given for which to base planning for the future on. "The Long Range View" is divided into two sections, the 'overview' and the 'fore-casts.' The overview gives a general discussion of the relationship between the Coast Guard's missions, facilities, and personnel; and external changes in national programs and policies. The forecasts section documents the Coast Guard's formal objectives and considers responses to future events and trends that may impact heavily on the Agency.

In late February of BY+2, Operating Program Plans are submitted by Program Managers to the Office of Planning Evaluation (CPE). Table 2-1 outlines the operating program areas within Coast Guard Headquarters and what Operating Program Plans are required to be submitted. These Program Plans reduce the Long Range Views twenty-five year forecasts to a more predictable ten year planning horizon and are intended to bridge operational activities with planning and programming efforts. This allows the Program Managers to

TABLE 2-1

OPERATING PROGRAMS

OPERATING PROGRAM AREA	OPERATING PROGRAM PLAN
SEARCH AND RESCUE	SEARCH AND RESCUE
AIDS TO NAVIGATION	SHORT RANGE AIDS TO NAVIGATION
OBSTRUCTIVE BRIDGES	BRIDGE ADMINISTRATION
MARINE SAFETY	COMMERCIAL VESSEL SAFETY RECREATIONAL BOATING SAFETY
MARINE ENVIRONMENTAL SAFETY	PORT AND ENVIRONMENTAL SAFETY MARINE ENVIRONMENTAL RESPONSE
OCEAN OPERATIONS	ICE OPERATIONS ENFORCEMENT OF LAWS AND TREATIES
MILITARY READINESS	MILITARY OPERATIONS/PREPAREDNESS
RESERVE TRAINING	RESERVE TRAINING

set appropriate levels for their operations and the resulting resource requirements.

Upon receiving approval on the Program Plans, the Program Managers now develop Operating Program Plan Summaries in mid-April. These summaries reduce the necessary planning and programming to a period of five years. The Plan Summaries are concerned with current shortages and the resources that are needed to reduce these shortages.

In June the Cutter, Boat and Aviation Plan, along with the Shore Facility Plan are submitted as outlined in Table 2-2. These three Plans list the resources needed for aircraft, vessels, and shore facilities in the various Coast Guard programs.

TABLE 2-2

FACILITY REQUIREMENTS/FACILITY PLANS RESPONSIBILITIES

FACILITY	PROGRAM MANAGER
SHORE FACILITIES REQUIREMENTS/SHORE FACILITIES PLAN	Chief, G-ECV
CUTTER REQUIREMENTS/ CUTTER PLAN	Chief, G-OP
AVIATION REQUIREMENTS/ AVIATION PLAN	Chief, G-OP

At the same time that the Operating Plans are being submitted and approved, Support Programs are going through the same process. Table 2-3 shows the different plans submitted for General Support.

TABLE 2-3

SUPPORT PROGRAMS

SUPPORT PROGRAM/PLAN
GENERAL ADMINISTRATION
PERSONNEL
ENGINEERING
FINANCIAL MANAGEMENT, PERSONNEL AND SUPPLY
RESEARCH AND DEVELOPMENT
HEALTH SERVICES SUPPORT
LEGAL SUPPORT
SAFETY AND OCCUPATIONAL HEALTH
CIVIL RIGHTS
PUBLIC AFFAIRS
INTELLIGENCE AND SECURITY
COMMAND, CONTROL AND COMMUNICATIONS

During August and September of BY+2, Determination drafts are submitted by Program Managers for both operational and support programs. The drafts are then reviewed, and in October, the Commandant issues the Determinations for the various programs to be included in the budget that is still twenty-four months from appropriation.

Determinations are a method through which the Commandant sets priorities for the appropriate budget. The submitted drafts set the agenda for discussions between the individual

Program Managers and the Commandant and his staff. Emphasizing concepts, Determinations set a priority listing of problems, not solutions. Through the use of these documents, the Commandant can give strategic guidance on those programs and/or activities that he feels are important and should be included in the budget. After the Commandant issues the final Determinations in October, the Program Managers review the documents and prepare appropriate Resource Change Proposals (RCP's) for submission in February and March of BY+1. The Resource Change Proposals are developed at the program level and are a basis for requesting and allocating funds. They are utilized as a format for guidance, approval, and selection and contain proposed solutions to various program problems. Any RCP submitted contains a preferred solution and at least three alternatives to a particular problem, and includes the net change in money and personnel that is required by each proposed solution. The costs (or gains) of each solution is provided not only for the budget year, but must be extended over a five year period in the future. Each RCP is scored based on a scoring and weighing algorithm which assigns a numerical grade to the RCP. Each RCP is scored many times, and as the priority setting process continues, individual RCP's must satisfy higher and higher standards to remain in competition for funding. Upon completion of the RCP scoring process, the Coordinating Board; consisting of the Deputy Chief of Staff (Chairman), the

Deputy Chief of Headquarters Divisions, Program and Support Managers, and the Chiefs of CPE and CBU; assembles to hear appeals on RCP's that failed to make the 'cut'. Any appeal must contain a statement describing the impact that the non-selection of this project will have on the Coast Guard. Based on recommendations from this Board, a draft of the 'Spring Preview Budget,' which is basically the surviving RCP's, is assembled. In June, the Spring Preview Budget is submitted to the Office of the Secretary of Transportation and the budget process goes outside the Coast Guard for the first time.

The budget that the Department of Transportation receives from the Coast Guard consists of an analysis of major changes in existing or new programs and gives an insight into the direction that the Coast Guard plans to take. In July, the Department of Transportation issues their policies in junction with the Coast Guard's budget and also issues dollar ceilings for the Service's budget. On receipt of the guidance, the Coast Guard must revise their priority list and budget figures to conform to DOT policies. In late July of BY+1, the Coast Guard's budget becomes part of DOT's budget which is submitted to the Office of Management and Budget (OMB) in September

In September and October, Coast Guard personnel appear before OMB hearings to defend the Service's OMB Stage Budget. Another set of guidance and dollar ceilings are issued by

OMB in early November. The next step for the Coast Guard is the preparation and submission of the Congressional Stage Budget for approval to become part of the President's budget.

Throughout the summer months of BY, the budget is reviewed by Congressional House and Senate Appropriation subcommittees and committees. In October, the beginning of this budget's fiscal year, the Appropriation Act is issued by Congress and the Operating Stage Budget is distributed by Coast Guard Headquarters. The Operating Stage Budget represents those funds that the Coast Guard has legal authority, as a federal agency, to spend over the course of the fiscal year. Table 2-4 is an outline of the budget cycle process for the Coast Guard.

Throughout the budget cycle, internal decision-making authority is that of the Commandant's, but the structure of the system also allows for inputs of information and recommendations from personnel up and down the chain of command. Table 2-5 outlines an interactive system where there is a formal dialogue between different levels.

When appropriations are received from Congress the following categories are used:

(a) Operating Expenses

(b) Acquisition, Construction, and Improvements (AC&I)

(c) Alteration of Bridges

(d) Retired Pay

(e) Reserve Training

TABLE 2-4

COAST GUARD BUDGET CYCLE

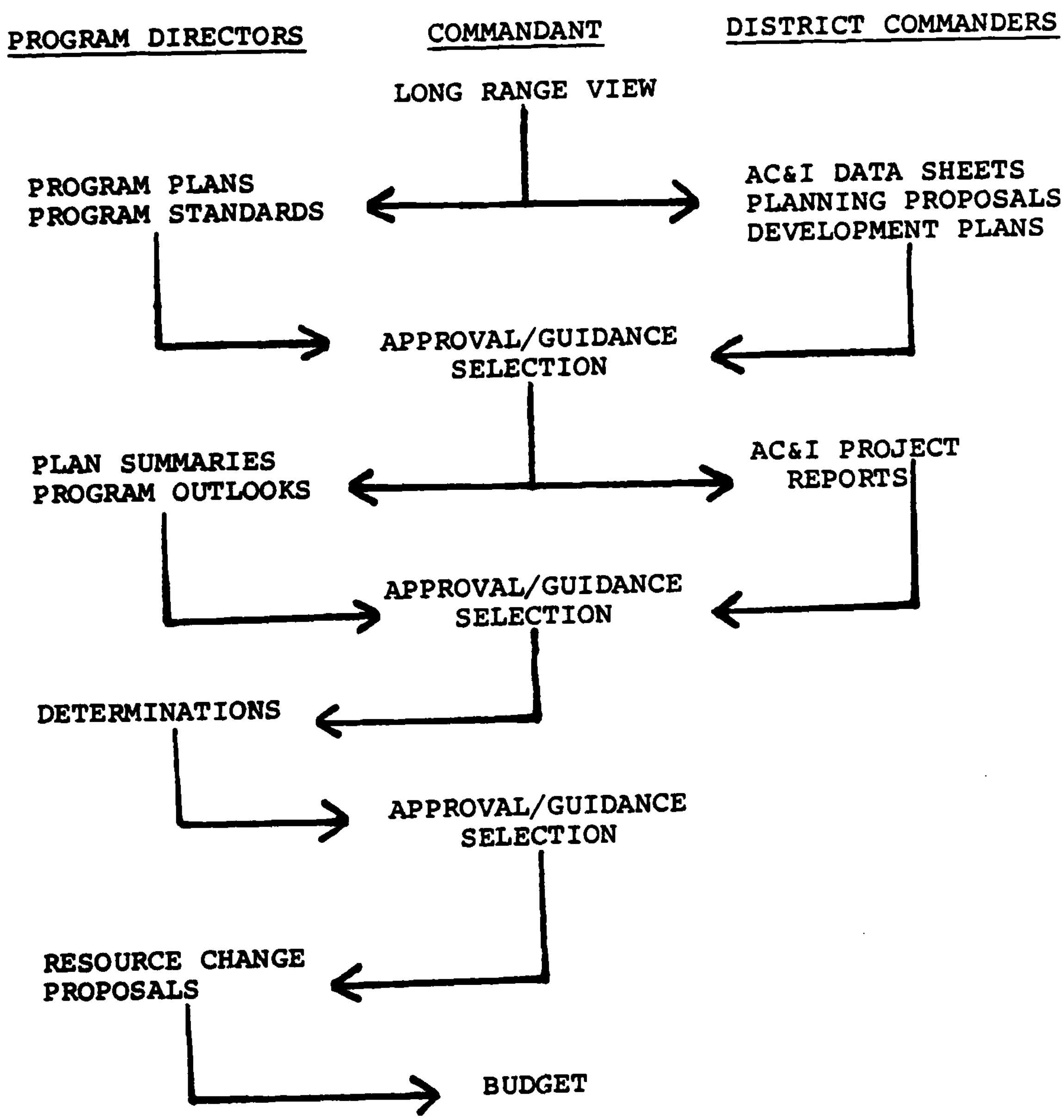
BY+2	
FEBRUARY:	Commandant Issues Long Range View
MARCH:	Submission of Program Plans/Standards
APRIL:	Submission of Operating Plan Summaries
MAY:	Commandant Issues Operating Plan Summaries
JUNE:	Submission of Support Plan Summaries
JULY:	Commandant Issues Support Plan Summaries
AUGUST & SEPTEMBER:	Submission of Determination Drafts
OCTOBER:	Commandant Issues Determinations
BY+1	
FEBRUARY & MARCH:	Submission of Resource Change Proposals
APRIL & MAY:	Scoring of Resource Change Proposals
JUNE:	Spring Preview Budget Submitted to OST
JULY:	OST Guidance Received. Budget Becomes Part of DOT's Budget
SEPTEMBER:	DOT Budget Submitted to OMB
OCTOBER:	OMB Hearings
NOVEMBER:	OMB Guidance Received
DECEMBER:	OMB Budget Finalized
BY	
JANUARY:	Submission of Congressional Stage Budget
MARCH:	House Appropriation Hearings
JUNE:	Senate Appropriation Hearings

TABLE 2-4 (CONT.)

SEPTEMBER:	2nd Concurrent Joint Resolution
OCTOBER:	Appropriation Act Issued by Congress. Operating Stage Budget Issued by the Coast Guard

TABLE 2-5

THE INTERACTIVE NATURE OF COAST GUARD PLANNING



(f) Research, Development, Test and Evaluation

(g) National Recreation Boating Safety and Facilities Improvement Fund

(h) Offshore Oil Pollution Compensation Fund

(i) Deepwater Ports Liability Fund

(j) Oil Pollution Fund

Internally, there are three different classifications of money used; (1) operating expenses (one year money), (2) research and development funds (no year money), and improvement funds (AC&I), which is fixed year money. AC&I money is used for acquisitions of vessels (over $125,000), acquisition of aircrafts, complete or partial renewal of vessels and aircraft (cost over $125,000 and over 75 percent renewed), complete or partial renewal of structures (cost over $125,000 and 75 percent renewed), and betterments costing over $125,000 per aircraft, vessel, or structure. If these requirements are not met, the funding is from the operating expenses account, although operating expenses can not be used to augment any AC&I project.

While AC&I money is zero-based each year, the Operating Expense (OE) money is limited to follow-on money and is an incremental process, base plus an inflation adjustment.

The Operating Expense category, which is the main concern of this thesis, is further subdivided into operating program areas as follows:

(a) Search and Rescue

(b) Aids to Navigation

(c) Marine Safety

(d) Marine and Environmental Protection

(e) Enforcement of Laws and Treaties

(f) Ice Operations

(g) Military Readiness

(h) Headquarter Administration

Within the Coast Guard, Operating Expense funds used by the programs are accounted for on the basis of operating guides. Operating guides consists of those listed earlier plus OG-80 and OG-88 (Reimbursements), OG-08 (Civilian Pay and Allowances), and OG-90 (Reserve Programs Expenses). These four guides are not of a concern since they deal with pay and are affected by another inflation adjustment as provided by Congress.

In the budget process, operating expenses are funded on an incremental process. The previous year's base is fully funded, and then a line item for inflation is included. This inflation adjustment is the COLA received from OMB. Any further additional funds are for RCP's which have been approved and funds provided for. This inflation estimate applies only to non-pay costs in the operating expenses category. OMB Circular A-11 requires that all executive agencies plan any estimates for inflation allowances based on the OMB generated inflation rate. Further guidance is issued in A-11 as stated; "the policy of permitting consideration of price changes for goods and services, (other than federal employee's pay), as a factor in developing the estimate, does not mean that an allowance for the full rate of anticipated inflation should be included in an agency's requests. While agency's totals approved by OMB will reflect consideration of the effect of inflation, they may include an allowance for less than the full rate of anticipated inflation or even no allowance for inflation" [Ref. 18]. This implies that although an agency may plan for the full rate of inflation, they may have to allocate based on a different, smaller rate.

B. THE FIGURES

Although the budget planning cycle begins within the Coast Guard, the actual funding of programs starts with the Congress and their approval of various appropriation bills. It becomes important to understand where the Coast Guard is located in the overall budget set-up.

On the Department level, the Coast Guard is located in the Department of Transportation (DOT) from which they are allocated funds in accordance with a DOT budget. DOT in turn is allocated funds based on a national level budget. Tables 2-6 and 2-7 outline Budget Authority and Budget Outlay as distributed to the different Departments. The Department of Transportation was allocated approximately 2.6 percent of the total Authority and 2.7 percent of total Outlays in fiscal year 1982. Based upon projections to fiscal year 1987, DOT's share will decrease to approximately

TABLE 2-6

BUDGET AUTHORITY BY AGENCY
(In Billions of Dollars)

Department	1982 (Actual)	1983 (Est.)	1984 (Est.)	1985 (Est.)	1986 (Est.)	1987 (Est.)
Legislative Branch	1.4	1.5	1.6	1.6	1.7	1.7
Judiciary	.7	.8	.9	.9	.9	1.0
President	8.6	10.5	9.9	9.4	9.0	8.8
Agriculture	40.6	41.6	39.2	33.7	31.3	32.2
Commerce	1.8	1.6	1.4	1.4	1.4	1.5
Defense (Military)	213.8	239.4	273.4	321.6	356.4	383.3
Defense (Civil)	3.0	3.0	2.1	2.3	2.3	2.4
Education	14.7	13.8	13.1	13.1	13.1	13.1
Energy	7.9	8.4	8.9	10.7	10.6	11.0
Health and Human Services	246.2	273.0	285.2	320.8	353.7	386.9
Housing and Urban Development	20.1	10.7	4.1	4.6	8.7	14.8
Interior	3.7	3.8	3.4	2.9	2.5	3.3
Justice	2.6	2.9	3.4	3.4	3.2	3.3
Labor	27.2	38.1	36.3	34.9	35.3	35.5
State	2.6	2.7	2.9	3.0	3.1	3.2
Transportation	20.5	25.9	27.0	27.7	28.6	28.5
Treasury	111.3	118.2	135.1	152.4	167.5	179.3
Environmental Protection	3.7	3.7	3.6	3.7	3.7	3.4
NASA	6.0	6.8	7.1	7.0	6.3	6.3
Veterans Administ.	24.9	25.0	26.1	26.8	27.7	28.6
Personnel Management	32.6	36.0	38.3	43.5	45.3	47.4
Other Agencies	15.2	16.6	15.6	15.9	15.9	15.9

TABLE 2-7

BUDGET OUTLAYS BY AGENCY
(In Billions of Dollars)

Department	1982 (Actual)	1983 (Est.)	1984 (Est.)	1985 (Est.)	1986 (Est.)	1987 (Est.)
Legislative Branch	1.4	1.5	1.6	1.6	1.6	1.6
Judiciary	.7	.8	.9	.9	.9	.9
President	6.2	7.4	8.0	8.2	8.1	8.1
Agriculture	36.2	45.0	35.0	32.9	32.4	32.9
Commerce	2.0	2.0	1.7	1.6	1.5	1.6
Defense (Military)	182.9	208.9	238.6	277.5	314.9	345.6
Defense (Civil)	3.0	2.9	2.2	2.2	2.3	2.4
Education	14.1	14.4	13.5	13.4	13.0	12.9
Energy	7.6	8.7	8.8	9.6	10.1	10.7
Health and Human Services	251.3	274.4	288.8	312.6	336.2	363.0
Housing and Urban Development	14.5	14.9	13.7	12.8	12.9	14.0
Interior	3.9	4.0	3.6	2.9	2.4	3.3
Justice	2.6	3.0	3.3	3.3	3.3	3.3
Labor	30.7	43.0	34.3	30.5	28.9	28.0
State	2.2	2.3	2.6	2.7	2.8	2.9
Transportation	19.9	21.2	24.4	24.4	26.3	27.1
Treasury	110.5	118.0	135.0	152.2	167.2	179.0
Environmental Protection	5.1	4.4	4.1	4.0	3.8	3.6
NASA	6.0	6.7	7.0	7.0	6.4	6.3
Veterans Administ.	23.9	24.4	25.7	26.4	27.1	27.8
Personnel Management	20.0	21.5	23.2	24.2	25.9	27.5
Other Agencies	13.1	12.5	11.4	10.4	10.3	9.6

2.5 percent of the total in each category. The annual rate of change, for DOT, in Outlays is estimated to fall from a 15 percent increase between 1983-84 to a 3 percent increase between 1986-87. For Budget Authority this decrease will be from a high of 26 percent between fiscal years 1982-83 to a minus .3 percent between 1986-87.

This decreasing rate of growth will likely affect the Department of Transportation's goal of providing a U.S. transportation system that is safe, efficient, and economical in the movement of people and goods and in supporting the national defense. These goals are intrinsically in conflict, but especially so when funds are scarce which means that trade offs will have to be made between these three major goals. These changes on the national level will also affect the agencies within each Department. Table 2-8 shows the budget authority allocations and Table 2-9 shows the budget outlays allocations, for the major programs within the Department of Transportation. Ground transportation includes highway safety, mass transit, and railways; air transportation deals with airports, aeronautical research and technology, and air carrier subsidies; and water transportation includes ocean shipping, marine safety, and marine transportation. Generally, these programs are facing the same monetary situation as the Department is facing on the national level. The expected cutbacks in DOT's budget and their effect on various agencies is depicted in Table 2-10, which

TABLE 2-8

BUDGET AUTHORITY--MAJOR PROGRAMS IN DOT
(In Millions of Dollars)

Program	1982 (Actual)	1983 (Est.)	1984 (Est.)	1985 (Est.)
GROUND TRANSPORTATION	14,559	18,869	19,062	19,147
AIR TRANSPORTATION	3,785	4,806	5,692	6,142
WATER TRANSPORTATION	2,939	2,994	2,995	3,103
OTHER				

TABLE 2-9

BUDGET OUTLAYS--MAJOR PROGRAMS IN DOT
(In Millions of Dollars)

Program	1982 (Actual)	1983 (Est.)	1984 (Est.)	1985 (Est.)
GROUND TRANSPORTATION	14,326	14,562	17,249	17,875
AIR TRANSPORTATION	3,564	4,222	4,884	5,173
WATER TRANSPORTATION	2,696	3,059	3,019	3,054
OTHER	90	120	118	173

TABLE 2-10

TOTAL FEDERAL FUNDS--DOT BUDGET
(In Thousands of Dollars)

Agency	1982 (Actual)	1983 (Est.)	1984 (Est.)
FEDERAL HIGHWAY ADM.			
AUTHORITY	431,598	533,309	13,020
OUTLAYS	122,451	356,105	465,255
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION			
AUTHORITY	50,252	52,745	55,784
OUTLAYS	45,521	64,748	55,580
FEDERAL RAILROAD ADM.			
AUTHORITY	1,951,464	1,019,679	908,707
OUTLAYS	2,218,532	1,616,015	1,190,819
URBAN MASS TRANSIT			
AUTHORITY	3,532,238	3,566,166	2,665,166
OUTLAYS	3,864,234	3,818,330	3,487,970
FEDERAL AVIATION			
AUTHORITY	1,537,929	1,369,535	1,652,405
OUTLAYS	1,379,635	1,404,095	1,651,954
COAST GUARD			
AUTHORITY	2,525,522	2,465,126	2,544,447
OUTLAYS	2,077,060	2,462,075	2,571,734
MARITIME ADMINISTRATION			
AUTHORITY	434,150	525,234	511,513
OUTLAYS	650,830	597,747	509,403

shows the funds allocated to the major agencies within DOT. Of the total funds received by the Department, the Coast Guard is typically allocated 9 percent of the budget authority and 10.5 percent of the outlays. Of the funds allocated to the Coast Guard, approximately 64 percent is targeted for the important appropriation category, operating expenses.

In the final budget the Coast Guard actually receives 85 to 90 percent of funds requested in their initial budget. As the budget progresses through the different stages from the agency level to the congressional level, priorities are established at each level. As the sequence of priorities are established, the dollar figures within the Coast Guard's budget also changes as shown in Tables 2-11 and 2-12 for fiscal years 1983 and 1984. At each ascending level the dollars being funded at that level must be allocated to more units than at the preceding level. With funds being slashed at each level, individual budgets are being reduced.

Table 2-13 gives the allocation of funds within the Operating Expense category to the major programs. Search and Rescue, Aids to Navigation, and Enforcement of Laws and Treaties receive almost 70 percent of all funds being allocated with 26 percent, 22 percent, and 21 percent, respectively. These three programs make major use of aircraft and cutters, and receive a large amount of support from land stations. The use of these systems and the funds used by these programs is the link between the major program

TABLE 2-11

FY 1983 COAST GUARD BUDGET REQUEST
(In Thousands of Dollars)

APPROPRIATION REQUEST TO:	DOT	OMB	CONGRESS
OPERATING EXPENSES	1,668,371	1,603,799	1,577,958
ACQUISITION, CONSTRUCTION, IMPROVEMENTS	417,000	396,300	284,820
ALTERATION OF BRIDGES	19,000	0	10,200
RETIRED PAY	310,000	310,000	319,500
RESERVE TRAINING	57,500	52,600	50,094
RESEARCH, DEVELOPMENT AND TEST AND EVALUATION	30,730	15,000	15,000
NATIONAL RECREATIONAL BOATING AND FACILITIES FUND	0	0	5,000
POLLUTION FUND	(7,000)	(7,000)	(7,000)
OFFSHORE OIL POLLUTION COMPENSATION FUND	4,500	1,000	1,000
DEEPWATER PORT LIABILITY FUND	1,000	1,000	1,000
SUPPLY FUND	0	0	0
TOTAL	2,508,151	2,379,699	2,264,572

TABLE 2-12

FY 1984 COAST GUARD BUDGET REQUEST
(In Thousands of Dollars)

APPROPRIATION REQUEST TO:	DOT	OMB	CONGRESS
OPERATING EXPENSES	1,744,084	1,713,697	1,687,542
ACQUISITION, CONSTRUCTION, IMPROVEMENTS	685,000	453,427	378,600
ALTERATION OF BRIDGES	22,700	13,200	13,200
RETIRED PAY	351,900	351,900	341,300
RESERVE TRAINING	59,079	56,106	54,805
RESEARCH, DEVELOPMENT AND TEST AND EVALUATION	25,000	25,000	22,000
NATIONAL RECREATIONAL BOATING AND FACILITIES FUND	5,000	5,000	4,500
POLLUTION FUND	7,000	7,000	7,000
OFFSHORE OIL POLLUTION COMPENSATION FUND	1,000	1,000	1,000
DEEPWATER PORT LIABILITY FUND	1,000	1,000	1,000
SUPPLY FUND	80	80	80
TOTAL	2,901,843	2,672,410	2,551,527

TABLE 2-13

OPERATING EXPENSES FUNDS
(In Thousands of Dollars)

PROGRAM	1982 (Actual)	1983 (Est.)	1984 (Est.)
SEARCH AND RESCUE	397,124	422,735	436,066
AIDS TO NAVIGATION	341,163	360,438	369,321
MARINE SAFETY	127,974	125,202	127,260
MARINE ENVIRONMENTAL PROTECTION	145,365	152,431	159,507
ENFORCEMENT OF LAWS AND TREATIES	306,199	332,309	359,039
ICE OPERATIONS	86,717	56,712	58,106
MILITARY READINESS	77,321	81,459	84,634
HEADQUARTERS ADMINISTRATION	-	75,140	93,610
TOTAL	1,481,863	1,606,426	1,687,542

appropriations and the internal allocation and control of funds through the operating guides. The funds are controlled by the operating guides, and as resources are used by the programs, funds are charged to the programs for accounting purposes. An example of this is in fiscal year 1980, where the primary areas for cutter employment were search and rescue (17.2%), enforcement of laws and treaties (9.4%), and aids to navigation (8.6%). For aircraft the primary areas for the same year were search and rescue (27.9%), enforcement of laws and treaties (3.3%), and training (2.6%). To keep the cutters and aircraft operational, funds from the different operating guides, such as OG-45 (vessel maintenance), OG-41 (aviation maintenance), and OG-30 (fuel) are used. In this way the resources are made available to carry out the missions of the major programs. In dealing with its major systems the Coast Guard is facing some stringent cost problems. In fiscal year 1980, there was a maintenance backlog for cutters of some $506.7 million for machinery and structural deficiencies, $89.1 in habitability deficiencies and $9.8 million in allowance and parts deficiencies [ref. 19: p. 677]. At the same time maintenace cost per hour for aircraft increased some 59 percent between 1979 and 1984, and fuel costs per hour has increased by some 231 percent [Ref. 20: p. 654]. The impact of rising prices on aircraft maintenance can be demonstrated by cost and usage rates in 1980 [Ref. 21: pp. V-VI]:

PLANE TYPE	COST	UTILIZATION RATE
HC-131A	+28%	-19%
HC-130B/H	+32%	0
HH-52A	+22%	- 1%
HU-16E	-34%	-16%
HH-3F	+22%	(slightly)
VC-11A	+ 4%	-10%
VC-4A	+44%	-22%

Costs are rising and usage is decreasing as prices continue to rise. As inflation continues to grow and systems grow older, the allocation of funds to those areas that require additional funds becomes very important.

This chapter has outlined reasons why the proper allocation of funds to the operating guides is necessary and desired. The next chapter deals with the development of individual models for each account and is the first step in a process to accomplish the above task.

III. ANALYSIS OF THE OPERATING GUIDES

A. METHODOLOGY AND ASSUMPTIONS

The initial step in the development of a model to allocate the COLA funds to the operating guides, is to estimate the rate of inflation that has been experienced by the individual accounts. To accomplish this, market baskets have been developed that represent the commodities and services that the account purchases. The market baskets were developed by determining the commodities and services that are used by the accounts and then by determining inflation rate factors to act as proxy variables. Weights were then assigned to these variables to represent the percent of total funds that was spent on that good. Since this is the first time that the Coast Guard has attempted to produce market baskets for each account, there was a lack of suitable data. Spending by Object Codes was investigated, but because of the manner of the data and storage, suitable access to the data was not possible. Therefore to determine the market baskets and weights each operating guide manager was interviewed and his account discussed. Cost data was received for one or two years which highlighted the major cost items in each account. Also studies developed by other services and independent groups were investigated. With these resources, the author determined the commodities and services and assigned appropriate weights. In the weighting process, equal weights were given to the products and services when data was not available. In areas where data was available, appropriate estimates of the weights were developed. It is important to realize that the weights express proportions of total expenditures, and that these proportions were developed through limited data, and limited knowledge of the entire market structure of each account.

The inflation rate factors that were chosen to act as proxy variables were the Consumer Price Index, Producer Price Index, and Average Hourly Earnings. They were selected because they represent a large number of products and services, and are easy to obtain as they are published monthly. For the CPI and PPI codes, the Bureau of Labor Statistics publishes seasonally adjusted data as well as unadjusted changes in a time period. Seasonally adjusted changes are usually used by those seeking to analyze general price trends in the economy, whereas unadjusted changes are of interest to those consumers wanting knowledge of the prices they are actually paying [Ref. 22: p. 82]. As unadjusted data is used for escalation purposes, they will be used in the execution of the individual developed models. The Average Hourly Earnings are also published monthly by the Bureau of Labor Statistics and is an indicator which covers straight time wage, overtime premiums and selected employee contributions [Ref. 23: p. 6].

Each individual model has a material section, and in cases where labor costs in the product industries are important and a suitable proxy is available, a labor section is included. Small arms, personnel training, housing, and fuel do not include a labor section as explained in the development of each model.

The weights are then assigned in each section so that they sum to one. This means that under the material section and the labor section, the weights will add to one. The weight assigned to materials and labor overall will also sum to one. The assignment of weights is important in that those indexes with a larger weight have a heavier impact on the calculations of the final index. If the commodities or services that make up the market basket have index measurements that are relatively the same, the weights can be interchanged without a great deal of impact on the final index. But if the indexes represent price movements that progress inversely to each other, any changes in the weights could have an impact on the final index [Ref. 24: pp. 37-38]. Appendix C contains graphs of the indexes used in each account. These are supplied to give the operating guide managers an indication of the impact of changing weights in his account.

It is assumed that the commodities and services chosen for each market basket represent the account and are a fixed basket. Since the accounts are made up of products for maintenance, repair, and general upkeep, the same products should be purchased year after year. Changes in a market basket could arise from a change in technology. An example of this would be that of switching to nuclear power where different maintenance supplies would be required.

B. OG-30 OPERATING AND MAINTENANCE

Operating Guide 30 purchases a variety of goods and services from flags to fuel. The account is administered by the Office of the Comptroller in the Financial Branch (G-F), and is affected by the inflation rate in almost all sectors of the economic structure.

This account pays for administrative travel; rental of equipment such as Xerox machines; water, sewage, electricity, and other utilities used by Coast Guard units; printing and reproduction; telephone systems such as FTS, Autovon, and WATTS; leased equipment; rental of vehicles; and general administrative supplies. OG-30 is also responsible for general medical care and supplies, which includes the CHAMPUS program.

As this account involves many segments of the economy, a general index that measures inflation for the entire economy was determined to be the most suitable proxy variable. The overall Consumer Price Index is a composite index determined by food and beverages, housing, apparel and upkeep, transportation, medical care, entertainment, and other goods and services. Since OG-30 is affected by each of these groups except food and beverage, the overall CPI index--less food will be used as the material section of the OG-30 index.

The labor section is an aggregate of four general Average Hourly Earnings (AHE) components, each weighted at 25 percent, that represent areas from which OG-30 purchases goods and services.

(a) Manufacturing

(b) Retail and Wholesale

(c) Transportation

(d) Services

In the final composite index for OG-30 both labor and materials are equally weighed at 50 percent.

C. OG-41 AVIATION MAINTENANCE

Operating Guide 41, controlled by the Office of Aeronautical Engineering (G-EAE), is responsible for procuring those items needed for the maintenance and repair of aircraft utilized by the Coast Guard. It is not responsible for the cost of fuel as fuel is purchased by OG-30, nor for the cost of some of the major electronic equipment which is purchased by OG-42. This account does purchase aircraft parts for repairs and overhauls, major components such as engines and rotors, life support equipment, technical services, ground support equipment, and avionics. G-EAE projected cost percentages are:

Aircraft Maintenance	71 Percent
Aircraft Overhauls	15 Percent
Avionics	8 Percent
Services	4 Percent
Ground Support Equipment	1 Percent
Training, Travel, Misc.	1 Percent

OG-41 has encountered large increases in cost, partially from a lack of adequate spares caused by the aging of major systems. This will be alleviated somewhat by the purchase of 41 HU-25 Guardian jets to replace the HU-16E seaplane, and the purchase of the HH-65A Dolphin helicopter to replace the aging HH-52A single-engine helicopter.

To determine OG-41's composite index various models were researched, including a Navy study on production flyaway aircraft escalation indexes, and the contract for the new Dolphin helicopter. The escalation clause in the Dolphin contract involved the use of indexes that were broadly defined. These indexes included the following producer price indexes, PPI for Industrial Commodities (for the Airframe material index0, and the PPI for Electrical Machinery and Equipment (for Engine and Electrical material index). In contrast, the Navy study used a very detailed market basket, but emphasized costs that are important in the procurement of a system and not in the upkeep and repair of the system. From these two resources, plus an Army study, and input from Coast Guard personnel, three main cost areas were identified, the airframe, the engine, and electronics. The following proxy variables and weights were decided on:

<u>Materials</u> (42 percent)

(a) AIR FRAME (62 percent)

PRI 1013-02	Finished Steel Mill Products (20 percent)
PPI 1013-0264	Stainless Sheets (10 percent)
PPI 1025	Mill Shapes (20 percent)
PPI 1143	Fluid Power Equipment (10 percent)
PPI 1081	Bolts, nuts, screws, rivets (10 percent)
PPI 101	Iron and Steel (30 percent)

In June of 1982 a new index appeared that will now be used in place of PPI 1081. It is PPI 1081-05, Aerospace Fastiners.

(b) ENGINE (19 percent)

PPI 101	Iron and Steel (60 percent)
PPI 1022-0128	Nickel, Cathode Sheets (10 percent)
PPI 1013-02	Finished Steel Mill Products (20 percent)
PPI 117	Electrical Machinery and Equipment (10 percent)

(c) ELECTRICAL (19 percent)

PPI 117	Electrical Machinery and Equipment (100 percent)

<u>Labor</u> (58 percent)

(a) AIR FRAME (50 percent)

AHE 3721	Aircraft Industry (60 percent)
AHE 3728	Aircraft Parts and Equipment (40 percent)

(b) ENGINE (20 percent)

AHE 3724 Aircraft Engine Parts (100 percent)

(c) ELECTRICAL (30 percent)

AHE 366 Communications Equipment (45 percent)

AHE 367 Electrical Components and Accessories (55 percent)

D. OG-42 ELECTRONIC MAINTENANCE

Operating Guide 42 is located in the Office of Telecommunications and Electronics (G-TPP), and is responsible for the procurement of components and other equipment needed for the repair and maintenance of electronic equipment used by the Coast Guard. This equipment includes anti-submarine warfare systems, including sonars and depth sounder equipment. Other equipment that OG-42 is responsible for includes radars, communication systems, computers, electronic antenna networks, and electronic support for cutters, aircrafts, and other units of the Service. In comparison to the other accounts, OG-42 probably has to be more aware of the available state-of-the art equipment.

There are four major cost categories to determine proxy variables and weights for.

(a) Major Electronic Equipment (transmitters, teletypes, receivers, radars)

(b) Electronic Structures and Circuits

(c) Command and Control Systems

(d) Operating Systems (software)

Producer price indexes selected to represent these cost categories are as follows:

PPI 1171 Wiring Devices (20 percent)

PPI 1172 Integrating and Measuring Instruments (20 percent)

PPI 1174 Transformers and Power Regulators (10 percent)

PPI 1175 Switchgear and Switchboard Equipment (10 percent)

PPI 1178 Electronic Accessories and Components (40 percent)

PPI's 1174 and 1175 represent the category of Major Equipment, as they include various types of transformers, receivers, and controls. PPI codes 1171 and 1172 represent Electronic Structures and Circuits, as they include various types of current devices, test equipment, and structures. PPI 1178 includes items for all four categories, but mainly represents the new state-of-the-art equipment such as computers.

The labor part of the electronic industry is represented by AHE 36, Electrical Equipment and Supplies. This is the only index used in the labor section.

In the final composite index, labor is weighted 60 percent and materials 40 percent.

E. OG-43 STRUCTURE MAINTENANCE

The Office of Civil Engineering (G-ECV) controls the funds allotted to Operating Guide 43. OG-43 is responsible for the repair of buildings and structures throughout the Coast Guard. This includes repairing of moorings and pilings, rebuilding generators and electrical panels, installation and maintenance of CO2 systems, and the maintenance of living spaces and other buildings.

The proxy variables and weights selected were determined from research of the Engineer News Record Building Cost Index and Construction Cost Index. The Construction Cost index was designed as a general purpose construction cost index, and is a weighted aggregate index of structural steel, portland cement, lumber, and common labor. Because the index is designed to indicate basic underlying trends of construction costs in the United States, it uses materials that are least influenced by purely local conditions [Ref. 25: p. 116]. Steel, lumber, and cement were selected as they represent the most stable relationship with the nation's economy and its price structure [Ref. 26: p. 116]. The current construction cost index is:

(a) Common Labor (74 percent)

(b) Structural Steel (15 percent)

(c) Lumber (2 x 4's) (9 percent)

(d) Portland Cement (2 percent)

The current building index is made up of the following:

(a) Skilled Labor (56 percent)

(b) Structural Steel (26 percent)

(c) Lumber (2 x 4's) (15 percent)

(d) Portland Cement (3 percent)

Based on these two indexes, the following proxy variables and weights were selected in forming a market basket for OG-43:

Materials (44 percent)

PPI 10 Metals and Metal Products (59 percent)

PPI 08 Lumber and Wood Products (34 percent)

PPI 1322 Portland Cement (7 percent)

Labor (56 percent)

AHE 15 General Building (unskilled) (55 percent)

AHE 17 Special Trades (skilled) (45 percent)

F. OG-45 VESSEL MAINTENANCE

Operating Guide 45 is operated by the Office of Naval Engineering (G-ENE), and is responsible for the funding of repairs and maintenance of Coast Guard vessels. This includes the main propulsion plant, the hull, and the auxiliary equipment.

In developing the composite index, conversations were held with the Navy (NAVSEA 17) and the Maritime Administration (MARAD). Both of these agencies use a similar model in estimating ship procurement costs. The model consists of a material index made up of three indexes from the Producer Price Index series. They are PPI 101 Iron and Steel (45 percent), PPI 114 General Purpose Machinery and Equipment (40 percent), and PPI 117 Electrical Machinery and Equipment (15 percent). The labor index is developed from the wages of 18 selected shipyards. In comparing the Coast Guard's maintenance attitude with those of the Navy and commercial business, there are differences to be found.[1]

	NAVY	COMMERCIAL	COAST GUARD
REDUNDANCY LEVELS	HIGH	MEDIUM	HIGH TO MEDIUM
ONBOARD SUPPORT	HIGH	LOW	MEDIUM
DEPLOYMENT	LONG	SHORT	SHORT
CREW ASSIGNED MAINTENANCE	HIGH	MINIMUM	MEDIUM

There are also differences in the major maintenance cycle, as the Navy's is shorter than the Coast Guard's. The average age of the vessels in the Coast Guard's fleet is twenty-seven years, although this will change with the addition of the new Bear class cutter. Rather than building the new ships it needs, the Coast Guard has had to rely on such programs as SLEP (Service Life Extension Program) and FRAM (Fleet Rehabilitation and Modernization) to update the vessels in the active fleet [Ref. 27: p. 24].

Because major overhauls and maintenance may be delayed certain areas are emphasized for repair through programs such as SLEP and FRAM. The proxy variables and weights which represent these areas are:

---

[1]Conversation with OG-45 Manager, November 1982.

Materials (40 percent)

PPI 101	Iron and Steel (30 percent)
PPI 107	Fabricated Metal Products and Structures (20 percent)
PPI 114	General Purpose Machinery and Equipment (20 percent)
PPI 117	Electrical Machinery and Equipment (20 percent)
PPI 1392	Insulation Materials (10 percent)

Labor (60 percent)

AHE 373	Ship/Boat Building and Repair (40 percent)
AHE 3731	Ship Building and Repair (50 percent)
AHE 36	Electrical Equipment and Supplies (10 percent)

G. OG-46 OCEAN ENGINEERING EQUIPMENT AND SUPPORT

Distributed from the Office of Ocean Engineering (G-EOE), Operating Guide 46 is responsible for aids to navigation, marine environmental protection (MEP) equipment, power sources and supplies for lighthouses and smaller aids to navigation. This account also procures such items as batteries, lamps, lanterns, flashers, fog detectors and sound signals for buoys, but the biggest single cost factor is the procurement of buoy bodies. Although some of the smaller buoys are plastic, most of them are made out of iron and steel. Table 3-1 gives the prices for buoys in fiscal years 1980, 1981, and 1982, and the estimated cost for fiscal year

TABLE 3-1

BUOY PRICES (PER BUOY)

BUOY CLASS	Price 1980	1981	1982	1983
9 x 20	7,683	N/A	N/A	N/A
8 x 26 LR	10,311	12,252	13,000	13,000
8 x 26 LWR*	11,050	12,705	13,100	14,500
7 x 17 LR	6,737	9,387	10,300	10,100
6 x 20 LR	7,929	9,945	7,000	9,600
5 x 11 LR	4,990	5,244	8,900	8,700
3 1/2 x 8 LR	3,850	4,134	6,600	4,900
1CR	3,000	6,706	4,000	6,200
1NR	3,000	6,548	6,000	6,200
2CR	2,000	4,217	6,000	3,600
2NR	2,000	4,214	2,900	3,600
3CR	1,000	1,604	1,000	1,200
3NR	1,000	1,618	1,000	1,200

*Does not include cost of whistle and whistle valve.

1983. Table 3-2 shows the annual percent increase in prices for the major buoy types. These two tables display the tremendous increase in prcies for buoys of which the Coast Guard operates close to 50,000.

TABLE 3-2

YEARLY PERCENT INCREASE IN BUOY PRICES

BUOY TYPE	1980-81	1981-82	1982-83	1980-83
8 x 26LR	18.8	6.1	0.0	26
8 x 26LWR	15.0	3.1	10.7	31
7 x 17LR	39.3	9.7	-1.9	50
6 x 20LR	25.4	-10.5	7.9	21
5 x 11LR	5.1	25.9	31.8	74
3 1/2 x 8LR	7.4	- 3.2	22.5	27

Because of the cost of buoys, the majority of funds spent on materials is for iron and steel. The remainder of the funds is spent on electronic components used on aids to navigation. The labor index is based on skilled and unskilled labor wages and represent the labor overhead rates at the Coast Guard Yard in Curtis Bay, Maryland where many of the buoys are produced and repaired.

Materials (40 percent)

PPI 101 Iron and Steel (80 percent)

PPI 1178 Electronic Components and Accessories (20 percent)

Labor (60 percent)

AHE 17 Special Trade (skilled) (30 percent)

AHE 15 General Building (unskilled) (60 percent)

AHE 36 Electrical Equipment and Supplies (10 percent)

H. OG-54 SMALL ARMS AND AMMUNITION

Operating Guide 54 is under the direction of the Office of Military Readiness (G-OMR), and is responsible for the procurement of small arms, small arms ammunition, and pyrotechnics. The term small arms include the following:

40 mm

30 mm

25 mm

20 mm

12 GA

.45 CAL

.50 CAL

5.56 mm

Funds for larger weapons systems are provided by the Navy.

Since it has to be purchased annually, while the weapon itself needs only repairs, ammunition is the major cost area. The cost of small arms ammunition depends a great deal on the inventory on hand. The U.S. Army is responsible for supplying small arms ammunition within the Department of Defense. Stockpiles of ammunition from World War II and the Vietnam War are being depleted and the Army may have to start purchasing from industry again. Being in the Department of Transportation, the Coast Guard may purchase either from the Army or commercial sources.

It is estimated by OMR that Coast Guard ordnance items have increased approximately 265 percent from their January 1979 prices. Presently most of the ammunition is used for annual training, which is vital for such missions as enforcement of law and treaties and drug interdiction. If prices continue to increase at the present rate, it is estimated that training may have to be reduced some 40 percent.

As the on-hand inventory is reduced, new production contracts will have to be established, which may mean retooling for production which may lead to higher prices.

As no suitable labor index could be found, industry indexes were selected as proxy variables, instead of breaking the weapons and ammunition into components which are used in their development.

PPI 151301 Small Arms (40 percent)

PPI 151302 Small Arms Ammunition (60 percent)

I. OG-56 PERSONNEL TRAINING

Operating Guide 56 is operated by the Office of Personnel in the branch of Training and Education (G-PTE). The funds allocated to this account are used to send Coast Guard members to various types of schools including Class A and C, flight, Postgraduate, and various types of field training needed by Coast Guard units. OG-56 also pays for travel expenses of Coast Guard Auxiliarists in connection with any official training. Figure 3-1 shows the percent allocation of funds to various types of school, and Table 3-3 displays the funds spent in fiscal year 1982 in sending personnel to school.

TABLE 3-3

FUNDS SPENT IN 1982

TYPE OF SCHOOL	DOLLARS SPENT	PERCENT
CLASS C	11,837,100	52
FIELD TRAINING	3,319,900	15
RECRUIT TRAINING	2,063,300	9
CLASS A	1,685,800	7
FLIGHT	1,373,400	6
MISCELLANEOUS	1,340,800	6
POSTGRADUATE	1,111,200	4.8
OFFICER CANDIDATE	40,900	.2

The category of miscellaneous covers such items as off-duty tuition, auxiliary training, and training programs for civilians working in the Coast Guard.

The higher cost items in OG-56 are per diem, travel and transportation, and tuition. To determine proxy variables, travel has been divided into five major modes; air, bus,

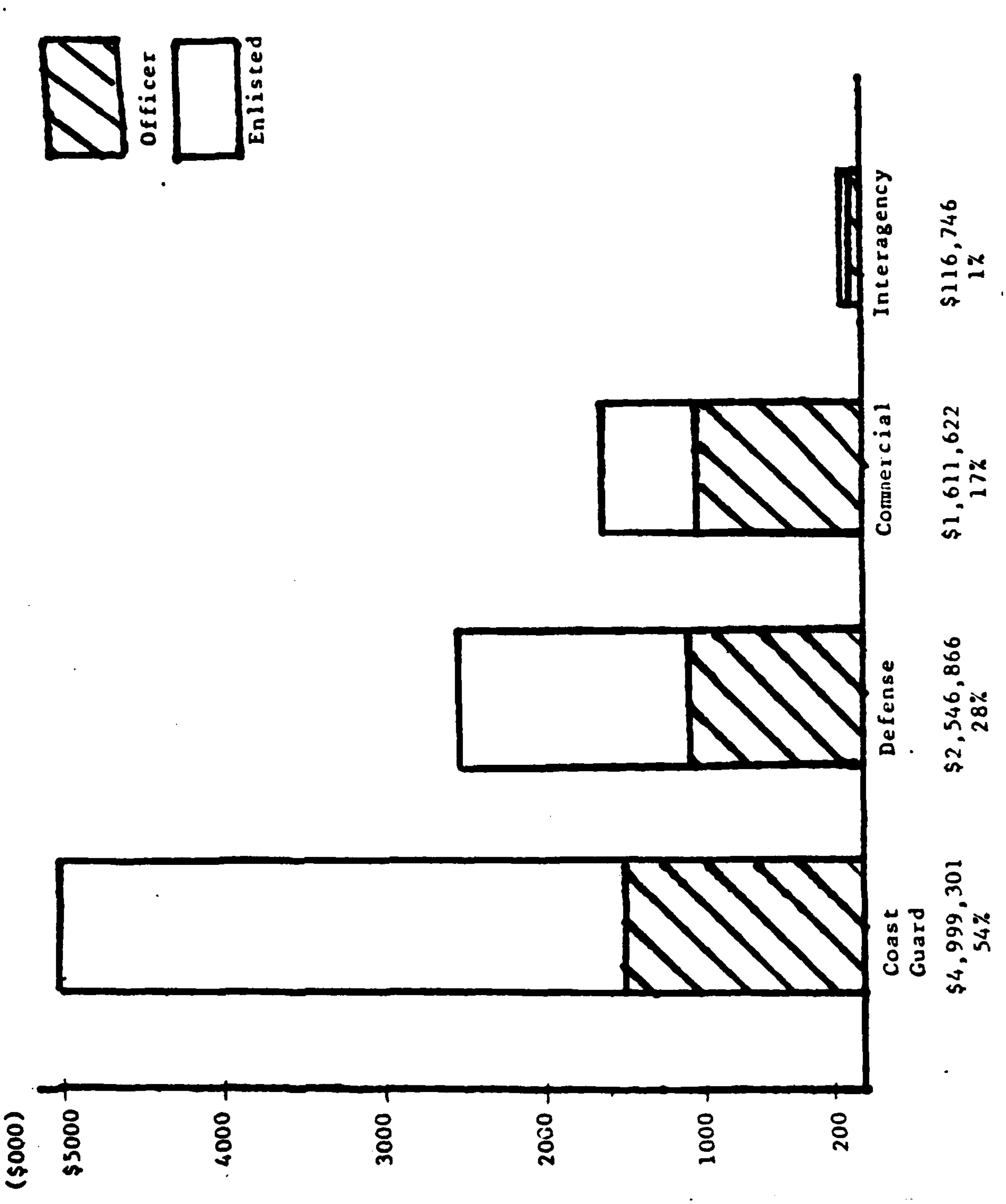


Figure 3-1. OG-56 School Type Report FY 82

mass transit, taxi, and train, and associated consumer Price Index codes chosen to represent them.

The per diem allowance given to personnel on official training orders is for lodging and food. This allowance differs according to the location of the school. The CPI indexes for lodging while out of town and food away from home are used as proxy variables. For tuition costs the proxy variable selected is the CPI index, tuition and other school fees.

The proxy variables and their assigned weights are summarized below.

<u>Travel and Transportation</u> (50 percent)

CPI Air Fare (60 percent)

CPI Intercity Bus Fare (10 percent)

CPI Intercity Mass Transit (10 percent)

CPI Taxi Fare (10 percent)

CPI Train Fare (10 percent)

<u>Per Diem</u> (30 percent)

CPI Lodging While Out of Town (60 percent)

CPI Food Away From Home (40 percent)

<u>Tuition</u> (20 percent)

CPI Tuition and Other School Fees

J. OG-57 MEDICAL SUPPLIES AND EQUIPMENT

Operating Guide 57 is operated by the Office of Health Services (G-K), and is responsible for the procurement and maintenance of major equipment which cost over 500 dollars.

The Coast Guard operates two large hospitals, one is at Kodiak, Alaska and the other is at the Coast Guard Academy in New London, Conn. Along with the two major hospitals, the Service has many smaller units with medical capabilities. The major equipment purchase at present is for mobile dental units at approximately $100K.

The proxy variables used are a CPI index for non-prescription equipment and supplies, and a PPI index for electronic accessories and components, which represents advancements in technology in producing medical equipment [Ref. 28: p. 61]. For the labor index, the variables selected are average hourly earnings for medical instruments and supplies and for electrical equipment and supplies.

<u>Material</u> (50 percent)

CPI Medical Equipment and Supplies (90 percent)

PPI 1178 Electronic Accessories and Components (10 percent)

<u>Labor</u> (50 percent)

AHE 36 Electrical Equipment and Supplies (20 percent)

AHE 384 Medical Instruments and Supplies (80 percent)

K. FUEL -- A SPECIAL CASE

Although funds for fuel are distributed by Operating Guide 30, it was decided to look at it as an individual account because of its impact on the economy during recent years.

Fuel is divided into four different categories that a military service would encounter. Military aircraft primarily use AVGAS 100 and JP-4 jet fuel, with JP-4 being the major fuel used. As JP-4 fuel prices are highly correlated with kerosene prices [Ref. 29: p. 60], the proxy variable used is a PPI index for light distillates. Ships basically use petroleum bunker fuel number two, and therefore an index for middle distillates is used as a proxy variable [Ref. 30: p. 60]. An index for residual fuels represents the fuel used by stations and other land units, and the index for gasoline is used for fuel used by vehicles.

The selected proxy variables and weights are as follows:

PPI 0571 Gasoline (10 percent)

PPI 0572 Light Distillates (40 percent)

PPI 0573 Middle Distillates (40 percent)

PPI 0574 Residual Fuels (10 percent)

L. OG-01 HOUSING AND GENERAL MESS

Operating Guide 01 is controlled by the Office of Personnel and is responsible for the costs of housing and general mess operation throughout the Coast Guard.

In developing the composite index for OG-01, the following variables and weights are used:

CPI Housing (70 percent)

CPI Food and Beverage (30 percent)

M. OG-20 TRAVEL AND TRANSPORTATION (PCS)

Operating Guide 20, which is also operated by the Office of Personnel, distributes funds to pay for the cost of personnel travel and shipments of household goods during a permanent change of station.

Travel of personnel is divided into travel modes and per diem. The travel modes considered are air, bus, train, and mass transit. Per diem is broken down into lodging and food. The transportation of household goods is split into four different types of carriers; truck, rail, postal service, and air.

The proxy variables used and their corresponding weights are listed below. The material section contains travel and transportation which have also been divided into different segments [Ref. 31: pp. 28-33].

<u>Material</u> (40 percent)

<u>Travel</u> (50 percent)

Travel Modes (50 percent)

CPI Air Fare (60 percent)

CPI Train Fare (20 percent)

CPI Bus Fare (10 percent)

CPI Mass Transit (10 percent)

Per Diem (50 percent)

CPI Loding While Out of Town (70 percent)

CPI Food Away From Home (30 percent)

Transportation (50 percent)

Truck Freight (60 percent)

PPI 05 Fuels and Related Power Products (70 percent)

PPI 071201 Tires (10 percent)

PPI 141102 Motor Trucks (20 percent)

Rail Freight (20 percent)

PPI Railroad Freight (table) (100 percent)

Postal Service (10 percent)

PPI Postal Service (table) (100 percent)

Air Freight (10 percent)

PPI 05 Fuels and Related Power Products (100 percent)

Labor (60 percent)

Truck Freight (60 percent)

AHE 421 Trucking and Trucking Terminals (50 percent)

AHE 422 Public Terminals (50 percent)

Postal Services (20 percent)

AHE 73 Business Services (100 percent)

Air Freight

AHE 36 Electrical Equipment and Supplies (40 percent)

AHE 372 Aircraft Parts (60 percent)

IV. MODELS FOR DETERMINING COST OF LIVING RATES

A. METHODOLOGY

In forming a model to calculate the cost-of-living rates for each operating guide account, two major restrictions had to be fulfilled. The first restriction is that the model be simple and easy to use, and does not require knowledge of statistics or a great deal of mathematics on the part of the person operating it. The second restriction, that it use easy-to-obtain data, has been fulfilled by using indexes that are published monthly and can be obtained via a computer link with the Bureau of Labor statistics.

Two models will be introduced in this chapter, one that calculates the cost-of-living rate in the previous year, and then allocates the COLA funds based on that rate, and one that attempts to predict what the cost-of-living rate will be in the appropriate fiscal year.

To calculate an inflation rate, one must first determine the set of indexes for the years to be compared. The inflation rate experienced by that commodity or service is then $[(BLS(t))-(BLS(t-1))] \div BLS(t-1)$. In this equation BLS(t) represents the Bureau of Labor Statistics index in year t, and BLS(t-1) is the value of that same index in the previous year. Both models use this formula but at different stages in the calculations.

Model (1) uses actual data to determine a cost-of-living rate for each operating guide. Because this model uses actual data, it is actually expressing the inflation rates in an early period to allocate funds in a later period. In this thesis, the lag between the periods is one year. An example is that of allocating the COLA funds for fiscal year 1983. Since fiscal year 1983 begins in October 1982, data from October 1981 and October 1982 were used to calculate the rates. In budgetary practice the appropriate months will depend on the period when the allocation must be made. Continuing with the example, the value of each proxy variable for the two time periods are listed and the general equation, given earlier in this section, is used to obtain the inflation rates. These rates are then used in each account's model to determine the twelve individual cost-of-living rates.

As model (2) involves regression, another method of developing the inflation rates was developed. Rates do not appear to be useful in a regression equation, as they represent a change between absolute values, and appear not to have a functional relationship among them. The indexes although representing absolute values, not relative values, are useful in regression. In model (2), one need only list the index values and insert them into the individual models. Due to the fact that the Average Hourly earnings are actual dollar figures and not an index, separate models for materials and labor were developed in the accounts where appropriate. The indexes are then multiplied by their weights and summed together to produce a single material and labor index for each of the accounts. Then the general equation $[(BLS(t)-BLS(t-1))] \div BLS(t-1)$, is used between two appropriate time periods to obtain cost-of-living rates. In those cases with a material and a labor index, this equation must be used on each of these indexes to produce individual cost-of-living indexes for both labor and materials. To produce the final rate for an account, the labor and material indexes are multiplied by their assigned weights and added together. Step-by-step procedures for each model are given in Appendix A.

B. RESULTS AND ANALYSIS

An initial question to be investigated is if the two procedures of calculating the individual cost-of-living rates produced similar results and can therefore be compared. Table 4-1 shows the results of the two methods during the same time period. The calculated cost-of-living index from 1969 to 1970 would be the appropriate calculations, using data from October 1969 and October 1970, to get the inflation rate between those two periods. The values in the table are the cost-of-living rates expressed as decimals. In taking the algebraic differences between the values, it appears that the methods are similar and produce the same results.

TABLE 4-1

COMPARING METHODS OF DETERMINING INFLATION RATES

TIME PERIOD	ACCOUNTS (percent expressed as decimals)									
	(1) 30	(2)	(1) 41	(2)	(1) 42	(2)	(1) 43	(2)	(1) 45	(2)
1969–1970	.0575	.0574	.0604	.0615	.0544	.0550	.0665	.0633	.0390	.0438
1970–1971	–.0245	–.0231	.0378	.0410	–.0025	–.0038	.0799	.0815	.0430	.0384
1971–1972	.0526	.0545	.0504	.0508	.0415	.0416	.0617	.0626	.0466	.0467
1972–1973	.0581	.0582	.0651	.0663	.0446	.0447	.0851	.0867	.0590	.0599
1973–1974	.1040	.1126	.1837	.1867	.1307	.1332	.1324	.1200	.1904	.1926
1974–1975	.0792	.0799	.0766	.0749	.0701	.0714	.0525	.0515	.0877	.0866
1975–1976	.0639	.0666	.0746	.0755	.0609	.0611	.0795	.0791	.0758	.0763
1976–1977	.0690	.0555	.0716	.0706	.0710	.0718	.0692	.0691	.0584	.0619
1977–1978	.0862	.0833	.1053	.1070	.0791	.0801	.0862	.0875	.0894	.0901
1978–1979	.1006	.1042	.1036	.1039	.0919	.0929	.0933	.0922	.1007	.1004
1979–1980	.1114	.1098	.1100	.1087	.1107	.1086	.0559	.0531	.1229	.1218
1980–1981	.0995	.1024	.0899	.0897	.0871	.0897	.0462	.0465	.0934	.0887
1981–1982	.0592	.0590	.0618	.0640	.0578	.0580	.0324	.0321	.0594	.0582

TIME PERIOD	ACCOUNTS (percent expressed as decimals)							
	(1) 46	(2)	(1) 01	(2)	(1) FUEL	(2)	(1) 56	(2)
1969–1970	.0885	.0884	.0634	.0649	–.0150	–.0538	–	
1970–1971	.0758	.0761	–.0970	–.0968	.0153	.0184	–	
1971–1972	.0460	.0454	.0402	.0417	.0234	.0217	–	
1972–1973	.0613	.0612	.0702	.0650	.2744	.2748	–	
1973–1974	.2144	.2143	.1302	.1499	.9853	1.015	–	
1974–1975	.0552	.0550	.0873	.0871	.1119	.0891	–	

TABLE 4-1 (CONT.)

TIME PERIOD	ACCOUNTS (percent expressed as decimals)							
	(1) 46	(2)	(1) 01	(2)	(1) FUEL	(2)	(1) 56	(2)
1975-1976	.0587	.0587	.0472	.0495	.0465	.0436	-	
1976-1977	.0581	.0578	.0530	.0623	.0814	.0759	-	
1977-1978	.0730	.0736	.0914	.0956	.1044	.1046	-	
1978-1979	.0852	.0861	.1233	.1232	.7111	.7149	.1300	.1338
1979-1980	.0720	.0723	.1286	.1288	.2722	.2675	.2186	.2217
1980-1981	.0758	.0761	.1010	.1018	.1894	.1912	.1525	.1554
1981-1982	.0375	.0370	.0500	.0505	-.0619	-.0615	.0920	.0900

	(1) 57	(2)	(1) 20	(2)
1977-1978	-		.0760	.0768
1978-1979	.0424	.0448	.1258	.1553
1979-1980	.0782	.0833	.1444	.1437
1980-1981	.1016	.1082	.1051	.1146
1981-1982	.0871	.0876	.0608	.0562

Of the 130 values, six (4.6 percent) were found to have differences above .0100, or one percentage point, and 15 had differences above .0050, or one half of a percentage point. For the entire 130 values, the mean (of the differences) was .0028, or .28 of a percent, with a standard deviation of one half of a percentage point, .0050. A possible cause for the differences is round-off error as in model (1) the rates were inserted into the individual models expressed to the ninth decimal place, whereas in model (2), the indexes were used in the individual models rounded to the nearest one hundredth. Therefore it appears that the final result does not depend on the stage at which percent rates are determined. Although model (2) must use indexes throughout all its calculations to be useful in predicting, the ability to use percent values at the beginning of model (1) saves many steps of calculations, which is important if a computer is not present. Values are not available for accounts 56, 57, and 20 until 1977 and 1978 as indexes that are used in their individual models were not published by BLS until this time period.

In the field of economics, the use of previous values to predict present, or future values is quite common. An example of this is the Cobweb Theorem [Ref. 32: p. 24], which assumes that supply reacts to price with a lag of one period,

$$s(t) = a(1) + b(1)p(t-1)$$

where a and b are constants and p represents price. Another situation would be,

$$s(t) = a(1) + b(1)p(t \text{ hat})$$

where p(t hat) is the expected price, or the price that produces, at the moment of starting producting, one thinks will hold [Ref. 33: p. 28]. A method of calculating the expected value of the price, would be to relate the expected price to all previous prices.

$$p(\text{hat}) = \beta p(t-1) + \beta(1-\beta)p(t-2) + \beta(1-\beta)^2 p(t-3)$$
$$+ \ldots + \beta(1-\beta)^{n-1} p(t-n) + \ldots$$

In this equation β is a positive coefficient not greater than one, and the expected price is a weighted average, with geometrically declining weights, of all past observed prices [Ref. 34: pp. 30-31]. As most economic data is a time series, a collection of observations made sequentially in time [Ref. 35: p. 1], time series models with distributed lags are commonly used. This includes moving averages, autoregressive models, mixed models, and differencing techniques. These models attempt to take out variations such as trends, seasonal effects, and other cycles, so that the data observations are independent of each other. These models can become quite complex and usually require a computer with library programs for computation.

As a restriction was that any model proposed should be easy to compute, the model introduced in this chapter consists of finding a functional form between past values, and then performing regression on the values to form a least-squares equation in which to predict the index value for the upcoming fiscal year. A key decision was how much past data to use to accurately predict a value and at the same time have present values influence the prediction more than the past data does. In an autogressive time series process this is performed by an equation such as [Ref. 36: p. 231]:

$$n_t = (1-\theta)(n(t-1) + \theta(n(t-1) + \theta^2 n(t-2) + \ldots) + a_t$$

where past information is exponentially discounted. But for the proposed simple model, values representing a certain time period was decided on. A lag of five years was selected as it appeared to give suitable predictions and still leave a suitable number of degrees of freedom. By looking at scatter plots of the data, a straight linear model $Y = a + bX$ was attempted with Y being the past five year's index values, and X being the number of years (1 to 5). Through the use of model (2), the latest indexes were calculated and the regression updated by including these new values and dropping those from five years ago. Statistical results, for F-tests, t-tests, Durbin-Watson, Coefficient of Determination, and standard error of prediction are listed in Appendix B, along with concepts of regression. The scatter plots were also investigated at different scales, and a slight curvature was discovered. Different transformations were attempted and the equation

$$\ell n\ (Y) \;=\; \ell n\ (a) + bX$$

was found to be the best at linearizing the data. Table 4-2 shows the predicted values obtain by each of the regression models, as compared to the actual value obtained for the time period being predicted. Accounts 43 and 01 maintained a linear model and the account fuel maintained a log model throughout. From the table, one can see that the log model produced "better" predictions than the linear model as compared with the actual values obtained, except for in fiscal year 1982. The log model produced higher values than the linear model throughout all time periods, and values of both models were rising when the actual rates actually declined between fiscal years 1981 and 1982. Therefore the linear model appears to be the better predictor for 1982, but this is only because they were below the actual results from the beginning and caught up with the actual values only because the actual values decreased. Therefore for the period 1981-82, it is inconclusive which model is the better predictor.

TABLE 4-2

PREDICTIONS FOR FY 1979

ACCOUNT	LINEAR PREDICTION	LOG PREDICTION	ACTUAL 78-79
30	.0507	.0578	.1006
41	.0494	.0520	.1036
42	.0496	.0509	.0929
*43	.0485	.0485	.0922
45	.0556	.0623	.1004
46	.0423	.0496	.0861
54	.0526	.0682	.0974
56	N/A	N/A	N/A
57	N/A	N/A	N/A
20	N/A	N/A	N/A
*01	.0451	.0451	.1232
*Fuel	.0442	.0442	.7149
	PREDICTIONS FOR FY 1980		ACTUAL 79-80
30	.0438	.0527	.1098
41	.0560	.0620	.1087
42	.0522	.0531	.1086
*43	.0550	.0550	.0531
45	.0508	.0561	.1218
46	.0442	.0554	.0723
54	.0500	.0661	.1079
56	N/A	N/A	N/A
57	N/A	N/A	N/A
20	N/A	N/A	N/A
*01	.0400	.0400	.1288
*Fuel	.0895	.0895	.2675

TABLE 4-2 (CONT.)

PREDICTIONS FOR FY 1981

ACCOUNT	LINEAR PREDICTION	LOG PREDICTION	ACTUAL 80-81
30	.0527	.0676	.1024
41	.0645	.0732	.0897
42	.0544	.0605	.0897
*43	.0687	.0687	.0465
45	.0535	.0615	.0887
46	.0547	.0650	.0761
54	.0578	.0795	.1102
56	N/A	N/A	N/A
57	N/A	N/A	N/A
20	N/A	N/A	N/A
*01	.0576	.0576	.1018
*Fuel	.2133	.2133	.1912
	PREDICTIONS FOR FY 1982		ACTUAL 81-82
30	.0692	.0878	.0592
41	.0783	.0874	.0640
42	.0682	.0769	.0580
*43	.0707	.0707	.0321
45	.0756	.0855	.0582
46	.0598	.0713	.0370
54	.9652	.0920	.0595
56	.1203	.1883	.0900
57	.0512	.0773	.0876
20	.0810	.1132	.0562
*01	.0817	.0817	.0505
*Fuel	.4090	.4090	-.0614

TABLE 4-2 (CONT.)

PREDICTIONS FOR FY 1983

ACCOUNT	LINEAR PREDICTION	LOG PREDICTION	ACTUAL 82-83
30	.0863	.1025	N/A
41	.0829	.0915	N/A
42	.0816	.0899	N/A
*43	.0601	.0601	N/A
45	.0876	.0953	N/A
46	.0703	.0776	N/A
54	.0852	.1085	N/A
56	.1338	.1905	N/A
57	.0547	.0626	N/A
20	.1063	.1485	N/A
*01	.1000	.1000	N/A
*Fuel	.4910	.4910	N/A

*OG-43 Linear Model only

OG-01 Linear Model only

Fuel Log Model only

N/A: Data not available

Because of the above result it appears that even at lag five, both models contain a trend that is based on a relationship between the indexes of past years. This trend would account for both models producing increasingly higher rates, even though the actual rates were growing smaller. This trend may possibly extend into 1983 and 1984, before the decrease in 1982 influences the results. This can only be determined by observing the values over many years. As stated earlier, this trend can be eliminated by the use of time series techniques, but this also increases the complexity of the models.

In summary, three models for calculating the cost-of-living rate for the operating guides have been introduced. One uses actual data, but allocates funds for one period based on inflation rates for a previous period. The other two models use simple regression techniques in an attempt to predict the values of the different indexes for the upcoming years. But because of trends and cycles, these estimates may be poor. The next chapter introduces a model that uses the computed individual inflation rates to allocate the COLA funds to the Operating Guides.

V. MODEL FOR ALLOCATION OF FUNDS

The model developed to allocate the COLA funds to the operating guides is based on a simple formula as follows:

$$\text{Allocation (i)} \atop \text{(in dollars)} = \left(\frac{B(i) \cdot COL(i)}{\sum B(i) \cdot COL(i)}\right) \cdot [(\sum B(i)) \cdot COLA]$$

where:

$B(i)$	=	base of OG account i (dollars)
$COL(i)$	=	calculated cost-of-living rate for OG account i expressed in decimal form
$\sum B(i) \cdot COL(i)$	=	summing up over all accounts the two terms above multiplied together (dollars)
COLA	=	this is the COLA rate as given by OMB, expressed as a percent.

The first term represents the amount of money actually needed by the account to counter the effects of inflation weighted by the total amount of COLA actually needed by the appropriation category Operating Expenses. This term also represents the cost-of-living for each account in relation to the cost-of-living of other accounts weighted by the budgets of each. The second term is the total COLA received from OMB, which is just last year's total non-pay Operating Expenses multiplied by the COLA rate provided by OMB. When these two terms are multiplied together, the allocation, for each account, is provided in dollars.

The input data required are the twelve cost-of-living rates computed in Chapter IV, the cost base for each account from the previous fiscal year, and the COLA rate as provided by OMB. Results were simulated for fiscal years 1979 through 1983 for model (1).

Due to a lack of data, the actual base for each operating guide could not be obtained for each year, except for fiscal year 1983. This was deemed acceptable as the main concern was if the model allocated in an equitable manner and not if the specific amount allocated was correct. The actual total base for non-pay operating expenses for each year was obtained and so was the COLA rate for each year. To keep the data as close as possible to actual amounts, the percent that each account represented of the total Operating Expense base in 1983, was used in the other years. Since fuel is paid by OG-30, data for fuel was calculated as 10 percent of OG-30's budget. Table 5-1 shows the data used as the base for allocating the COLA funds. The COLA rates used, as provided by OMB, are 6 percent in 1979, 7.6 percent in 1980, 9.45 percent in 1981, 7.8 percent in 1982, and 8 percent in 1983. Table 5-2 gives the simulated results from using model (1). The column, Cost of Living, is the rate calculated for each model from the proxy variables and assigned weights. Actual Funds correspond to this cost-of-living rate multiplied by each account's base. This computed figure represents the amount of money each account

TABLE 5-1

BASE AMOUNTS ($000)

Percent of Total	ACCOUNT	Base used for allocation in 1979	1980	1981	1982	1983
57.0	30	196,823	214,919	228,085	310,649	356,774
7.5	41	28,775	31,421	33,346	45,390	52,160
9.2	42	35,298	38,543	40,904	55,697	63,983
6.4	43	24,555	26,812	28,455	38,733	44,510
8.1	45	31,077	33,935	36,013	49,021	56,332
1.6	46	6,139	6,703	7,114	9,683	11,127
.5	54	1,918	2,095	2,223	3,026	3,477
2.4	56	9,208	10,055	10,671	14,525	16,691
1.4	57	5,371	5,865	6.225	8,473	9,737
4.0	20	15,347	16,758	17,784	24,208	27,819
0.0	01	3,453	3,771	4,001	5,448	6,259
10 of OG-30	Fuel	25,706	28,069	29,789	40,549	46,596
	COLA Amount	23,020	31,840	42,016	47,206	55,637
	TOTAL OE	383,670	418,946	444,610	605,204	695,465

TABLE 5-2

ALLOCATION OF COLAR FUNDS

FISCAL YEAR 1979

ACCOUNT	COST OF LIVING	ACTUAL FUNDS	COLA AMOUNTS	PERCENT OF ACTUAL
30	.086185	16963186.02	11766043.31	69.3622
41	.105279	3029404.04	2101262.06	69.3622
42	.079055	2790483.79	1935541.65	69.3622
43	.086227	2117303.98	1468609.16	69.3622
45	.089404	2778407.70	1927165.41	69.3622
46	.072952	447852.16	310640.22	69.3622
54	.083032	159255.40	110463.09	69.3622
56	.056620	521356.98	361624.80	69.3622
57	.040159	215693.98	149610.14	69.3622
20	.075993	1166264.59	808947.08	69.3622
01	.091390	315569.73	218886.18	69.3622
Fuel	.104396	2683603.21	1861406.90	69.3622
Total		33188368.00	23020200.00	69.3622

FISCAL YEAR 1980

ACCOUNT	COST OF LIVING	ACTUAL FUNDS	COLA AMOUNTS	PERCENT OF ACTUAL
30	.100642	21629883.47	11630807.51	53.7719
41	.103572	3254336.16	1749919.62	53.7719
42	.091942	3543720.98	1905527.45	53.7719
43	.093335	2502497.29	1345641.29	53.7719
45	.100719	3417898.42	1837870.22	53.7719
46	.085178	570948.25	307009.94	53.7719
54	.097452	204161.91	109781.81	53.7719
56	.129961	1306757.99	702669.10	53.7719
57	.042417	248775.71	133771.52	53.7719
20	.125783	2107871.95	1133443.60	53.7719
01	.123289	464922.78	249997.99	53.7719
Fuel	.711143	19961073.34	10733455.96	53.7719
Total		59212848.00	31839896.00	53.7719

TABLE 5-2 (CONT.)

FISCAL YEAR 1981

ACCOUNT	COST OF LIVING	ACTUAL FUNDS	COLA AMOUNTS	PERCENT OF ACTUAL
30	.111425	25414367.14	19638943.53	77.275
41	.109991	3667760.35	2834260.56	77.275
42	.110652	4526110.62	3497550.43	77.275
43	.055878	1590008.45	1228678.48	77.275
45	.122853	4424304.41	3418879.72	77.275
46	.072020	512350.24	395918.47	77.275
54	.101463	225552.29	174295.46	77.275
56	.218576	2332424.65	1802380.35	77.275
57	.078167	486589.71	376012.03	77.275
20	.144392	2567867.57	1984318.79	77.275
01	.128605	514548.64	397617.28	77.275
Fuel	.272239	8109728.45	6266789.89	77.275
Total		54371600.00	42015645.00	77.275

FISCAL YEAR 1982

ACCOUNT	COST OF LIVING	ACTUAL FUNDS	COLA AMOUNTS	PERCENT OF ACTUAL
30	.099481	30885762.43	23865165.87	77.2692
41	.089921	4081514.08	3153751.21	77.2692
42	.087081	4848583.84	3746459.48	77.2692
43	.046153	1787644.21	1381297.47	77.2692
45	.093438	4589425.63	3539255.92	77.2692
46	.075841	734368.59	567440.29	77.2692
54	.110085	333117.24	257396.86	77.2692
56	.152473	2214669.93	1711256.61	77.2692
57	.100588	852282.32	658551.30	77.2692
20	.105089	2543994.73	1965723.08	77.2692
01	.101037	550449.71	425327.81	77.2692
Fuel	.189401	7680019.97	5934286.09	77.2692
Total		61092832.00	47205912.00	77.2692

TABLE 5-2 (CONT.)

FISCAL YEAR 1983

ACCOUNT	COST OF LIVING	ACTUAL FUNDS	COLA AMOUNTS	PERCENT OF ACTUAL
30	.059228	21131010.22	31030907.93	146.8501
41	.061767	3221766.76	4731167.44	146.8501
42	.057807	3698665.18	5431493.22	146.8501
43	.032429	1443414.72	2119655.85	146.8501
45	.059441	3348430.42	4917173.16	146.8501
46	.037484	417084.48	612488.95	146.8501
54	.061768	214767.33	415386.03	146.8501
56	.092006	1545672.61	2255136.64	146.8501
57	.089706	873467.36	1282687.62	146.8501
20	.060746	1689892.95	2481609.35	146.8501
01	.049992	312899.92	459493.82	146.8501
Fuel	-.061875	-2883127.53	0.0	0.0
Total		35003936.00	55637200.00	158.9456

would receive if COLA funds were unlimited, and represents the amount they actually require. COLA amounts are the amount allocated to each account based on a given fixed total COLA amount. The final column is the percent of the funds actually required that the COLA amount received represents. As seen in Table 5-2, the model allocates the same percent of the funds actually needed to each account. In this way no account is made "better off" than another account. Neither this model, nor this thesis, attempts to prioritize the accounts to decide if any should receive any more funds. Also note that in fiscal year 1983 fuel had a negative cost-of-living and therefore did not require any further funds. Because of this and the fact that the COLA rate for 1983 (8.0 percent) was greater than the inflation rate in 1982 (6.1 percent for CPI, 6.0 percent for GNP deflator), the other accounts received over 100 percent of the funds they actually acquire.

Table 5-3 lists the allocation of COLA based on the method presently used, that of multiplying each account's base by the COLA rate. From the table it can be observed that in using this method, each account does not receive an equal percent amount of their cost-of-living. In Table 5-3, the colume Percent of Proposed is the percentage that the allocation under the present method is of the allocation of the proposed model. The column Percent of Actual is defined the same as before, except now the present method's

TABLE 5-3

ALLOCATION OF COLA FUNDS--PRESENT METHOD

FISCAL YEAR 1979 (COLE Rate 6 Percent)

ACCOUNT	COLA AMOUNT	PERCENT OF PROPOSED	PERCENT OF ACTUAL
30	11809380.00	100.4	69.6
41	1726500.00	82.2	57.0
42	2117880.00	109.4	75.9
43	1473300.00	100.3	69.6
45	1864620.00	96.7	67.1
46	368340.00	118.6	82.2
54	115080.00	104.2	72.3
56	552480.00	152.8	106.0
57	322260.00	215.4	149.4
20	920820.00	113.8	79.0
01	207180.00	94.7	65.7
Fuel	1542360.00	82.9	57.5

FISCAL YEAR 1980 (COLA Rate 7.6 Percent)

ACCOUNT	COLA AMOUNT	PERCENT OF PROPOSED	PERCENT OF ACTUAL
30	16333844.00	140.4	75.5
41	2387996.00	136.5	73.4
42	2929268.00	153.7	82.7
43	2037712.00	151.4	81.4
45	2579060.00	140.3	75.5
46	509428.00	165.9	89.2
54	159220.00	145.0	78.0
56	764180.00	108.8	58.5
57	445740.00	333.2	179.1
20	1273608.00	112.4	60.4
01	286596.00	114.6	61.6
Fuel	2133244.00	19.9	10.7

TABLE 5-3 (CONT.)

FISCAL YEAR 1981 (COLA Rate 9.45 Percent)

ACCOUNT	COLA AMOUNT	PERCENT OF PROPOSED	PERCENT OF ACTUAL
30	21554032.50	109.7	84.8
41	3151197.00	111.2	85.9
42	3865428.00	110.5	85.4
43	2688997.50	218.9	169.1
45	3403228.50	99.5	76.9
46	672273.00	169.8	131.2
54	210073.50	120.5	93.1
56	1008409.50	55.9	43.2
57	588262.50	156.4	120.9
20	1680588.00	84.7	65.4
01	378094.50	95.1	73.5
Fuel	2815060.50	44.9	34.7

FISCAL YEAR 1982 (COLA Rate 7.8 Percent)

ACCOUNT	COLA AMOUNT	PERCENT OF PROPOSED	PERCENT OF ACTUAL
30	24216582.00	101.5	78.4
41	3540420.00	112.3	86.7
42	4342962.00	115.2	89.6
43	3021174.00	218.7	169.0
45	3823638.00	108.0	83.5
46	755274.00	133.1	102.8
54	236028.00	91.7	70.9
56	1132950.00	66.2	51.2
57	660894.00	100.4	77.5
20	1888224.00	96.1	74.2
01	424944.00	99.9	77.2
Fuel	3162822.00	53.3	41.2

TABLE 5-3 (CONT.)

FISCAL YEAR 1983 (COLA Rate 8 percent)

ACCOUNT	COLA AMOUNT	PERCENT OF PROPOSED	PERCENT OF ACTUAL
30	28541920.00	92.0	135.1
41	4172800.00	88.2	129.5
42	5118640.00	94.2	138.4
43	3560800.00	168.0	246.7
45	4506560.00	81.6	134.6
46	890160.00	145.3	213.4
54	278160.00	88.2	129.5
56	1335280.00	59.2	87.0
57	778960.00	60.7	89.2
20	2225520.00	89.7	131.7
01	500720.00	109.0	160.0
Fuel	3727680.00	(No Funds Allocated)	329.3

allocation is used instead of the model's allocation. The accounts that suffer are those that encounter the highest inflation rates. In fiscal year 1979, accounts 41 and Fuel were above 10 percent and 45 and 01 near nine percent. While the other totals exceeded the proposed amounts, these four accounts did not. Accounts 56 and 57 had low inflation rates, 5.6 percent and 4 percent respectively, but were also the big gainers under the present method.

In fiscal year 1980, Fuel had a 71 percent inflation rate which caused a low percentage of the actual needs for all accounts under the proposed model. But under the present method all the accounts except Fuel were better off than under the proposed model. It must be noted the Fuel was allocated only 10.7 percent of its needs, whereas OG-57 was over-allocated as it received more than it actually needed. Also in fiscal year 1983, Fuel had a negative inflation rate and under the proposed model received zero adjustment funds. But under the present system Fuel received more than three million dollars even though there was no need for any inflation augmentation.

In summary, this model appears to have three features that will benefit the Coast Guard's budget process. One, it allocates an equal percentage share to each operating guide based on inflation rates developed for each account. Two, the model does not overallocate funds to any of the accounts as the present method does. And finally, the proposed model allocates zero funds to those accounts experiencing a negative or zero inflation rate.

VI. CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to determine if a method could be developed that would allocate COLA funds based on inflation rates for the individual Operating Guides. Chapters IV and V show the development of models to estimate each account's inflation rate and then allocate the COLA funds based on these rates.

In developing the models, a major step is the formulation of market baskets and the assigning of weights. If these are incorrect, the models will not accurately estimate the inflation rates and thereby cause a misallocation of COLA funds. As this is an initial step for the Coast Guard in developing market baskets for the Operating Guide accounts, it is recommended that each account manager review the proposed market baskets and weights developed in this thesis. Further research could be conducted to make the market baskets more detailed, which would enhance even more the probability of the estimated inflation rates being correct. This may include a different market basket for each of the various cutters, aircraft, and stations.

Since the Coast Guard uses COLA funds to cover price increases which have incurred in the previous year [Ref. 37], model (1), which uses data from the previous year to allocate funds in the upcoming year, appears to be acceptable.

Chapter IV points out the fact that although any prediction estimate will contain some error, when dealing with price indexes time series analysis is necessary. Table 4-2 shows the possible errors in predicting when using a simple predictive model. As an accurate allocation of funds is necessary, a prediction model is not recommended until further research is done into the models proposed in time series analysis.

The allocation model proposed in Chapter V, appears to meet all requirements and has at least three features, as outlined in Chapter V, that will benefit the Coast Guard's budget process. Upon review of the market baskets and assigned weights, and selection of a model to compute the individual account inflation rates, this model is recommended for use in allocating a fixed total of money.

The proposed allocation model also shows the difference between the COLA amount received from OMB and the amount of funds actually needed to counter the effects of inflation. The percentages given in Table 5-2 imply that the COLA funds received have been insufficient during a majority of the years. The results during fiscal year 1983 are caused somewhat by a low inflation rate, but the percentage figures have also been inflated because the funds were allocated among eleven accounts and not twelve.

APPENDIX A

Step-by-step procedures for using Model (1), which uses data from a past period to allocate COLA funds in a later period.

(1). List the individual 61 Bureau of Labor Statistics indexes which are used as proxy variables.

(2). List the value for each index as listed in the appropriate publication. Do this for the months as necessary to get an annual rate.

(3). Using the formula [(BLS(t)-BLS(t-1)) ÷ BLS(t-1)] compute the percent change in indexes, but in decimal form.

Figure B-1 gives an example of the above procedure. The example shown in this figure is the allocation of COLA funds for fiscal year 1982. The indexes are listed as they would be read into the computer. Since fiscal year 1982 begins 1 October 1981, index values are found for October 1980 and October 1981. Note that the COLA rate, as given by OMB for fiscal year 1982, is listed in percent form.

(4). List the dollar base that each account will use for the allocation of funds. As explained in the text, these base figures are the amount of money budgeted to each account the previous fiscal year.

(5). List the total non-pay Operating Expenses base, summation of totals listed in step 4 above.

(6). List the total COLA amount in dollars. This amount equals the total amount from step 5, multiplied by the COLA rate as listed on Figure B-1 divided by 100.0.

Figure B-2 demonstrates the appropriate listings done in parts 4, 5, and 6.

(7). If computations are done by computer, one must read in the index changes (as decimals), the COLA rate (as a percent), the base figures for each account, the total non-pay Operating Expenses (OE) base, and the COLA amount in dollars. These values shall be read into the computer in accordance with the format statements given in Program number one, which is Figure B-4.

(8). If done by calculator, the following steps are to be taken:

(a) Figure B-4 gives the individual equations to calculate each account's inflation rate. Insert the appropriate Z(I) index change value and multiply by the corresponding weights as given in the program. As an example, for OG-30, use the model that calculates FP. Insert the index change values for Z(5) (.111996811), Z(31) (.099715099), Z(47) (.080291971), Z(48) (.093573844), and Z(49) (.095726496). Then perform the appropriate mathematical functions.

(b) Multiply each account's rate, as computed above in decimal form, by its base figure.

(c) Sum the terms calculated in (b).

(d) Determine the individual COLA allocations by using the following equation:

$$OG(i) = (\text{Value}(i) \text{ from } (b) \div \text{value from } (c)) \times \text{value from } (d)$$

where i = an individual account, i = 1,12. OG(i) gives the allocation for the account (i).

Step-by-step procedures for using Model (2), which uses regression techniques to predict index values to use in allocating COLA funds.

(1). List the indexes and values as in Figure B-1, but only the latest values. Using the example for fiscal year 1982, list the index values for only 1981. Do not perform any percentage calculations at this stage.

(2). Using computer program number two (2), Figure B-5, calculate the aggregate indexes for each account. Where appropriate both a material and a labor index will be calculated.

(a) To use the computer, read in the index values for the single year.

(b) The output will be the aggregate indexes.

(c) If using a calculator, use the index values as listed on Figure B-1 and insert them in the appropriate locations as outlined in Figure B-5.

(d) The final output will be indexes and dollar figures (for labor values), to two decimal places.

(3). List the values obtained above in Figure B-3 under actual. Update the appropriate regression program being used. Ensure that the values for the program represent the correct 'lag' you desire to have. With a lag of five to predict 1982 values, actual values from 1977, 78, 79, 80, and 81 would be required.

(4). List the predicted values in Figure B-3 under predicted. Then use the equation [(BLS(t)-BLS(t-1)) ÷ BLS(t-1)] to compute the index change percent.

(5). Multiply each percent, expressed in decimal form, by its appropriate weighting listed below.

ACCOUNT	LABOR	MATERIAL
30	.5	.5
41	.58	.42
42	.6	.4
43	.56	.44
45	.6	.4
46	.6	.4
54	None	1.0
56	None	1.0
57	.5	.5
20	.6	.4
01	0	1
Fuel	0	1

(6). If an account has separate indexes for labor and material add these together, after performing the operations in Part 5, to obtain the final index. Using OG-30 as an example, the following calculations would be made:

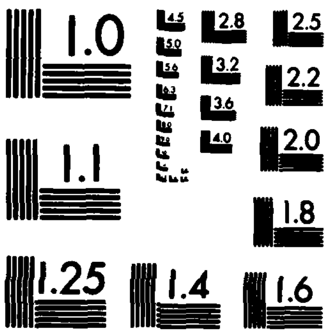
AD-A137 286 AN ANALYSIS OF COLA (COST OF LIVING ADJUSTMENT) ALLOCATION WITHIN THE UNITED STATES COAST GUARD(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA K G ROSS SEP 83 2/2

UNCLASSIFIED F/G 5/4 NL

END

FILMED

DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

OG-30 Material .0776 (from B-3) x .5 = .0388

OG-30 Labor .0605 x .5 = .0303

Final OG-30 Index = .0388 + .0303 = .0691

(7). Insert these values into the indicated location in Program number three (3), which is Figure B-6. Figure B-7 gives a list of variables used in the computer programs and their definitions. This figure indicates which accounts, FP through Fuel represent.

(8). If using a calculator, use the same procedure as outlined in steps 8(b) through 8(d) of the first section.

Figure B-8 shows the final output received from using computer programs one and three.

APPENDIX B

The use of simple linear regression in this thesis is based on postulating a functional relationship between an independent variable and a dependent variable, and then predicting values based on this relationship. The method used to determine if a simple relationship does exist is a graphical method called a dot or scatter diagram. This graph suggests a relationship when graphing the independent variable on the X-axis and the dependent variable on the Y-axis. Since we are interested in using linear regression, we desire a linear relationship. If a linear relationship does not exist, various transformations such as log, square root, inverse, and the squared value of the independent, dependent or both, variables may be used in an attempt to achieve a linear relationship. In the thesis a linear model was attempted, and also a log transformation on the dependent value was developed. The log model was attempted because a slight curvature was observed in some of the curves. The general models used are $Y(j) = a + bX(j) + e(j)$ and $\ell n(Y(j)) = \ell n(a) + bX(j) + e(j)$ where the $e(j)$'s represent the variations from the true value of Y and are termed the statistical error.

Tables B-1 and B-2 give the results of various statistical tests used in regression. These tests are explained in the following paragraphs.

The Coefficient of Determination, R^2, is a measure that is commonly used to describe how well the regression line fits the data. The value obtained is the proportion of variability explained by the regression on the X values. The larger the R^2 value, the more variability explained, and the better the regression line fits. The majority of R^2 values are above .90 which means that at least 90 percent of the variability in Y is explained by the regression on X. The lowest value obtained is 74 percent obtained for the material of OG-43 in Table B-1. The level of R^2 deemed satisfactory depends upon the desires of the user.

The F-test involves an Analysis of Variance with sum of square errors for the regression and residual values. The F-test measures whether or not, adding the term bX to the model, is a significant improvement over the very simple model $Y = a$, or just the intercept. This is equivalent to saying that the additional parameter is different than zero, and therefore Y is related to X. The null hypothesis for this test is $Y(j) = a + e(j)$ or $b = 0$, and the alternative hypothesis is $Y(j) = a + bX(j) + e(j)$ or $b \neq 0$. If the calculated F-value given in Tables B-1 and B-2 is larger than the F-value given in a statistical table, then reject the null hypothesis, implying that $b \neq 0$. Degrees of freedom (1,3).

alpha level	Table F-value
0.05	10.13
0.01	34.12

Of the 78 values given in Tables B-1 and B-2, only eight did not reject at the .01 level and only one value was not significant at .05 alpha level. This was again the material model for OG-43, which had a F-value of 8.63.

The t-test values measures the importance of the coefficients calculated in the regression model. If the calculated t-value given in Tables B-1 and B-2 is greater than the statistical tabled t-value, for the desired alpha level, then the coefficient is important and different than zero. For the t-test the degrees of freedom equal four.

alpha level	table t-value
0.05	2.78
0.01	4.60
0.001	8.61

All t-values are significant at the .05 level, only three are not significant at .01 and at the .001 level, twenty values fail to reject the null hypothesis.

An important assumption that is made in linear regression is that expected value of the error terms equals zero. If this is not true, then it is possible that the disturbance occurring at one point in time may be correlated with any other disturbance. It can be shown that if the error terms are correlated, then the estimates of the statistics just described will not be accurate and will usually be overestimated.

A test for the presence of autoregression is the Durbin-Watson test. Unfortunately, most books contain tables for the test beginning at n = 15, and the regression equations used contained only five observations. Therefore no formal test could be used, but there is a rule-of-thumb that when the statistic is near 2.0, the user can be confident that the errors are not correlated [Ref. 38: p. 13]. Using this rule, the Durbin-Watson values contained in Tables B-1 and B-2 appear to be satisfactory, except for the cases where the value is above 3.00. In these situations the user must be aware that the F-values and the t-values may be overestimated. Although the error terms appear to be uncorrelated, there may be high correlation among the X values themselves. As explained in the text, this is where time series analysis would be utilized.

Predictions are obtained by substituting values for the independent variables, X = 6 in this case, into an estimated regression equation. Two important terms in prediction are interpolation and extrapolation. Interpolation is when the predictor is within the range of the data, and extrapolation occurs in cases when the predictor is outside the range of the data. Interpolations tend to be accurate and reliable, while extrapolations are less accurate and possibly unreliable. Extrapolation is used in this thesis.

The standard error of prediction is made up of a variance due to estimating and the variance of the regression equation. The smaller the standard error of prediction the better, but the level of error that is satisfactory is based on the user's desires. Errors of prediction are given in Tables B-3 and B-4 for predicated values for fiscal years 1981, 1982, and 1983.

More detailed information about simple linear regression can be obtained from the books Applied Linear Regression [Ref. 39], and Statistical Methods in Research and Production [Ref. 40], or any other book on regression.

In the event that Model (2) is used, actual values for the regression equations are given in Table B-5. These values are for use in the linear model. For the log model, take the natural log (ℓn) of the appropriate values for which the log model is used.

TABLE B-1

REGRESSION RESULTS FOR LINEAR MODEL

N = 5

PREDICTING FOR 1981

ACCOUNT	MODEL	F-TEST	R^2	SSE	t-VALUES	DURBIN-WATSON
30 MAT.	Y = 144.2 + 20.0X	76.70	.962	7.236	25.25, 8.9	1.385
30 LABOR	Y = 4.56 + .433X	177.6	.983	.1027	42.3, 13.3	1.637
41 MAT.	Y = 169.7 + 20.2X	154.2	.981	2.944	59.24, 24.1	1.968
41 LABOR	Y = 5.05 + .717X	165.0	.982	.176	27.2, 12.8	2.12
42 MAT.	Y = 127.9 + 13.3X	75.2	.961	4.84	25.19, 8.7	1.446
42 LABOR	Y = 4.43 + .532X	373.1	.992	.087	48.5, 19.3	1.45
43 MAT.	Y = 182.5 + 23.2X	126.3	.977	6.52	26.7, 11.2	2.503
43 LABOR	Y = 7.27 + .55X	248.4	.988	.109	63.3, 15.8	1.459
45 MAT.	Y = 172.3 + 19.7X	230.18	.987	4.103	40.04, 15.2	1.415
45 LABOR	Y = 5.12 + .67X	79.1	.963	.238	20.55, 8.9	1.52
46 MAT.	Y = 191.1 + 23.8X	347.3	.991	4.042	45.1, 18.6	2.179
46 LABOR	Y = 7.24 + .505X	204.1	.986	.112	61.8, 14.3	1.39
54 MAT.	Y = 140.1 + 16.6X	209.3	.986	3.63	36.8, 14.5	1.42
56 MAT.	NONE					
57 MAT.	NONE					
57 LABOR	NONE					
20 MAT	NONE					
20 LABOR	NONE					
01 MAT	Y = 152.2 + 21.6X	92.6	.969	7.10	20.4, 9.6	1.414

TABLE B-1 (CONT.)

PREDICTING FOR 1982

ACCOUNT	MODEL	F-TEST	R^2	SSE	t-VALUES	DURBIN-WATSON
30 MAT.	Y = 151.3 + 24.9X	243.5	.987	5.046	79.4,22.4	1.623
30 LABOR	Y = 4.8 + .521X	525.8	.994	.072	63.1, 23	1.420
41 MAT.	Y = 182.9 + 22.4X	578.3	.994	2.95	59.2, 24.1	3.398
41 LABOR	Y = 5.49 + .82X	466.1	.994	.119	43.8, 21.6	2.313
42 MAT.	Y = 132.2 + 16.8X	180.7	.984	3.94	31.9, 13.4	1.464
42 LABOR	Y = 4.82 + .59X	882.8	.997	.062	73.9, 29.7	1.742
43 MAT.	Y = 214.3 + 18.9X	33.8	.918	10.27	19.9, 5.1	1.475
43 LABOR	Y = 7.63 + .62X	964.8	.997	.063	116.2, 31.1	1.622
45 MAT.	Y = 183.3 + 23.1X	446.5	.993	3.46	50.6, 21.1	1.442
45 LABOR	Y = 5.44 + .79X	352.2	.992	.133	39.1, 18.8	2.122
46 MAT.	Y = 207.7 + 26.4X	1311.1	.998	2.31	85.8, 36.2	3.41
46 LABOR	Y = 7.56 + .57X	495.7	.994	.081	88.6, 22.3	1.700
54 MAT.	Y = 148.1 + 16.6X	209.3	.986	3.63	36.8, 14.5	1.420
56 MAT.	Y = 143.1 + 38.3X	148.5	.990	7.04	16.6, 12.2	2.581
57 MAT.	Y = 98.99 + 10.5X	190.3	.989	1.70	47.5, 13.8	2.145
57 LABOR	Y = 4.68 + .38X	16.4	.891	.208	18.4, 4.1	2.016
20 MAT.	Y = 134.2 + 50.5X	91.12	.968	16.7	7.7, 9.6	1.797
20 LABOR	Y = 3.85 + 2.8X	15.9	.951	.211	19.6, 6.1	2.131
01 MAT.	Y = 161.7 + 26X	431.4	.969	7.1	20.4, 9.6	1.414

TABLE B-1 (CONT.)

PREDICTING FOR 1983

ACCOUNT	MODEL	F-TEST	R^2	SSE	t-VALUES	DURBIN-WATSON
30 MAT.	Y = 218.9 + 17.5X	306.5	.990	4.55	36.3, 17.5	2.055
30 LABOR	Y = 5.2 + .54X	12322.0	.998	.049	101.2, 35.1	2.515
41 MAT.	Y = 212.2 + 18.7X	49.2	.942	8.42	24.0, 17.0	1.936
41 LABOR	Y = 6.2 + .89X	483.4	.994	.127	46.0, 22.0	2.606
42 MAT.	Y = 147.0 + 16.8X	180.7	.984	3.94	35.6, 13.4	2.23
42 LABOR	Y = 5.34 + .61X	3399.6	.999	.033	155.1, 58.3	2.57
43 MAT.	Y = 253.9 + 10.4X	8.63	.7422	11.20	21.6, 2.94	1.685
43 LABOR	Y = 8.13 + .66X	4014.5	.999	.033	236.1, 63.4	2.650
45 MAT.	Y = 209.1 + 20.9X	81.75	.965	7.30	27.3, 9.04	2.161
45 LABOR	Y = 6.1 + .834X	933.2	.997	.086	67.1, 30.6	3.22
46 MAT.	Y = 245.5 + 20.8X	36.67	.924	10.84	21.6, 6.1	2.192
46 LABOR	Y = 7.96 + .64X	2258.0	.997	.0424	179.2, 47.5	2.33
54 MAT.	Y = 164.8 + 20.8X	616.9	.995	2.65	59.3, 24.8	2.688
56 MAT.	Y = 146.7 + 36.5X	302.9	.990	6.63	21.1, 17.4	2.64
57 MAT.	Y = 98.4 + 10.8X	523.1	.994	1.49	62.8, 22.9	1.937
20 MAT.	Y = 172.7 + 52.0X	136.6	.979	14.06	11.7, 11.7	1.801
20 LABOR	Y = 8.99 + .85X	179.5	.985	.008	185.1, 40.6	2.001
01 MAT.	Y = 186.7 + 25.4X	260.4	.989	4.98	35.76, 16.14	1.882

TABLE B-2

REGRESSION RESULTS FOR LOG MODEL

N = 5

PREDICTING FOR 1981

ACCOUNT	MODEL	F-TEST	R^2	SSE	t-VALUES	DURBIN-WATSON
30 MAT.	Y = 160.8 + .1101X	66.7	.996	.014	359.2, 25.8	2.18
41 MAT.	Y = 188.7 + .09X	377.4	.990	.015	339.7, 19.4	2.53
42 MAT.	Y = 137.0 + .092X	422.1	.993	.014	333.2, 20.54	1.67
43 MAT.	NONE-LINEAR	MODEL				
45 MAT.	Y = 190.6 + .0914X	3024.0	.999	.005	951.9, 55.0	1.66
46 MAT.	Y = 214.7 + .093X	690.1	.996	.011	457.5, 26.3	2.09
54 MAT.	Y = 154.5 + .096X	1057.6	.997	.009	517.8, 32.52	1.47
56 MAT.	NONE					
57 MAT.	NONE					
20 MAT.	NONE					
01 MAT.	NONE-LINEAR	MODEL				
Fuel	Y = 221.4 + .25X	26.83	.899	.155	33.5, 5.2	1.921

PREDICTING FOR 1982

ACCOUNT	MODEL	F-TEST	R^2	SSE	t-VALUES	DURBIN-WATSON
30 MAT.	Y = 160.8 + .1101X	66.7	.996	.014	359.2, 25.8	2.18
41 MAT.	Y = 214.9 + .07X	39.47	.930	.036	142.6, 6.3	1.80
42 MAT.	Y = 134.3 + .092X	422.1	.993	.014	333.2, 20.6	1.67
43 MAT.	NONE-LINEAR	MODEL				
45 MAT.	Y = 190.6 + .091X	3024.0	.999	.005	951.86, 55.0	1.66
46 MAT.	Y = 221.4 + .093X	690.1	.996	.011	457.5, 26.3	2.09
54 MAT.	Y = 154.5 + .096X	1057.6	.997	.009	517.8, 32.5	1.47
56 MAT.	Y = 131.6 + .166X	707.9	.996	.0197	235.5, 26.6	3.57
57 MAT.	Y = 101.5 + .084X	365.6	.995	.0097	386.1, 19.1	2.37
20 MAT.	Y = 162.4 + .177X	148.5	.980	.046	105.5, 12.2	2.38
01 MAT.	NONE-LINEAR	MODEL				
Fuel	Y = 259.8 + .288X	61.19	.9[illegible]	.116	45.5, 7.82	2.81

TABLE B-2 (CONT.)

PREDICTING FOR 1983

ACCOUNT	MODEL	F-TEST	R^2	SSE	t-VALUES	DURBIN-WATSON
30 MAT.	Y = 181.3 + .103X	162.40	.980	.026	193.4, 12.7	1.65
41 MAT.	Y = 214.9 + .07X	39.47	.930	.036	142.6, 6.28	1.800
42 MAT.	Y = 151.x + .086X	134.4	.980	.023	203.7, 11.6	1.900
42 MAT.	NONE-LINEAR	MODEL				
45 MAT.	Y = 212.7 + .08X	70.1	.960	.0295	173.4, 8.37	1.92
46 MAT.	Y = 249.6 + .07X	33.8	.920	.038	140.2, 5.8	2.02
54 MAT.	Y = 170.7 + .093X	406.9	.993	.0145	337.9, 20.2	2.17
56 MAT.	Y = 160.8 + .146X	194.2	.985	.033	146.6, 13.9	2.09
57 MAT.	Y = 101.5 + .083X	1013.5	.997	.008	537.6, 31.8	2.58
20 MAT.	Y = 194.4 + .166X	67.5	.960	.064	78.43, 8.22	1.48
01 MAT.	NONE-LINEAR	MODEL				
Fuel	Y = 387.6 + .22X	12.21	.802	.198	28.7, 3.5	1.57

TABLE B-3

REGRESSION RESULTS

LINEAR MODEL

ACCOUNT	1981		1982		1983	
	PREDICTED VALUE	STANDARD ERROR OF PREDICTION	PREDICATED VALUE	STANDARD ERROR OF PREDICTION	PREDICATED VALUE	STANDARD ERROR OF PREDICTION
30 MAT.	264.48	10.486	300.7	7.313	324.02	6.591
30 LABOR	7.154	.1488	7.89	.1042	8.47	.0711
41 MAT.	290.27	7.434	317.37	4.267	324.22	12.200
41 LABOR	9.35	.1816	10.40	.1761	11.454	.1844
42 MAT.	207.59	7.016	232.70	5.712	247.5	5.712
42 LABOR	7.626	.1265	8.33	.0900	8.97	.0480
43 MAT.	321.55	9.4710	327.46	14.88	316.37	16.2315
43 LABOR	10.55	.1587	11.32	.0906	12.07	.0479
45 MAT.	290.40	5.9452	321.78	5.007	334.32	10.5792
45 LABOR	9.13	.3435	10.17	.1924	11.08	.1253
46 MAT.	334.02	5.8571	366.38	3.3462	369.95	15.7032
46 LABOR	10.27	.1612	10.99	.1183	11.78	.0608
54 MAT.	239.76	5.2612	268.06	5.6683	289.66	3.8393
56 MAT.	N/A		334.66	11.1243	369.14	11.3256
57 MAT.	N/A		151.50	2.6918	163.19	2.1643
57 LABOR	N/A		6.56	.3283	7.25	.3219
20 MAT.	N/A		437.02	24.2282	484.4	20.3698
20 LABOR	N/A		7.56		8.031	
01 MAT.	281.772	10.2830	317.51	5.7315	339.10	7.2132
Fuel	1048.903	Log Model	1454.91	Log	1441.01	Log

TABLE B-4

REGRESSION RESULTS

LOG MODEL

ACCOUNT	1981		1982		1983	
	PREDICTED VALUE	STANDARD ERROR OF PREDICTION	PREDICTED VALUE	STANDARD ERROR OF PREDICTION	PREDICTED VALUE	STANDARD ERROR OF PREDICTION
30 MAT.	5.60 (270.43)	.0316	5.74 (311.06)	.0200	5.81 (333.6)	.0374
41 MAT.	5.69 (295.89)	.0263	5.78 (323.76)	.0632	5.80 (330.3)	.0520
42 MAT.	5.35 (210.61)	.0316	5.47 (237.46)	.0205	5.53 (252.14)	.0332
45 MAT.	5.69 (295.89)	.0141	5.80 (329.31)	.0077	5.83 (340.36)	.0447
46 MAT.	5.84 (342.06)	.0187	5.93 (376.15)	.0173	5.93 (376.15)	.0548
54 MAT.	5.5 (244.69)	.0155	5.62 (274.79)	.0141	5.69 (295.9)	.0210
56 MAT.	N/A	N/A	5.87 (354.96)	.0286	5.96 (387.61)	.0480
57 MAT.	N/A	N/A	5.03 (152.93)	.0141	5.11 (165.67)	.0316
20 MAT.	N/A	N/A	6.15 (468.72)	.0663	6.27 (528.5)	.0949
Fuel	6.96 (1048.9)	.2245	7.28 (1454.9)	.1686	7.27 (1441.0)	.2870

TABLE B-5

ACTUAL RESULTS FOR REGRESSION

ACCOUNT	1978	1979	1980	1981	1982
30 MAT.	196.70	221.80	250.9	279.00	294.00
30 LABOR	5.79	6.25	6.81	7.44	7.92
41 MAT.	224.18	253.44	271.75	294.87	296.82
41 LABOR	7.16	7.76	8.81	9.63	10.65
42 MAT.	163.33	178.20	199.07	218.74	226.83
42 LABOR	5.95	6.51	7.18	7.78	8.34
43 MAT.	252.68	284.04	292.30	299.90	296.80
43 LABOR	8.81	9.41	10.10	10.74	11.44
45 MAT.	227.43	249.34	274.43	301.67	305.63
45 LABOR	6.94	7.65	8.69	9.40	10.23
46 MAT.	259.90	289.20	310.50	341.30	337.60
46 LABOR	8.63	9.21	9.87	10.47	11.19
54	184.42	204.58	226.66	251.64	266.92
56	N/A	N/A	N/A	298.73	325.59
57 MAT.	N/A	N/A	N/A	141.96	152.99
57 LABOR	N/A	N/A	N/A	6.34	6.96
20 MAT.	N/A	N/A	N/A	394.56	417.37
20 LABOR	N/A	N/A	N/A	7.11	7.51
01	210.13	236.02	266.42	293.54	308.37
Fuel	397.71	682.02	864.47	1029.78	966.50

FIGURE B-1

ALLOCATION OF COLA FUNDS

FISCAL YEAR 1982
RATE(AS GIVEN BY OMB) 7.8

Z(I)	CODE	DESCRIPTION	OCT1980	OCT1981	INDEX CHANGE (DECMIAL)
1	PPI 1013-02	FINISHED STEEL MILL PRODUCTS	306.3	343.7	.122102514
2	PPI 1013-0261	STAINLESS SHEETS	222.4	235.9	.060701439
3	PPI 1025	MILL SHAPES	295.3	308.2	.043684389
4	PPI 1143	FLUID POWER EQUIP.	206.6	227.9	.103097774
5	PPI 1081	BOLTS,NUTS,SCREWS	247.1	265.9	.076082558
6	PPI 101	IRON AND STEEL	310.5	341.3	.099194847
7	PPI 1022-0128	NICKEL,CATHODE SHEETS	400.1	400.1	0
8	PPI 117	ELECTRICAL MACHINERY AND EQUIPMENT	271.2	313.5	.155973451
9	PPI 1171	WIRING DEVICES	271.2	313.5	.155973451
10	PPI 1172	INTEGRATING AND MEASURING INSTRUMENTS	188.4	203.9	.082271762
11	PPI 1174	TRANSFORMERS,REGULATORS, POWER EQUIPMENT	192.3	217.3	.130005200
12	PPI 1175	SWITCHGEAR,SWITCHBOARD EQUIPMENT	236.8	252.9	.067989865
13	PPI 1178	ELECTRONIC COMPONENTS AND ACCESSORIES	160.6	170.6	.062266501
14	PPI 08	LUMBER AND WOOD PRODUCTS	289.0	284.3	-.016262976

15	PPI 10	METALS AND METAL PRODUCTS	291.9	305.3	.045906132
16	PPI 1322	CEMENT	311.7	330.2	.059351941
17	PPI 107	METAL PRODUCTS, FABRICATED STRUCTURAL	276.9	302.6	.092813290
18	PPI 114	GENERAL PURPOSE MACHINERY AND EQUIPMENT	272.5	295.1	.082935779
19	PPI 1392	INSULATION MATERIALS	300.0	346.8	.156000000
20	PPI 1513C1	SMALL ARMS	228.7	258.6	.130738959
21	PPI 1513C2	SMALL ARMS AMMUNITION	225.3	247.0	.096316023
22	PPI 05	FUELS AND RELATED POWER PRODUCTS	592.9	698.1	.177432957
23	PPI 0712C1	TIRES	244.0	255.6	.047540984
24	PPI 1411C2	MOTOR TRUCKS	249.3	279.3	.120336943
25	PPI TABLE (USUALLY #9)	TOTAL RAILROAD FREIGHT	299.0	337.9	.130100334
26	PPI TABLE (USUALLY #11)	POSTAL SERVICE	N/A	138.7	N/A
27	PPI 0571	GASOLINE	642.1	723.5	.126771531
28	PPI 0572	LIGHT DISTILLATES	896.3	1042.7	.163338168
29	PPI 0573	MIDDLE DISTILLATES	868.4	1056.1	.216144634
30	PPI 0574	RESIDUAL FUELS	943.8	1179.1	.249311295
31	AHE	MANUFACTURING	7.02	7.72	.099715099
32	AHE 3721	AIRCRAFT INDUSTRY	10.05	10.86	.080597015
33	AHE 3728	AIRCRAFT PARTS AND EQUIPMENT	8.64	9.54	.104166667
34	AHE 3724	AIRCRAFT PARTS	9.65	10.59	.097409326

35	AHE 366	COMMUNICATIONS EQUIP.	8.20	9.11	.110975609
36	AHE 367	ELECTRONIC COMPONENTS AND ACCESSORIES	6.23	6.75	.083467095
37	AHE 36	ELECTRICAL EQUIPMENT AND SUPPLIES	7.18	7.78	.083565459
38	AHE 17	SPECIAL TRADE (SKILLED LABOR)	10.96	11.72	.069343066
39	AHE 15	GENERAL BUILDING (UNSKILLED LABOR)	9.40	9.93	.056382979
40	AHE 373	SHIP/BOAT BUILDING AND REPAIR	8.51	9.02	.059929495
41	AHE 3731	SHIP BUILDING AND REPAIR	8.87	9.78	.102593010
42	AHE 384	MEDICAL INSTRUMENTS AND SUPPLIES	5.98	6.61	.105351171
43	AHE 421	TRUCKING AND TRUCKING TERMINALS	9.69	10.34	.067079463
44	AHE 422	PUBLIC TERMINALS	6.38	7.04	.103448276
45	AHE 73	BUSINESS SERVICES	6.10	6.63	.086885246
46	AHE 372	AIRCRAFT AND PARTS	9.60	10.48	.091666667
47	AHE	RETAIL AND WHOLESALE	5.48	5.92	.080291971
48	AHE	TRANSPORTATION	8.87	9.70	.093573844
49	AHE	SERVICES	5.85	6.41	.095726496
50	CPI INDEX	TOTAL CPI INDEX LESS FOOD	250.9	279.0	.111996811
51	CPI INDEX	AIRLINE FARES	315.0	372.0	.180952381
52	CPI INDEX	INTERCITY BUS FARE	307.1	361.3	.176489743
53	CPI INDEX	INTERCITY MASS TRANSIT	235.6	301.7	.280560272

54	CPI INDEX	TAXI FARE	267.9	289.3	.079880552
55	CPI INDEX	INTERCITY TRAIN FARE	255.6	315.0	.232394366
56	CPI INDEX	LODGING WHILE OUT OF TOWN	286.0	324.2	.133566434
57	CPI INDEX	FOOD AWAY FROM HOME	273.1	296.2	.084584401
58	CPI INDEX	TUITION AND OTHER SCHOOL FEES	132.4	149.3	.127643504
59	CPI INDEX	NONPRESCRIPTION MEDICAL EQUIPMENT AND SUPPLIES	121.3	132.7	.093981863
60	CPI INDEX	HOUSING	271.1	303.5	.119513095
61	CPI INDEX	FOOD AND BEVERAGE	255.5	270.3	.057925636

FIGURE B-2

FISCAL YEAR 1982

OG ACCOUNT	THIS YEAR'S BASE(LAST YEAR'S BUDGET)
30	310465000
41	45359000
42	55679000
43	38733000
45	49021000
46	9683000
54	3026000
56	14525000
57	8473000
20	24208000
01	5448000
FUEL	40549000

TOTAL NON-PAY CE EASE 605204000
COLA AMOUNT IN DOLLARS(TOTAL NON-PAY OE BASE TIMES COLA RATE)
47205912

FIGURE B-3

ALLOCATION OF COLA FUNCS

FISCAL YEAR 1982
COLA RATE(AS GIVIN BY OMB) 7.8

ACCOUNT	1981(ACTUAL)	1982(PREDICTED)	INDEX(PERCENT)
OG30 MATERIAL	279.00	300.70	.0778
OG30 LABOR	7.44	7.89	.0605
OG41 MATERIAL	294.87	317.37	.0763
OG41 LABOR	9.63	10.39	.0789
OG42 MATERIAL	218.74	232.70	.0638
OG42 LABOR	7.78	8.33	.0707
OG43 MATERIAL	299.90	327.46	.0919
OG43 LABOR	10.74	11.32	.0540
OG45 MATERIAL	301.67	321.78	.0667
OG45 LABOR	9.40	10.17	.0819
OG46 MATERIAL	341.30	366.38	.0735
OG46 LABOR	10.47	11.00	.0506
OG54	251.64	268.06	.0653
OG56	298.73	334.66	.1203
OG57 MATERIAL	141.96	151.50	.0672
OG57 LABOR	6.34	6.56	.0347
OG20 MATERIAL	394.53	437.02	.1076
OG20 LABOR	7.11	7.56	.0633
OG01	293.54	317.51	.0817
FUEL	1029.78	1454.51	.4157

FIGURE B-4

```
C       LT. KEVIN G. ROSS   USCG
C       01 OCTOBER, 1983
C       PROGRAM NUMBER ONE (1)
C       THIS PROGRAM COMPUTES THE INDIVIDUAL RATES FOR EACH ACCOUNT
C       AND ALLOCATES COLA FUNDS BASED ON THOSE RATES.
C       READ IN PERCENT CHANGES(AS DECIMALS) FOR ALL 61 INDEXES.
C       FIELD IS SET UP FOR VALUES WITH 19 DECIMAL PLACES.
C       READ IN COLA IN PERCENT FORM(NOT DECIMAL).
C       READ IN BASE FOR EACH ACCOUNT AND TOTAL BASE FOR NON-PAY OE.
C
        INTEGER I
        DOUBLE PRECISION COLA,Z(61),FP,AFM,AVI,TONEED,
       *EL,ELL,NEED30,NEED41,NEED42,NEED43,
       *EC,CE,NE,OE,SA,PT,MED,TVL,TF,RF,PS,AF,TRANS,TVLTRA,
       *HGM,FUEL,B(12),TOBASE,COLAS,TOP,BUD30,WT,
       *BUD41,BUD42,BUD43,BUD45,BUD46,BUD54,BUD56,BUD57,BUD20,
       *BUD01,BUDFUL,OG30,OG41,OG42,OG43,OG45,OG46,OG54,OG56,
       *OG57,OG20,OG01,OFUEL,TOCOLA,AFL,M,ELM,EM,
       *I30,I41,I42,I43,I45,I46,I54,I56,I57,I20,I01,I77,
       *NEED45,NEED46,NEED54,NEED56,NEED57,NEED20,NEED01,
       *NEED77,TODIFF,PERDIF,GOT30,GOT41,GOT42,GOT43,GOT45,
       *GOT46,GOT54,GOT56,GOT57,GOT20,GOT01,GOT77,TFM,TFL,PSM,
       *PSL,AFM,AFL,TRANM,TRANL,TVLTRM
C
C
C       TOP-OF-FORM
        WRITE (6,900)
C
C       OUTPUT MAIN HEADING
        WRITE (6,200)
C
C       READ IN CPI/PPI/AHE CODES FOR COMMODITIES AS DECIMALS
        DO 10 I=1,61
           READ (2,100) Z(I)
10      CONTINUE
C
        READ (3,101) COLA
C       INDIVIDUAL TOTALS
C
C       OG30  FINANCIAL PROCURMENT
        FP= (.5*(Z(50))) + (.5*((.25*(Z(31)))+(.25*(Z(47)))+(.25*(Z(48)))
       *+(.25*(Z(49)))))
C
C       OG 41  AVIATION
C
C       AIR FRAME
```

```
      AFM=.62*((.2*(Z(1)))+(.1*(Z(2)))+(.2*(Z(3)))+(.1*(Z(4)))
     *+(.1*(Z(5)))+(.3*(Z(6))))
C     ENGINE
      EM=.19*((.6*(Z(6)))+(.1*(Z(7)))+(.2*(Z(3)))
     *+(.1*(Z(8))))
C     ELECTRICAL
      ELM=.19*(Z(8))
C     TOTAL  MATERIAL
      M=.42*(AFM+EM+ELM)
C
C     LABOR
C     AIR FRAME
      AFL= .5*((.6*(Z(32)))+(.4*(Z(33))))
C     ENGINE
      EL= .2*(Z(34))
C     ELECTRICAL
      ELL= .3*((.45*(Z(35)))+(.55*(Z(36))))
C     TOTAL FIXED WING LABOR
      L=.58*(AFL+EL+ELL)
C
C     TOTAL AVIATION
      AVI=L+M
C
C
C     OG42  ELCTRONICS/COMMUNICATIONS
C
      EC= (.4*((.2*(Z(9)))+(.2*(Z(10)))+(.1*(Z(11)))+(.1*(Z(12)))
     *+(.4*(Z(13)))))+(.6*(Z(37)))
C
C     OG43  CIVIL ENGINEERING
C
      CE=(.44*((.34*(Z(14)))+(.59*(Z(15)))+(.07*(Z(16)))))+
     *(.56*((.45*(Z(38)))+(.55*(Z(39)))))
C
C     OG45  NAVAL ENGINEERING
C
      NE= (.4*((.3*(Z(6)))+(.2*(Z(17)))+(.2*(Z(18)))+(.2*(Z(8)))
     *+(.1*(Z(19)))))+(.6*((.4*(Z(40)))+(.5*(Z(41)))+(.1*(Z(37)))))
C
C     OG46 OCEAN ENGINEERING
C
      OE=(.4*((.8*(Z(6)))+(.2*(Z(13)))))+(.6*((.3*(Z(38)))+(.6*(Z(39)))
     *+(.1*(Z(37)))))
C
C     OG54 SMALL ARMS
C
      SA= (.4*(Z(20)))+(.6*(Z(21)))
C
```

```
C     OG56  PERSONNEL TRAINING
C
      PT= (.5*((.6*(Z(51)))+(.1*(Z(52)))+(.1*(Z(53)))+
     *(.1*(Z(54)))+(.1*(Z(55)))))+(.3*((.6*(Z(56)))+
     *(.4*(Z(57)))))+(.2*(Z(58)))
C
C     OG57  MECICAL
C
      MED= (.5*((.9*(Z(59)))+(.1*(Z(13)))))+(.5*((.2*(Z(37)))
     *+(.8*(Z(42)))))
C
C     OG20  TRAVEL ANC TRANSPORTATION (PCS)
C     TRAVEL
      TVL= (.5*((.6*(Z(51)))+(.2*(Z(55)))+(.1*(Z(52)))+(.1*(Z(53)))))
     *+(.5*((.7*(Z(56)))+(.3*(Z(57)))))
C     TRANSPCRTATION
C     TRUCK FREIGHT
      TFM=(.7*(Z(22)))+(.1*(Z(23)))+(.2*(Z(24)))
      TFL=(.5*(Z(43)))+(.5*(Z(44)))
C     RAIL FREIGHT
      RF= (Z(25))
C     POSTAL SERVICE
      PSM=(Z(26))
      PSL=(Z(45))
C     AIR FREIGHT
      AFM=(Z(22))
      AFL=(.4*(Z(37)))+(.6*(Z(46)))
C
C     TOTAL TRANSPORTATICN
      TRANM=(.6*(TFM))+(.2*(RF))+(.1*(PSM))+(.1*(AFM))
      TRANL=(.6*(TFL))+(.2*(PSL))+(.2*(AFL))
C
C     TOTAL TRAVEL AND TRANSPORTATION
      TVLTRM=(.5*TRANM)+(.5*TVL)
      TVLTRA=(.6*TRANL)+(.4*TVLTRM)
C
C     OG01  HCUSING AND GENERAL MESS
C
      HGM= (.7*(Z(60)))+(.3*(Z(61)))
C
C     FUEL
C
      FUEL= (.1*(Z(27)))+(.4*(Z(28)))+(.4*(Z(29)))+(.1*(Z(30)))
C
      WRITE (6,201)
      WRITE (6,202) FP
      WRITE (6,203) AVI
      WRITE (6,204) EC
```

```
      WRITE (6,205) CE
      WRITE (6,206) NE
      WRITE (6,207) OE
      WRITE (6,208) SA
      WRITE (6,209) PT
      WRITE (6,210) MED
      WRITE (6,211) TVLTRA
      WRITE (6,212) HGM
      WRITE (6,213) FUEL
C
C
C     END INDIVIDUAL CG MODELS
C
C     READ IN LAST YEARS BUDGET(THIS YEAR'S BASE) FOR EACH OG ACCOUNT
      DO 12 I=1,12
         READ (4,102) B(I)
12    CONTINUE
C     READ IN TOTAL OF NON-PAY BASE
      READ (3,103) TOBASE
C
      WRITE (6,900)
      WRITE (6,215)
      WRITE (6,216) B(1)
      WRITE (6,217) B(2)
      WRITE (6,218) B(3)
      WRITE (6,219) B(4)
      WRITE (6,220) B(5)
      WRITE (6,221) B(6)
      WRITE (6,222) B(7)
      WRITE (6,223) B(8)
      WRITE (6,224) B(9)
      WRITE (6,225) B(10)
      WRITE (6,226) B(11)
      WRITE (6,227) B(12)
C
C     CALCULATE ACTUAL FUNDS NEEDED BY EACH ACCOUNT
C
      NEED30=FP*B(1)
      NEED41=AVI*B(2)
      NEED42=EC*B(3)
      NEED43=CE*B(4)
      NEED45=NE*B(5)
      NEED46=OE*B(6)
      NEED54=SA*B(7)
      NEED56=PT*B(8)
      NEED57=MED*B(9)
      NEED20=TVLTRA*B(10)
      NEED01=HGM*B(11)
```

```
      NEED77=FUEL*B(12)                                                 COL01930
      WRITE (6,247)                                                     COL01940
      WRITE (6,216) NEED30                                              COL01950
      WRITE (6,217) NEED41                                              COL01960
      WRITE (6,218) NEED42                                              COL01970
      WRITE (6,219) NEED43                                              COL01980
      WRITE (6,220) NEED45                                              COL01990
      WRITE (6,221) NEED46                                              COL02000
      WRITE (6,222) NEED54                                              COL02010
      WRITE (6,223) NEED56                                              COL02020
      WRITE (6,224) NEED57                                              COL02030
      WRITE (6,225) NEED20                                              COL02040
      WRITE (6,226) NEED01                                              COL02050
      WRITE (6,227) NEED77                                              COL02060
C                                                                       COL02070
C     CALCULATE TOTAL AMOUNT OF OF COLA ACTUALLY NEEDED BY CG.          COL02080
      TONEED=NEED30+NEED41+NEED42+NEED43+NEED45+NEED46+NEED54+          COL02090
     *NEED56+NEED57+NEED20+NEED01+NEED77                                COL02100
      WRITE (6,248) TONEED                                              COL02110
C                                                                       COL02120
C     READ IN COLA AMOUNT IN DOLLARS                                    COL02130
      READ (3,104) COLA$                                                COL02140
C                                                                       COL02150
C     THE AGGREGATE MODEL                                               COL02160
C                                                                       COL02170
      I30=(FP)*B(1)                                                     COL02180
      I41=(AVI)*B(2)                                                    COL02190
      I42=(EC)*B(3)                                                     COL02200
      I43=(CE)*B(4)                                                     COL02210
      I45=(NE)*B(5)                                                     COL02220
      I46=(OE)*B(6)                                                     COL02230
      I54=(SA)*B(7)                                                     COL02240
      I56=(PT)*B(8)                                                     COL02250
      I57=(MEC)*B(9)                                                    COL02260
      I20=(TVLTRA)*B(10)                                                COL02270
      I01=(HGM)*B(11)                                                   COL02280
      I77=(FUEL)*B(12)                                                  COL02290
C                                                                       COL02300
C     CHECK FOR NEGATIVE COST OF LIVING                                 COL02310
      IF (FP.LT.0.0) I30=0.0                                            COL02320
      IF (AVI.LT.0.0) I41=0.0                                           COL02330
      IF (EC.LT.0.0) I42=0.0                                            COL02340
      IF (CE.LT.0.0) I43=0.0                                            COL02350
      IF (NE.LT.0.0) I45=0.0                                            COL02360
      IF (OE.LT.0.0) I46=0.0                                            COL02370
      IF (SA.LT.0.0) I54=0.0                                            COL02380
      IF (PT.LT.0.0) I56=0.0                                            COL02390
      IF (MEC.LT.0.0) I57=0.0                                           COL02400
```

```
      IF (TVLTRA.LT.0.0) I20=0.0                                        COL02410
      IF (HGM.LT.C.0) I01=0.0                                           COL02420
      IF (FUEL.LT.0.0) I77=0.0                                          COL02430
C                                                                       COL02440
      TOP= (I30)+(I41)+(I42)+(I43)+(I45)+(I46)+(I54)+(I56)+             COL02450
     *(I57)+(I20)+(I01)+(I77)                                           COL02460
C                                                                       COL02470
C     CALCULATE THE INDIVIDUAL COLA AMOUNTS                             COL02480
C                                                                       COL02490
      WT=(TOBASE*(COLA/100.0))                                          COL02500
      BUD30= (I30/TOP)*WT                                               COL02510
      BUD41= (I41/TOP)*WT                                               COL02520
      BUD42= (I42/TOP)*WT                                               COL02530
      BUD43= (I43/TOP)*WT                                               COL02540
      BUD45= (I45/TOP)*WT                                               COL02550
      BUD46= (I46/TOP)*WT                                               COL02560
      BUD54= (I54/TOP)*WT                                               COL02570
      BUD56= (I56/TOP)*WT                                               COL02580
      BUD57= (I57/TOP)*WT                                               COL02590
      BUD20= (I20/TOP)*WT                                               COL02600
      BUD01= (I01/TOP)*WT                                               COL02610
      BUDFUL= (I77/TOP)*WT                                              COL02620
C     DETERMINE CCLA AMOUNTS                                            COL02630
C                                                                       COL02640
      OG30= BUD30                                                       COL02650
      OG41= BUD41                                                       COL02660
      OG42= BUD42                                                       COL02670
      OG43= BUD43                                                       COL02680
      OG45= BUD45                                                       COL02690
      OG46= BUD46                                                       COL02700
      OG54= BUD54                                                       COL02710
      OG56= BUD56                                                       COL02720
      OG57= BUD57                                                       COL02730
      OG20= BUD20                                                       COL02740
      OG01= BUD01                                                       COL02750
      OFUEL= BUDFUL                                                     COL02760
C                                                                       COL02770
      WRITE (6,90C)                                                     COL02780
      WRITE (6,231)                                                     COL02790
      WRITE (6,216) OG30                                                COL02800
      WRITE (6,217) OG41                                                COL02810
      WRITE (6,218) OG42                                                COL02820
      WRITE (6,219) OG43                                                COL02830
      WRITE (6,220) OG45                                                COL02840
      WRITE (6,221) OG46                                                COL02850
      WRITE (6,222) OG54                                                COL02860
      WRITE (6,223) OG56                                                COL02870
      WRITE (6,224) OG57                                                COL02880
```

```
      WRITE (6,225) OG20
      WRITE (6,226) OG01
      WRITE (6,227) OFUEL
C     CALCULATE TOTAL COLA RECEIVED BY CG AS COMPUTED BY PROGRAM
      TOCOLA= OG30+OG41+OG42+OG43+OG45+OG46+OG54+OG56+OG57+OG20
     *+OG01+OFUEL
      WRITE (6,246) TOCOLA
C
C     DIFFERENCE BETWEEN COLA RECEIVED AND COLA NEEDED
C
      TODIFF=TONEED-COLA$
      WRITE(6,249) TODIFF
C     PERCENT DIFFERENCE
      PERDIF=COLA$/TONEED
      WRITE(6,250) PERDIF
C
C     PERFORM CHECK TO ENSURE ALL COLA IS ALLOCATED
C     DIFFERENCE BETWEEN COLA ALLOCATED BY PROGRAM AND COLA RECEIVED.
      DICOLA= COLA$-TOCOLA
      WRITE (6,245) DICOLA
      GOT30=OG30/NEED30
      GOT41=OG41/NEED41
      GOT42=OG42/NEED42
      GOT43=OG43/NEED43
      GOT45=OG45/NEED45
      GOT46=OG46/NEED46
      GOT54=OG54/NEED54
      GOT56=OG56/NEED56
      GOT57=OG57/NEED57
      GOT20=OG20/NEED20
      GOT01=OG01/NEED01
      GOT77=OFUEL/NEED77
      WRITE (6,263)
      WRITE (6,251) GOT30
      WRITE (6,252) GOT41
      WRITE (6,253) GOT42
      WRITE (6,254) GOT43
      WRITE (6,255) GOT45
      WRITE (6,256) GOT46
      WRITE (6,257) GOT54
      WRITE (6,258) GOT56
      WRITE (6,259) GOT57
      WRITE (6,260) GOT20
      WRITE (6,261) GOT01
      WRITE (6,262) GOT77
C
C     EJECT PAGE
      WRITE (6,900)
```

```
      STCP
C
C     FORMAT STATEMENTS
C
100   FORMAT (F12.9)
101   FORMAT (F8.4)
102   FORMAT (F14.2)
103   FORMAT (F16.2)
104   FORMAT (F14.2)
900   FORMAT ('1')
200   FORMAT ('0','ALLOCATION OF COLA FUNDS 198X')
201   FORMAT ('0','COST OF LIVING')
202   FORMAT ('0','OG-30',2X,F9.6)
203   FORMAT ('0','OG-41',2X,F9.6)
204   FORMAT ('0','OG-42',2X,F9.6)
205   FORMAT ('0','OG-43',2X,F9.6)
206   FORMAT ('0','OG-45',2X,F9.6)
207   FORMAT ('0','OG-46',2X,F9.6)
208   FORMAT ('0','OG-54',2X,F9.6)
209   FORMAT ('0','OG-56',2X,F9.6)
210   FORMAT ('0','OG-57',2X,F9.6)
211   FORMAT ('0','OG-20',2X,F9.6)
212   FORMAT ('0','OG-01',2X,F9.6)
213   FORMAT ('0','FUEL',2X,F9.6)
215   FORMAT ('0','BASE FOR INDIVIDUAL OG ACCOUNTS')
216   FORMAT ('0','OG-30',2X,F14.2)
217   FORMAT ('0','OG-41',2X,F14.2)
218   FORMAT ('0','OG-42',2X,F14.2)
219   FORMAT ('0','OG-43',2X,F14.2)
220   FORMAT ('0','OG-45',2X,F14.2)
221   FORMAT ('0','OG-46',2X,F14.2)
222   FORMAT ('0','OG-54',2X,F14.2)
223   FORMAT ('0','OG-56',2X,F14.2)
224   FORMAT ('0','OG-57',2X,F14.2)
225   FORMAT ('0','OG-20',2X,F14.2)
226   FORMAT ('0','OG-01',2X,F14.2)
227   FORMAT ('0','FUEL',2X,F14.2)
231   FORMAT ('0','COLA AMOUNTS FOR EACH OG ACCOUNT')
245   FORMAT ('0','MONEY LEFT TO ALLOCATE',2X,F14.2)
246   FORMAT ('0','TOTAL COLA ALLOCATED',2X,F16.2)
247   FORMAT ('0','ACTUAL FUNDS NEEDED FOR INFLATION')
248   FORMAT ('0','TOTAL ACTUAL FUNDS NEEDED',2X,F14.2)
249   FORMAT ('0','DIFFERENCE BETWEEN COLA NEEDED AND COLA
     *RECEIVED',2X,F14.2)
250   FORMAT ('0','PER CENT DIFFERENCE',2X,F8.6)
251   FORMAT ('0','OG-30',2X,F8.6)
252   FORMAT ('0','OG-41',2X,F8.6)
253   FORMAT ('0','OG-42',2X,F8.6)
```

```
254   FORMAT ('0','OG-43',2X,F8.6)                                    COL03850
255   FORMAT ('0','OG-45',2X,F8.6)                                    COL03860
256   FORMAT ('0','OG-46',2X,F8.6)                                    COL03870
257   FORMAT ('0','OG-54',2X,F8.6)                                    COL03880
258   FORMAT ('0','OG-56',2X,F8.6)                                    COL03890
259   FORMAT ('0','OG-57',2X,F8.6)                                    COL03900
260   FORMAT ('0','OG-20',2X,F8.6)                                    COL03910
261   FORMAT ('0','OG-01',2X,F8.6)                                    COL03920
262   FORMAT ('0','FUEL',2X,F8.6)                                     COL03930
263   FORMAT ('0','PER CENT OF ACTUAL FUNDS NEEDEC RECEIVED BY        COL03940
     *EACH ACCCUNT')                                                  COL03950
      END                                                             COL03960
```

FIGURE B-5

```
C       LT KEVIN G. ROSS  USCG
C       01 OCTOBER, 1983
C       PROGRAM NUMBER TWO (2)
C       THIS PROGRAM COMPUTES THE INDIVIDUAL MATERIAL AND LABOR INDEXES
C       FOR EACH OF THE INDIVIDUAL OG ACCOUNTS.
C       THE INDEXES OBTAINED IN THIS PROGRAM WILL BE INPUTTED INTO
C       A REGRESSION PROGRAM.
C       READ IN THE 61 INDEXES AS COPIED FROM BLS PUBLICATIONS.
C
        INTEGER I
        DOUBLE PRECISION Z(61),AFM,
       *EL,ELL,FP2,A1,A2,FP1,EC1,EC2,CE1,CE2,NE1,NE2,OE1,OE2,
       *SA,PT,MED1,MED2,RF,PS1,PS2,TF1,TVL,TF2,AF1,AF2,TRANS1,
       *HGM,FUEL,TVLTR1,TVLTR2,ELM,EM
C
C
C       TOP-OF-FORM
        WRITE (6,900)
C
C       OUTPUT MAIN HEADING
        WRITE (6,200)
C
C       READ IN CPI/PPI/AHE CODES FOR COMMODITIES
        DO 10 I=1,61
           READ (2,100) Z(I)
10      CONTINUE
C
C       INDIVIDUAL TOTALS
C
C       OG30  FINANCIAL PROCURMENT
        FP1=(Z(50))
        FP2=(.25*(Z(31)))+(.25*(Z(47)))+(.25*(Z(48)))+(.25*(Z(49)))
C
C       OG 41  AVIATION
C
C       AIR FRAME
        AFM=.62*((.2*(Z(1)))+(.1*(Z(2)))+(.2*(Z(3)))+(.1*(Z(4)))
       *+(.1*(Z(5)))+(.3*(Z(6))))
C       ENGINE
        EM=.19*((.6*(Z(6)))+(.1*(Z(7)))+(.2*(Z(3)))
       *+(.1*(Z(8))))
C       ELECTRICAL
        ELM=.15*(Z(8))
C       TOTAL  MATERIAL
        A1=(AFM+EM+ELM)
C
```

```
C     LABOR
C     AIR FRAME
      AFL= .5*((.6*(Z(32)))+(.4*(Z(33))))
C     ENGINE
      EL= .2*(Z(34))
C     ELECTRICAL
      ELL= .3*((.45*(Z(35)))+(.55*(Z(36))))
C     TOTAL FIXED WING LABOR
      A2=(AFL+EL+ELL)
C
C
C
C     OG42  ELCTRCNICS/COMMUNICATIONS
C
      EC1=(.2*(Z(9)))+(.2*(Z(10)))+(.1*(Z(11)))+(.1*(Z(12)))
     *+(.4*(Z(13)))
      EC2=(Z(37))
C
C     OG43  CIVIL ENGINEERING
C
      CE1=(.34*(Z(14)))+(.59*(Z(15)))+(.07*(Z(16)))
      CE2=(.45*(Z(38)))+(.55*(Z(39)))
C
C     OG45  NAVAL ENGINEERING
C
      NE1=(.3*(Z(6)))+(.2*(Z(17)))+(.2*(Z(18)))+(.2*(Z(8)))
     *+(.1*(Z(19)))
      NE2=(.4*(Z(40)))+(.5*(Z(41)))+(.1*(Z(37)))
C
C     OG46 OCEAN ENGINEERING
C
      OE2=(.3*(Z(38)))+(.6*(Z(39)))+(.1*(Z(37)))
      OE1=(.8*(Z(6)))+(.2*(Z(13)))
C
C     OG54 SMALL ARMS
C
      SA= (.4*(Z(20)))+(.6*(Z(21)))
C
C     OG56  PERSONNEL TRAINING
C
      PT= (.5*((.6*(Z(51)))+(.1*(Z(52)))+(.1*(Z(53)))+
     *(.1*(Z(54)))+(.1*(Z(55)))))+(.3*((.6*(Z(56)))+
     *(.4*(Z(57)))))+(.2*(Z(58)))
C
C     OG57  MECICAL
C
      MED1=(.9*(Z(59)))+(.1*(Z(13)))
      MED2=(.2*(Z(37)))+(.8*(Z(42)))
```

```
C                                                                       COL0C970
C     OG20   TRAVEL AND TRANSPORTATION (PCS)                            COL0C980
C     TRAVEL                                                            COL0C990
      TVL= (.5*((.6*(Z(51)))+(.2*(Z(55)))+(.1*(Z(52)))+(.1*(Z(53)))))   COL01000
     *+(.5*((.7*(Z(56)))+(.3*(Z(57)))))                                 COL01010
C     TRANSPCRTATION                                                    COL01020
C     TRUCK FREIGFT                                                     COL01030
      TF1=(.7*(Z(22)))+(.1*(Z(23)))+(.2*(Z(24)))                        COL01040
      TF2=(.5*(Z(43)))+(.5*(Z(44)))                                     COL01050
C     RAIL FREIGHT                                                      COL01060
      RF= (Z(25))                                                       COL01070
C     POSTAL SERVICE                                                    COL01080
      PS1=(.3*(Z(26)))                                                  COL01090
      PS2=(.7*(Z(45)))                                                  COL01100
C     AIR FREIGHT                                                       COL01110
      AF2=(.55*((.4*(Z(37)))+(.6*(Z(46)))))                             COL01120
      AF1=(.45*(Z(22)))                                                 COL01130
C                                                                       COL01140
C     TOTAL TRANSFORTATION                                              COL01150
      TRANS1=(.6*TF1)+(.2*RF)+(.1*PS1)+(.1*AF1)                         COL01160
C                                                                       COL01170
C     TOTAL TRAVEL AND TRANSPORTATION                                   COL01180
      TVLTR1= (.5*TRANS1)+(.5*TVL)                                      COL01190
      TVLTR2=(.6*TF2)+(.2*PS2)+(.2*AF2)                                 COL01200
C                                                                       COL01210
C     OG01  HCUSING AND GENERAL MESS                                    COL01220
C                                                                       COL01230
      HGM= (.7*(Z(60)))+(.3*(Z(61)))                                    COL01240
C                                                                       COL01250
C     FUEL                                                              COL01260
C                                                                       COL01270
      FUEL= (.1*(Z(27)))+(.4*(Z(28)))+(.4*(Z(29)))+(.1*(Z(30)))         COL01280
C                                                                       COL01290
      WRITE (6,201)                                                     COL01300
      WRITE (6,202) FP1,FP2                                             COL01310
      WRITE (6,203) A1,A2                                               COL01320
      WRITE (6,204) EC1,EC2                                             COL01330
      WRITE (6,205) CE1,CE2                                             COL01340
      WRITE (6,206) NE1,NE2                                             COL01350
      WRITE (6,207) OE1,OE2                                             COL01360
      WRITE (6,208) SA                                                  COL01370
      WRITE (6,209) PT                                                  COL01380
      WRITE (6,210) MED1,MED2                                           COL01390
      WRITE (6,211) TVLTR1,TVLTR2                                       COL01400
      WRITE (6,212) HGM                                                 COL01410
      WRITE (6,213) FUEL                                                COL01420
C                                                                       COL01430
C                                                                       COL01440
```

```
C       END INDIVIDUAL CG MODELS                                          COL01450
C                                                                         COL01460
C       EJECT PAGE                                                        COL01470
        WRITE (6,900)                                                     COL01480
        STOP                                                              COL01490
C                                                                         COL01500
C       FORMAT STATEMENTS                                                 COL01510
C                                                                         COL01520
100     FORMAT (F7.3)                                                     COL01530
900     FORMAT ('1')                                                      COL01540
200     FORMAT ('0','ALLOCATION OF COLA FUNDS 198X')                      COL01550
201     FORMAT ('0','COST OF LIVING')                                     COL01560
202     FORMAT ('0','OG-30',2X,2F7.3)                                     COL01570
203     FORMAT ('0','OG-41',2X,2F7.3)                                     COL01580
204     FORMAT ('0','OG-42',2X,2F7.3)                                     COL01590
205     FORMAT ('0','OG-43',2X,2F7.3)                                     COL01600
206     FORMAT ('0','OG-45',2X,2F7.3)                                     COL01610
207     FORMAT ('0','OG-46',2X,2F7.3)                                     COL01620
208     FORMAT ('0','OG-54',2X,F7.3)                                      COL01630
209     FORMAT ('0','OG-56',2X,F7.3)                                      COL01640
210     FORMAT ('0','OG-57',2X,2F7.3)                                     COL01650
211     FORMAT ('0','OG-20',2X,2F7.3)                                     COL01660
212     FORMAT ('0','OG-01',2X,F7.3)                                      COL01670
213     FORMAT ('0','FUEL',2X,F9.3)                                       COL01680
        END                                                               COL01690
```

FIGURE B-6

```
C     LT. KEVIN G. ROSS  USCG
C     01 OCTOBER 1983
C     PROGRAM NUMBER THREE (3)
C     THIS PROGRAM COMPUTES THE COLA ALLOCATION FOR EACH ACCOUNT.
C     INSERT THE VALUES OF THE INFLATION RATES AS COMPUTED FROM
C     THE REGRESSION EQUATIONS.  INSET THESE VALUES STRAIGHT INTO
C     THE PROGRAM.
C     READ IN THE INDIVIDUAL BASE TOTALS.
C     READ IN COLA AS A PERCENT AND AS A DOLLAR FIGURE.
C     READ IN TOTAL BASE FOR NON-PAY OE.
C
      INTEGER I
      DOUBLE PRECISION COLA,Z(61),FP,NEED30,NEED41,
     *NEED30,NEED41,NEED42,NEED43,AVI,NEED42,NEED43,
     *EC,CE,NE,OE,SA,PT,MED,TVLTRA,
     *HGM,FUEL,B(12),TOBASE,COLA$,TOP,BUD30,WI,
     *BUD41,BUD42,BUD43,BUD45,BUD46,BUD54,BUD56,BUD57,BUD20,
     *BUD01,BUDFUL,OG30,OG41,OG42,OG43,OG45,OG46,OG54,OG56,
     *OG57,OG20,OG01,CFUEL,TOCOLA,
     *I30,I41,I42,I43,I45,I46,I54,I56,I57,I20,I01,I77,
     *NEED45,NEED46,NEED54,NEED56,NEED57,NEED20,NEED01,
     *NEED77,TODIFF,PERDIF,GOT30,GOT41,GOT42,GOT43,GOT45,
     *GOT46,GOT54,GOT56,GOT57,GOT20,GOT01,GOT77
C
C
C     TOP-OF-FORM
      WRITE (6,900)
C
C     OUTPUT MAIN HEADING
      WRITE (6,200)
C
      READ (3,101) COLA
C     INSERT VALUES AS COMPUTED BY REGRESSION
      FP= .0692
      AVI=.0783
      EC= .0682
      CE=.0707
      NE=.0756
      OE=.0598
      SA=.0652
      PT=.1203
      MED=.0512
      TVLTRA=.0810
      HGM=.0817
      FUEL=.4090
      WRITE (6,201)
```

```
      WRITE (6,202) FP
      WRITE (6,203) AVI
      WRITE (6,204) EC
      WRITE (6,205) CE
      WRITE (6,206) NE
      WRITE (6,207) OE
      WRITE (6,208) SA
      WRITE (6,209) PT
      WRITE (6,210) MED
      WRITE (6,211) TVLTRA
      WRITE (6,212) HGM
      WRITE (6,213) FUEL
C
C
C     END INDIVIDUAL OG MODELS
C
C     READ IN LAST YEARS BUDGET(THIS YEAR'S BASE) FOR EACH OG ACCOUNT
      DO 12 I=1,12
         READ (4,102) B(I)
12    CONTINUE
C     READ IN TOTAL OE NON-PAY BASE
      READ (3,103) TOBASE
C
      WRITE (6,900)
      WRITE (6,215)
      WRITE (6,216) B(1)
      WRITE (6,217) B(2)
      WRITE (6,218) B(3)
      WRITE (6,219) B(4)
      WRITE (6,220) B(5)
      WRITE (6,221) B(6)
      WRITE (6,222) B(7)
      WRITE (6,223) B(8)
      WRITE (6,224) B(9)
      WRITE (6,225) B(10)
      WRITE (6,226) B(11)
      WRITE (6,227) B(12)
C
C     CALCULATE ACTUAL FUNDS NEEDED BY EACH ACCOUNT
C
      NEED30=FP*B(1)
      NEED41=AVI*B(2)
      NEED42=EC*B(3)
      NEED43=CE*B(4)
      NEED45=NE*B(5)
      NEED46=CE*B(6)
      NEED54=SA*B(7)
      NEED56=PT*B(8)
```

```
      NEED57=MED*B(9)
      NEED20=TVLTFA*B(10)
      NEED01=HGM*B(11)
      NEED77=FLEL*B(12)
C
C     CALCULATE TOTAL AMOUNT OF COLA ACTUALLY NEEDED BY THE CG
C
      WRITE (6,247)
      WRITE (6,216) NEED30
      WRITE (6,217) NEED41
      WRITE (6,218) NEED42
      WRITE (6,219) NEED43
      WRITE (6,220) NEED45
      WRITE (6,221) NEED46
      WRITE (6,222) NEED54
      WRITE (6,223) NEED56
      WRITE (6,224) NEED57
      WRITE (6,225) NEED20
      WRITE (6,226) NEED01
      WRITE (6,227) NEED77
      TONEED=NEED30+NEED41+NEED42+NEED43+NEED45+NEED46+NEED54+
     *NEED56+NEED57+NEED20+NEED01+NEED77
      WRITE (6,248) TONEED
C
C     READ IN COLA AMOUNT IN DOLLARS
      READ (3,104) COLAS
C
C     THE AGGREGATE MODEL
C
      I30=(FP)*B(1)
      I41=(AVI)*B(2)
      I42=(EC)*B(3)
      I43=(CE)*B(4)
      I45=(NE)*B(5)
      I46=(GE)*B(6)
      I54=(SA)*B(7)
      I56=(PT)*B(8)
      I57=(MED)*B(9)
      I20=(TVLTRA)*B(10)
      I01=(HGM)*B(11)
      I77=(FLEL)*B(12)
C
C     CHECK FOR NEGATIVE COST OF LIVING
      IF (FP.LT.0.0) I30=0.0
      IF (AVI.LT.0.0) I41=0.0
      IF (EC.LT.0.0)I42=0.0
      IF (CE.LT.0.0) I43=0.0
      IF (NE.LT.0.0) I45=0.0
```

```
      IF (OE.LT.0.0) I46=0.0
      IF (SA.LT.0.0) I54=0.0
      IF (PT.LT.0.0) I56=0.0
      IF (MED.LT.0.0) I57=0.0
      IF (TVLTRA.LT.0.0) I20=0.0
      IF (HGM.LT.0.0) I01=0.0
      IF (FUEL.LT.0.0) I77=0.0
C
      TOP= (I30)+(I41)+(I42)+(I43)+(I45)+(I46)+(I54)+(I56)+
     *(I57)+(I20)+(I01)+(I77)
C
C     CALCULATE THE INDIVIDUAL COLA AMOUNTS
C
      WT=(TOBASE*(COLA/100.0))
      BUD30= (I30/TOP)*WT
      BUD41= (I41/TOP)*WT
      BUD42= (I42/TOP)*WT
      BUD43= (I43/TOP)*WT
      BUD45= (I45/TOP)*WT
      BUD46= (I46/TOP)*WT
      BUD54= (I54/TOP)*WT
      BUD56= (I56/TOP)*WT
      BUD57= (I57/TOP)*WT
      BUD20= (I20/TOP)*WT
      BUD01= (I01/TOP)*WT
      BUDFUL= (I77/TOP)*WT
C     DETERMINE COLA AMOUNTS
C
      OG30= BUD30
      OG41= BUD41
      OG42= BUD42
      OG43= BUD43
      OG45= BUD45
      OG46= BUD46
      OG54= BUD54
      OG56= BUD56
      OG57= BUD57
      OG20= BUD20
      OG01= BUD01
      OFUEL= BUDFUL
C
      WRITE (6,900)
      WRITE (6,231)
      WRITE (6,216) OG30
      WRITE (6,217) OG41
      WRITE (6,218) OG42
      WRITE (6,219) OG43
      WRITE (6,220) OG45
```

```
      WRITE (6,221) OG46
      WRITE (6,222) OG54
      WRITE (6,223) OG56
      WRITE (6,224) OG57
      WRITE (6,225) OG20
      WRITE (6,226) OG01
      WRITE (6,227) OFUEL
C     TOTAL COLA RECEIVED AS COMPUTED BY PROGRAM
      TOCOLA= OG30+OG41+OG42+OG43+OG45+OG46+OG54+OG56+OG57+OG20
     *+OG01+OFUEL
      WRITE (6,246) TOCOLA
C     DIFFERENCE BETWEEN COLA RECEIVED AND COLA NEEDED
      TODIFF=TONEED-COLA$
      WRITE(6,249) TODIFF
C     PERCENT DIFFERENCE
      PERDIF=COLA$/TONEED
      WRITE(6,250) PERDIF
C     PERFORM A CHECK
C     DIFFERENCE BETWEEN COLA RECEIVED AND COLA CALCULATED
      DICOLA= COLA$-TOCOLA
      WRITE (6,245) DICOLA
      GOT30=OG30/NEED30
      GOT41=OG41/NEED41
      GOT42=OG42/NEED42
      GOT43=OG43/NEED43
      GOT45=OG45/NEED45
      GOT46=OG46/NEED46
      GOT54=OG54/NEED54
      GOT56=OG56/NEED56
      GOT57=OG57/NEED57
      GOT20=OG20/NEED20
      GOT01=OG01/NEED01
      GOT77=OFUEL/NEED77
      WRITE (6,263)
      WRITE (6,251) GOT30
      WRITE (6,252) GOT41
      WRITE (6,253) GOT42
      WRITE (6,254) GOT43
      WRITE (6,255) GOT45
      WRITE (6,256) GOT46
      WRITE (6,257) GOT54
      WRITE (6,258) GOT56
      WRITE (6,259) GOT57
      WRITE (6,260) GOT20
      WRITE (6,261) GOT01
      WRITE (6,262) GOT77
C
C     EJECT PAGE
```

```
      WRITE (6,900)                                                     COL02410
      STOP                                                              COL02420
C                                                                       COL02430
C     FORMAT STATEMENTS                                                 COL02440
C                                                                       COL02450
101   FORMAT (F8.4)                                                     COL02460
102   FORMAT (F14.2)                                                    COL02470
103   FORMAT (F16.2)                                                    COL02480
104   FORMAT (F14.2)                                                    COL02490
900   FORMAT ('1')                                                      COL02500
200   FORMAT ('0','ALLOCATION OF COLA FUNDS FOR FY 1982')               COL02510
201   FORMAT ('0','COST OF LIVING')                                     COL02520
202   FORMAT ('0','OG-30',2X,F9.6)                                      COL02530
203   FORMAT ('0','OG-41',2X,F9.6)                                      COL02540
204   FORMAT ('0','OG-42',2X,F9.6)                                      COL02550
205   FORMAT ('0','OG-43',2X,F9.6)                                      COL02560
206   FORMAT ('0','OG-45',2X,F9.6)                                      COL02570
207   FORMAT ('0','OG-46',2X,F9.6)                                      COL02580
208   FORMAT ('0','OG-54',2X,F9.6)                                      COL02590
209   FORMAT ('0','OG-56',2X,F9.6)                                      COL02600
210   FORMAT ('0','OG-57',2X,F9.6)                                      COL02610
211   FORMAT ('0','OG-20',2X,F9.6)                                      COL02620
212   FORMAT ('0','OG-01',2X,F9.6)                                      COL02630
213   FORMAT ('0','FUEL',2X,F9.6)                                       COL02640
215   FORMAT ('0','BASE FOR INDIVIDUAL OG ACCOUNTS')                    COL02650
216   FORMAT ('0','OG-30',2X,F14.2)                                     COL02660
217   FORMAT ('0','OG-41',2X,F14.2)                                     COL02670
218   FORMAT ('0','OG-42',2X,F14.2)                                     COL02680
219   FORMAT ('0','OG-43',2X,F14.2)                                     COL02690
220   FORMAT ('0','OG-45',2X,F14.2)                                     COL02700
221   FORMAT ('0','OG-46',2X,F14.2)                                     COL02710
222   FORMAT ('0','OG-54',2X,F14.2)                                     COL02720
223   FORMAT ('0','OG-56',2X,F14.2)                                     COL02730
224   FORMAT ('0','OG-57',2X,F14.2)                                     COL02740
225   FORMAT ('0','OG-20',2X,F14.2)                                     COL02750
226   FORMAT ('0','OG-01',2X,F14.2)                                     COL02760
227   FORMAT ('0','FUEL',2X,F14.2)                                      COL02770
231   FORMAT ('0','COLA AMOUNTS FOR EACH OG ACCOUNT')                   COL02780
245   FORMAT ('0','MONEY LEFT TO ALLOCATE',2X,F14.2)                    COL02790
246   FORMAT ('0','TOTAL COLA ALLOCATED',2X,F16.2)                      COL02800
247   FORMAT ('0','ACTUAL FUNDS NEEDED FOR INFLATION')                  COL02810
248   FORMAT ('0','TOTAL ACTUAL FUNDS NEEDED',2X,F14.2)                 COL02820
249   FORMAT ('0','DIFFERENCE BETWEEN COLA NEEDED AND COLA              COL02830
     *RECEIVED',2X,F14.2)                                               COL02840
250   FORMAT ('0','PER CENT DIFFERENCE',2X,F8.6)                        COL02850
251   FORMAT ('0','OG-30',2X,F8.6)                                      COL02860
252   FORMAT ('0','OG-41',2X,F8.6)                                      COL02870
253   FORMAT ('0','OG-42',2X,F8.6)                                      COL02880
```

```
254    FORMAT ('0','OG-43',2X,F8.6)                                  COL02890
255    FORMAT ('0','OG-45',2X,F8.6)                                  COL02900
256    FORMAT ('0','OG-46',2X,F8.6)                                  COL02910
257    FORMAT ('0','OG-54',2X,F8.6)                                  COL02920
258    FORMAT ('0','OG-56',2X,F8.6)                                  COL02930
259    FORMAT ('0','OG-57',2X,F8.6)                                  COL02940
260    FORMAT ('0','OG-20',2X,F8.6)                                  COL02950
261    FORMAT ('0','OG-01',2X,F8.6)                                  COL02960
262    FORMAT ('0','FUEL',2X,F8.6)                                   COL02970
263    FORMAT ('0','PER CENT OF ACTUAL FUNCS NEEDEC RECEIVED BY      COL02980
      *EACH ACCOUNT')                                                COL02990
       END                                                           COL03000
```

FIGURE B-7

LIST OF VARIABLES USED IN PROGRAMS

I	INDEX FOR DO LOOPS
Z(I)	VALUES OF INDEXES, PERCENT OR INDEX
	INDIVIDUAL MCDEL REPRESENTATICNS
FP	OG30
AVI	OG41
EC	OG42
CE	OG43
NE	OG45
OE	OG46
SA	OG54
PT	OG56
MED	OG57
TVLTRA	OG20
HGM	OG01
FUEL	FUEL ACCOUNT
AFM	AIRFRAME MATERIALS
AFL	AIRFRAME LABCR
EM	ENGINE MATERAILS
EL	ENGINE LABOR
ELM	ELECTRICAL MATERIALS
ELL	ELECTRICAL LABOR
TVL	TRAVEL

INDIVIDUAL MODEL VARIABLES FOR PROGRAMS 2 AND 3

FP1	OG30 MATERIAL
FP2	OG30 LABCR
A1	OG41 MATERIAL
A2	OG41 LABOR
EC1	OG42 MATERIAL
EC2	OG42 LABOR
CE1	OG43 MATERIAL
CE2	OG43 LABCR
NE1	OG45 MATERIAL
NE2	OG45 LABCR
OE1	OG46 MATERIAL
OE2	OG46 LABOR
SA	OG54
PT	OG56
MED1	OG57 MATERIAL
MED2	OG57 LABCR

PS1	POSTAL SERVICE MATERIAL
PS2	POSTAL SERVICE LABOR
AF1	AIRFRAME MATERIAL
AF2	AIRFRAME LABOR
TRANS1	TRANSPORTATION MATERIAL
TVLTR1	OG20 MATERIAL
TVLTR2	OG20 LABOR
TFM	TRUCK FREIGHT MATERIAL
TFL	TRUCK FREIGHT LABOR

RF	RAIL FREIGHT
PSM	POSTAL SERVICE MATERIAL
PSL	POSTAL SERVICE LABOR
TRANM	TRANSPORTATION MATERIAL
TRANL	TRANSPORTATION LABOR
TVLTRM	TRAVEL AND TRANSPORTATION MATERIAL
B(I)	BASE AMOUNT FOR EACH ACCOUT
TOBASE	TOTAL NON-PAY OE BASE
NEED()	ACTUAL FUNDS NEEDED BY EACH ACCOUNT
TONEED	TOTAL COLA FUNDS ACTUALLY NEEDED BY THE COAST GUARD
COLA$	COLA AMOUNT RECEIVED BY THE COAST GUARD IN DOLLARS
TOP	CALCULATION FOR ALLOCATION MODEL
WT	CALCULATION FOR ALLOCATION MODEL
BUD(),OG()	REPRESENT THE COLA AMOUNT RECEIVED BY EACH ACCOUNT
TOCOLA	TOTAL COLA RECEIVED AS CALCULATED BY PROGRAM
GOT()	PERCENT OF ACTUAL FUNDS NEEDED THAT WERE RECEIVED
TODIFF	DOLLAR DIFFERENCE BETWEEN COLA RECEIVED AND COLA NEEDED
PERDIFF	PERCENT DIFFERENCE

FIGURE B-8

```
ALLOCATION OF COLA FUNDS FOR FY 1982
COST OF LIVING
OG-30    0.069200
OG-41    0.078300
OG-42    0.068200
OG-43    0.070700
OG-45    0.075600
OG-46    0.059800
OG-54    0.065200
OG-56    0.120300
OG-57    0.051200
OG-20    0.081000
OG-01    0.081700
FUEL   0.409000

BASE FOR INDIVIDUAL OG ACCOUNTS
OG-30     310469000.00
OG-41      45390000.00
OG-42      55679000.00
OG-43      38733000.00
OG-45      49021000.00
OG-46       9683000.00
OG-54       3026000.00
OG-56      14525000.00
OG-57       8473000.00
OG-20      24208000.00
OG-01       5448000.00
FUEL     40549000.00
ACTUAL FUNDS NEEDED FOR INFLATION
OG-30      21484448.37
OG-41       3554036.97
OG-42       3797307.36
OG-43       2738422.70
OG-45       3705988.97
OG-46        579043.35
OG-54        197295.11
OG-56       1747357.43
OG-57        433817.59
OG-20       1960847.28
OG-01        445101.75
FUEL     16584540.17
TOTAL ACTUAL FUNDS NEEDED     57228192.0

COLA AMOUNTS FOR EACH OG ACCOUNT
OG-30      17721907.27
OG-41       2591623.49
```

```
OG-42       3132290.29
OG-43       2258846.60
OG-45       3056964.36
OG-46        477636.34
OG-54        162743.10
OG-56       1441345.19
OG-57        357843.73
OG-20       1617446.87
OG-01        367151.71
FUEL    13680113.07
TOTAL COLA ALLOCATED           47205912.00
DIFFERENCE BETWEEN COLA NEEDED AND COLA             RECEIVED     10022280.00
PER CENT DIFFERENCE  0.824872
MONEY LEFT TO ALLOCATE               0.00
PER CENT OF ACTUAL FUNDS NEEDED RECEIVED BY         EACH ACCOUNT
OG-30  0.824871
OG-41  0.824871
OG-42  0.824871
OG-43  0.824871
OG-45  0.824871
OG-46  0.824871
OG-54  0.824871
OG-56  0.824871
OG-57  0.824871
OG-20  0.824871
OG-01  0.824871
FUEL  0.824871
```

APPENDIX C

The enclosed graphs show the trends for the various indexes that were used as proxy variables in developing the different market baskets. The graphs are developed for each account, and where appropriate, there are separate graphs for labor and materials.

If proposed weights are to be changed, the graphs can be used to estimate the effect on the final index value from these changes. If the curves are moving in similar directions and rates, the changes will have minor effects on the final index value. But if the curves are proceeding in inverse directions and/or at different rates, any change in weights could have an effect on the final value.

FIGURE C-1 OG30 MATERIALS

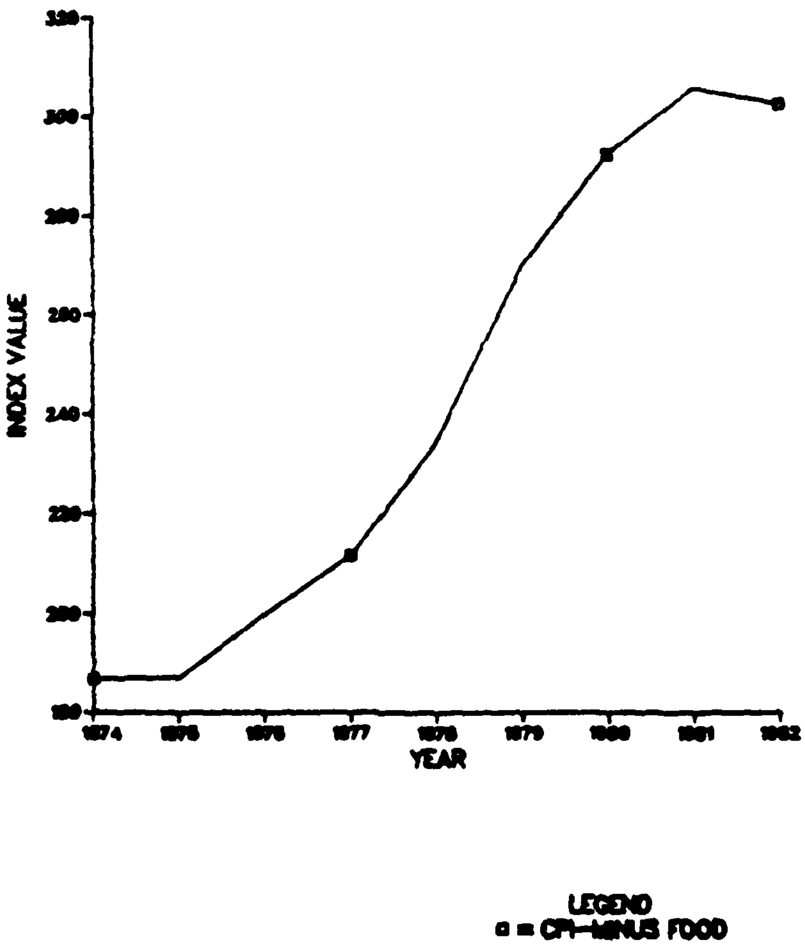


FIGURE C-2 AIR FRAME MATERIAL

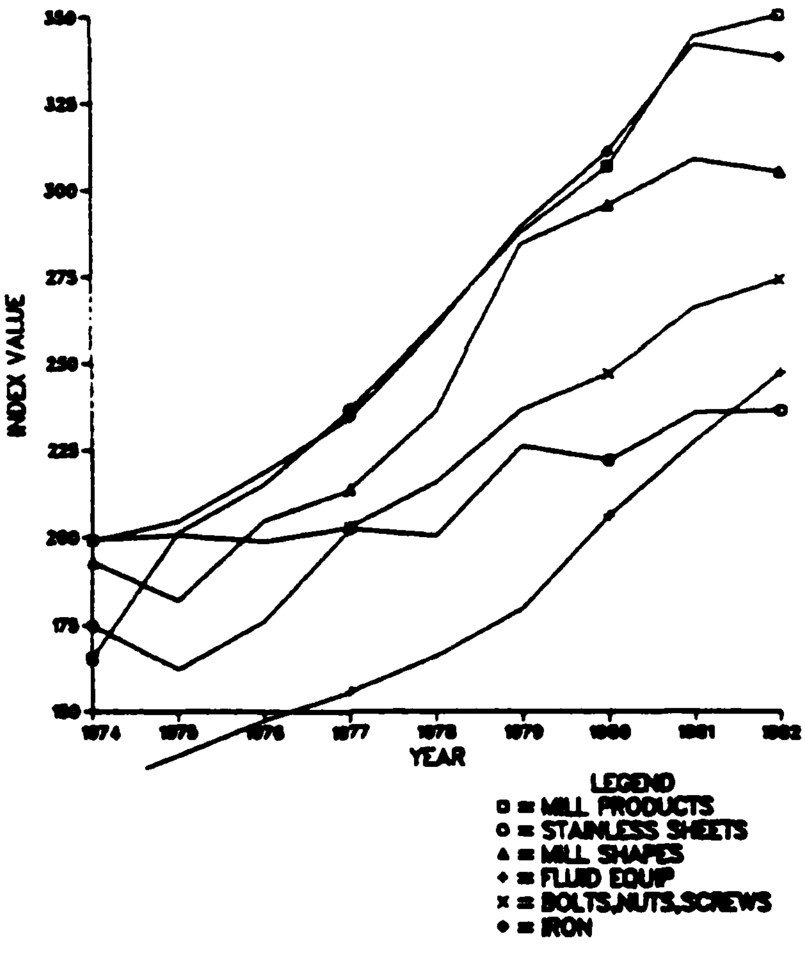


FIGURE C-3 OG41 ENGINE MATERIAL

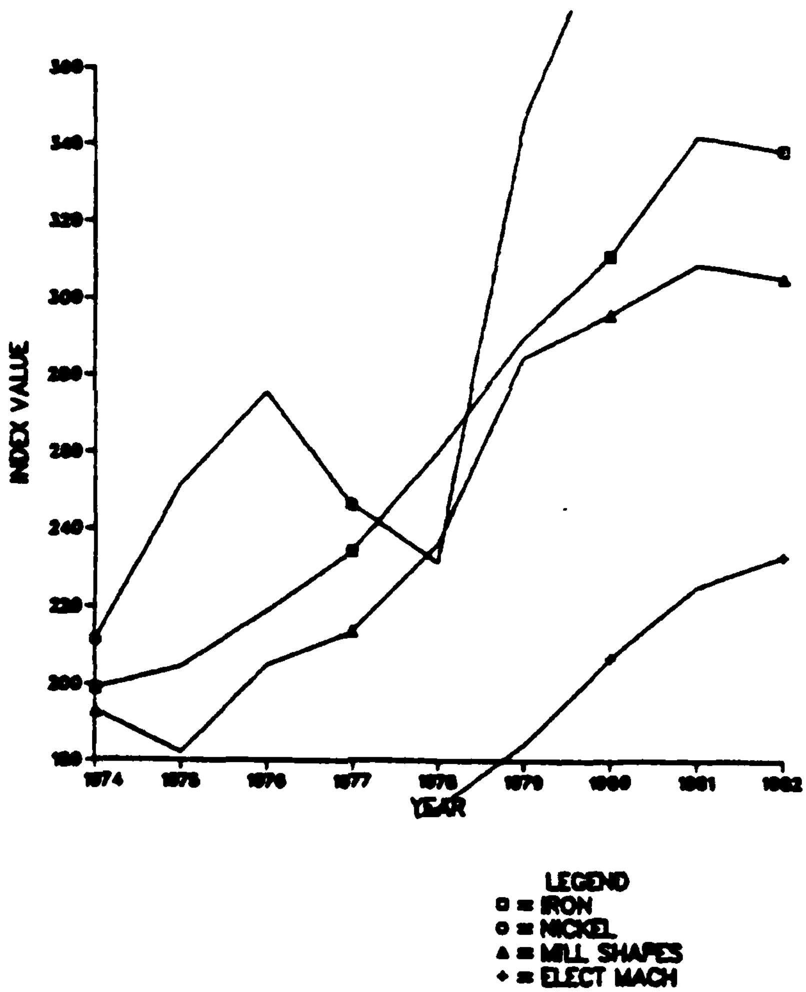


FIGURE C-4 OG41 ELECTRICAL MATERIAL

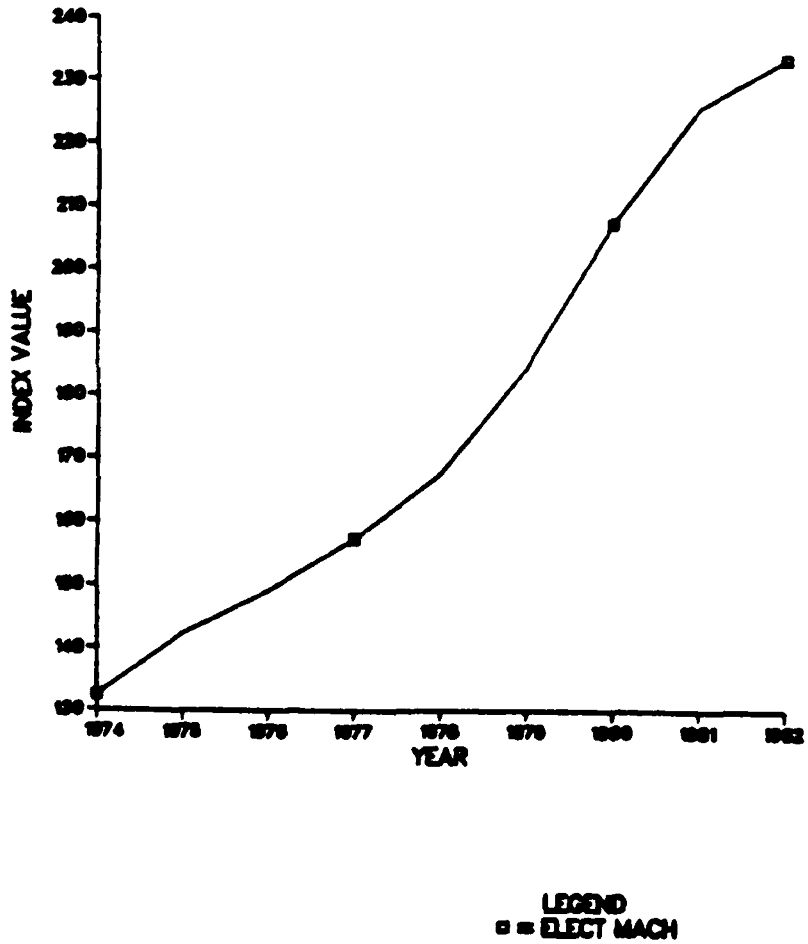


FIGURE C-5 OG42 MATERIAL

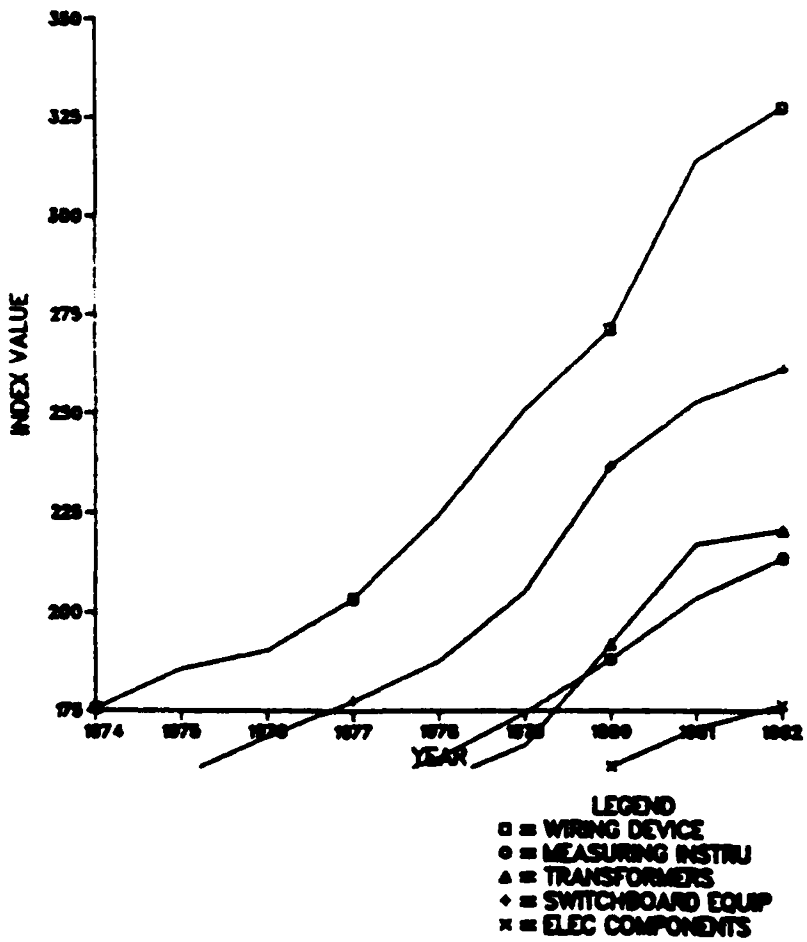


FIGURE C-6 OG43 MATERIAL

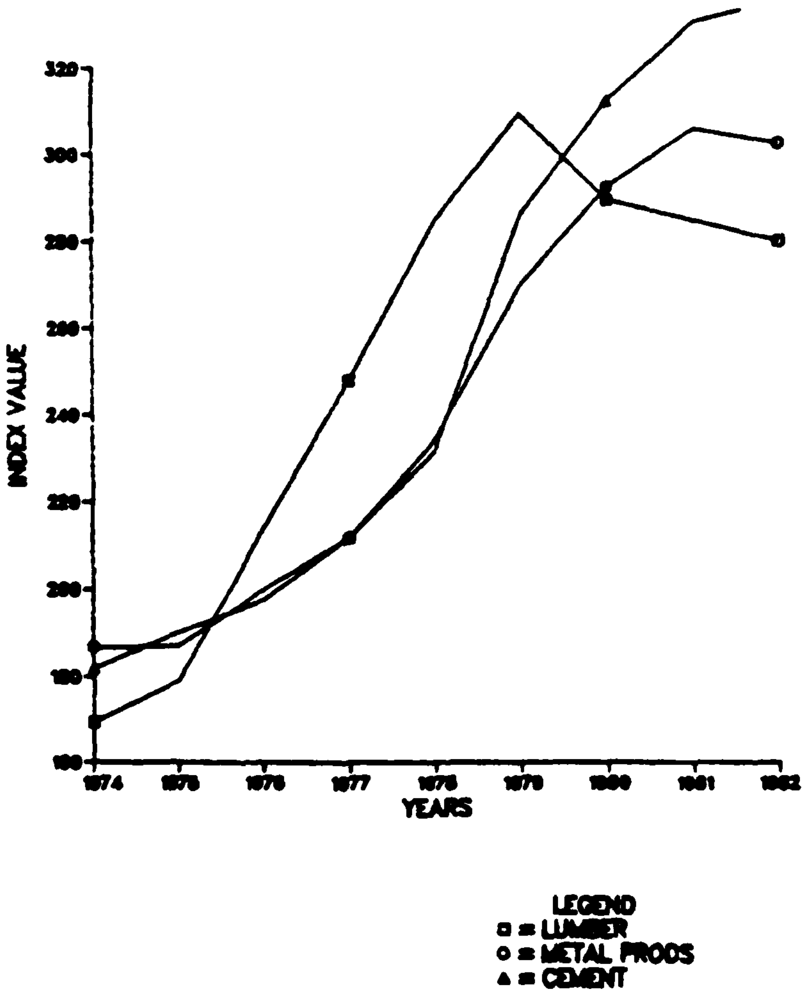


FIGURE C-7 OG45 MATERIAL

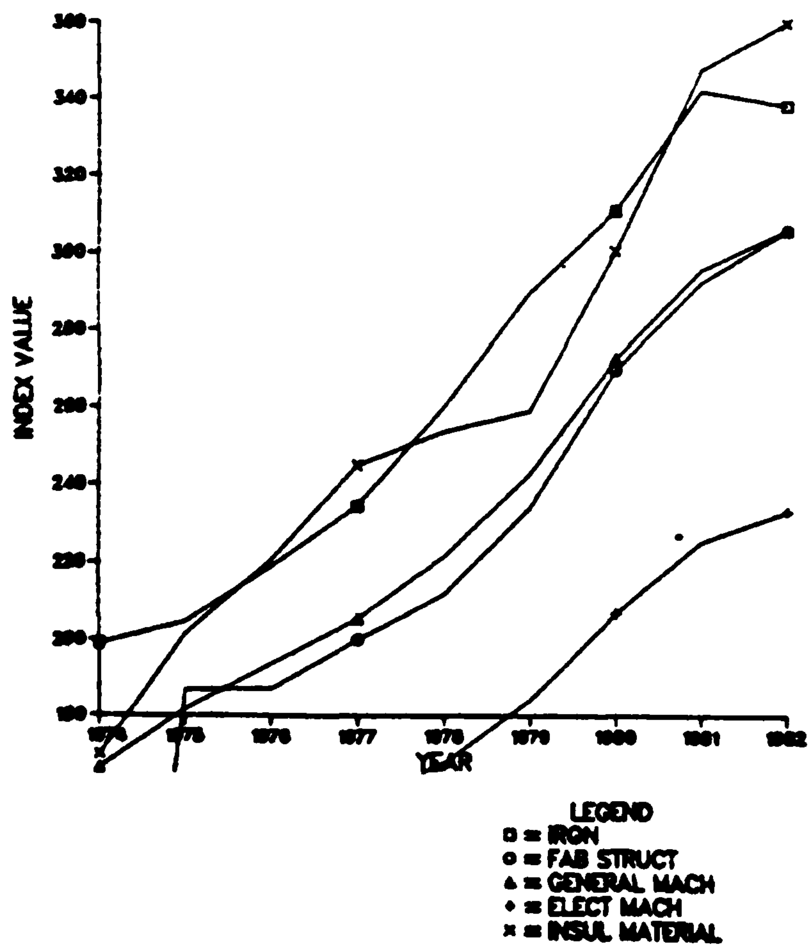


FIGURE C-8 OG46 MATERIAL

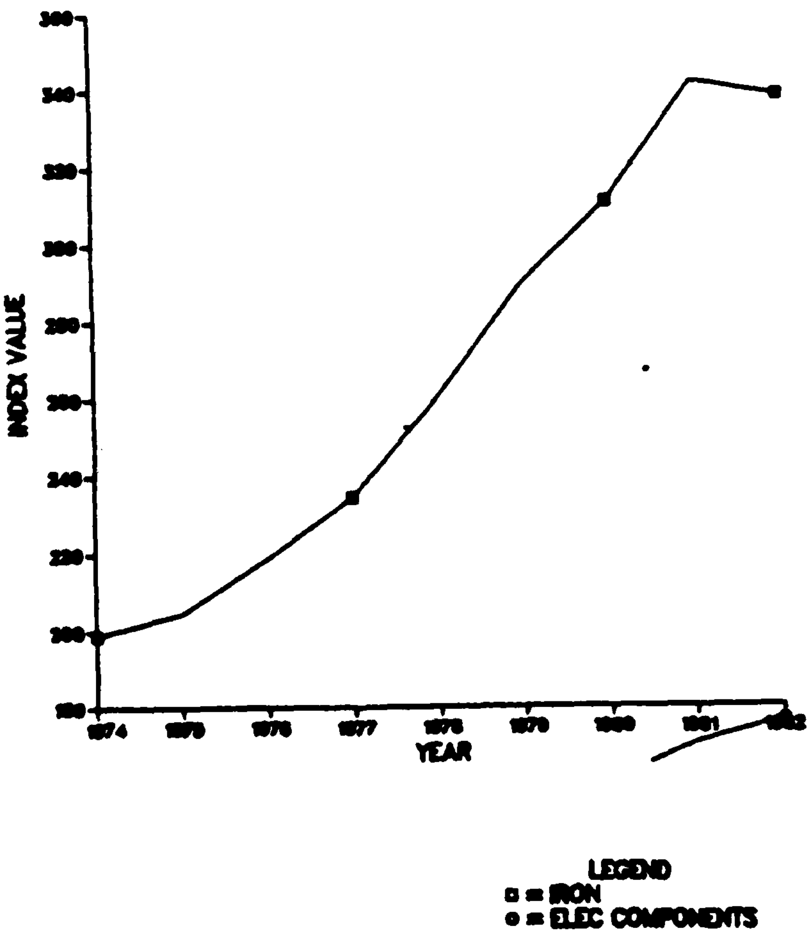


FIGURE C-9 OG54 MATERIAL

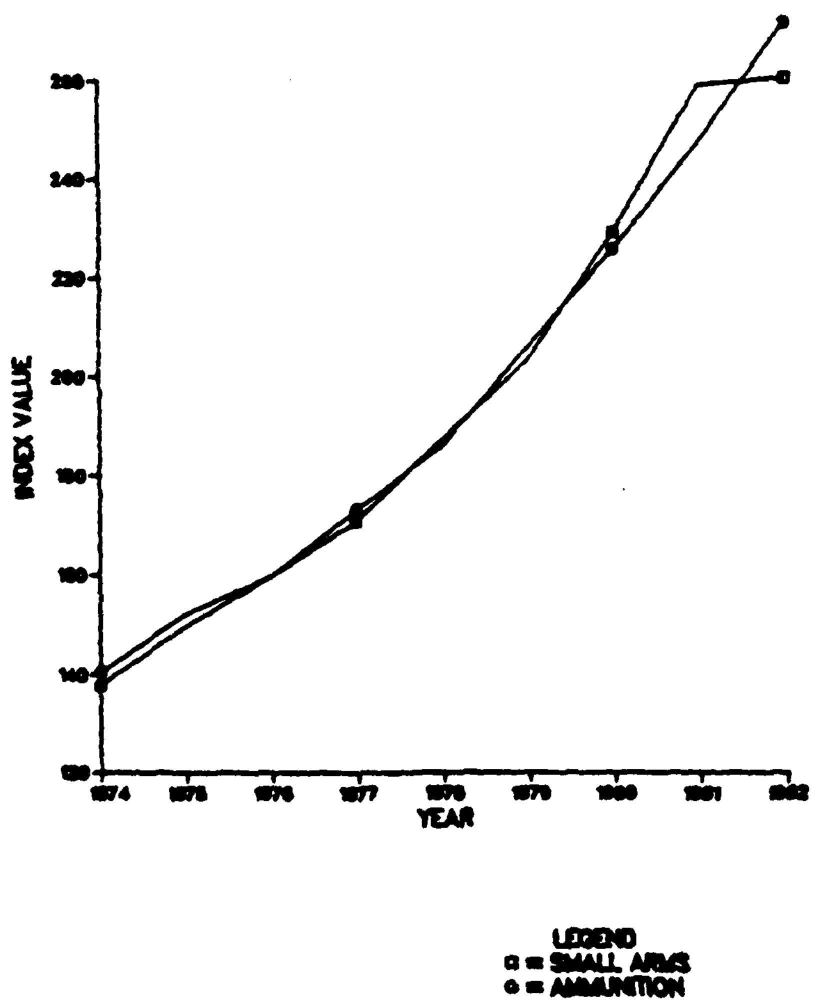


FIGURE C-10 OGS6 TRAVEL

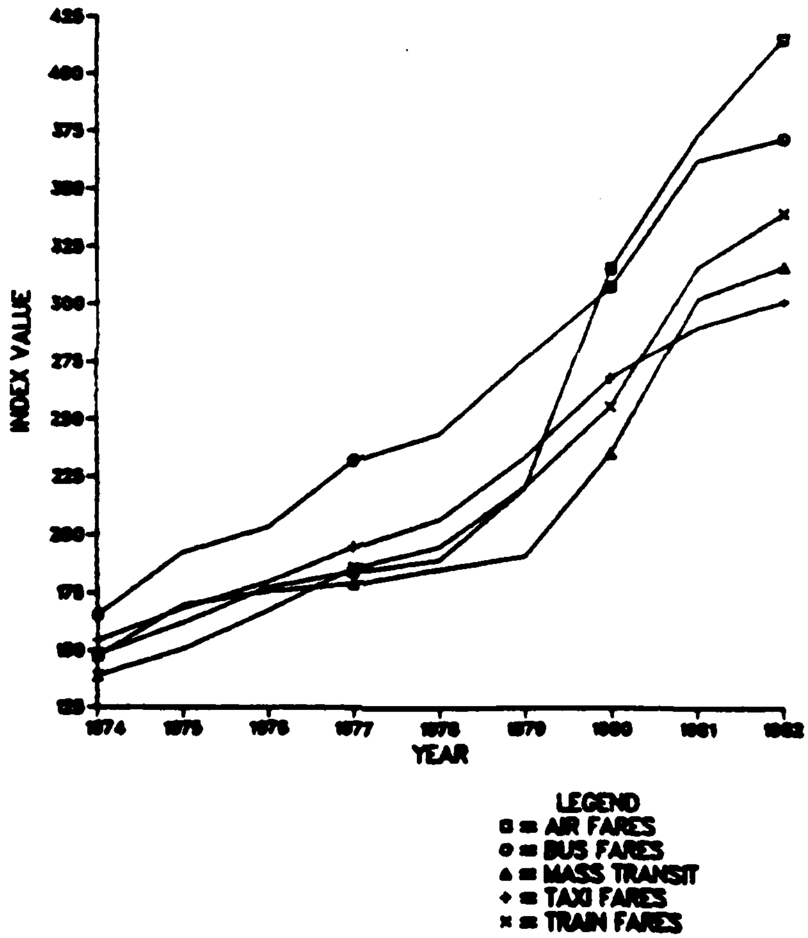


FIGURE C-11 OG56 PER DIEM

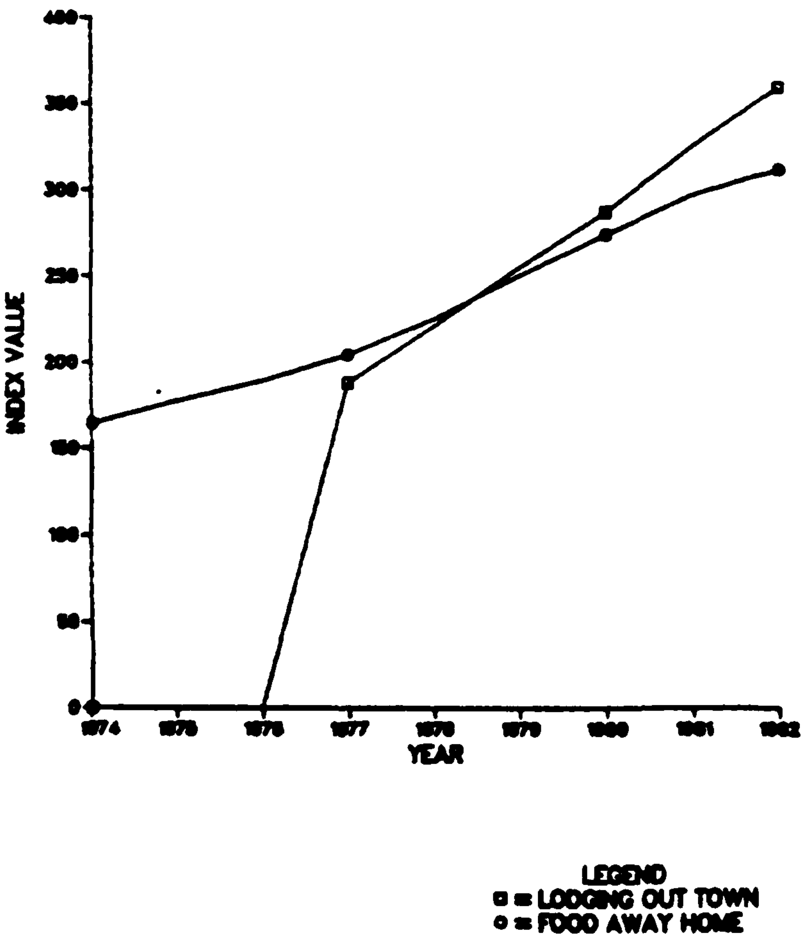


FIGURE C-12 OG56 TUITION

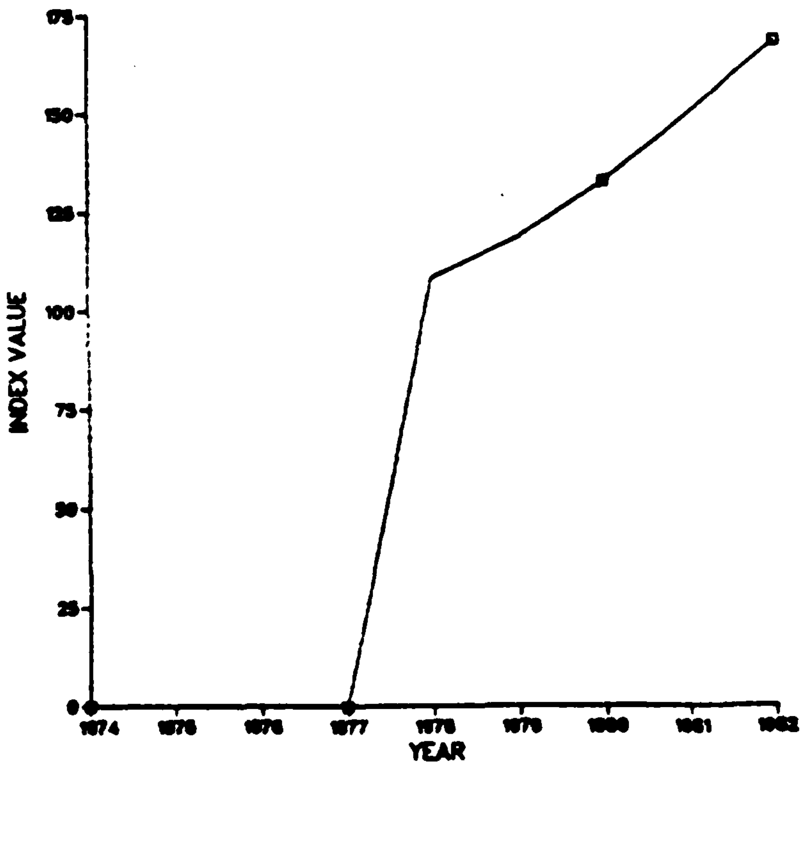


FIGURE C-13 OG57 MATERIAL

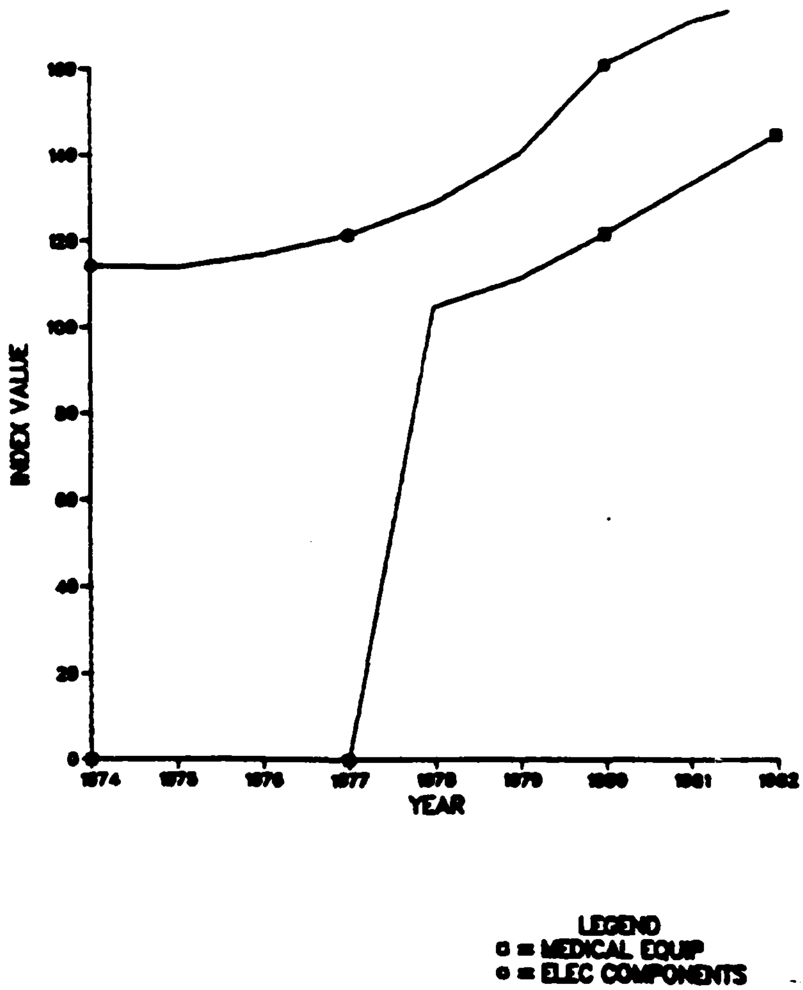


FIGURE C-14 OG20 TRAVEL

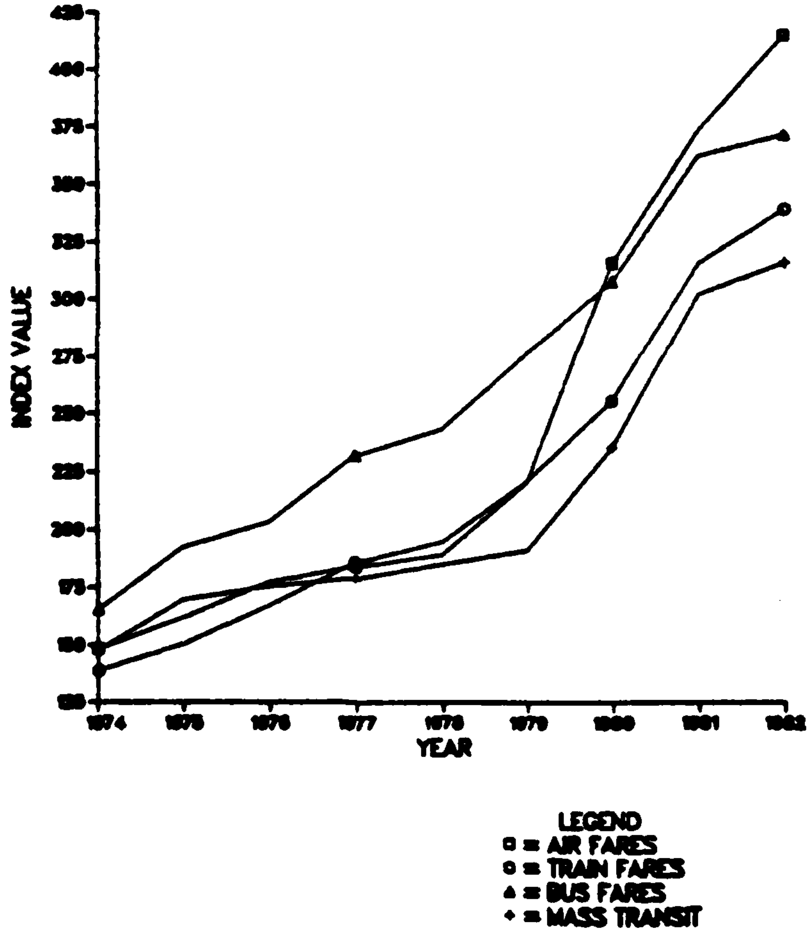


FIGURE C-15 OG20 PER DIEM

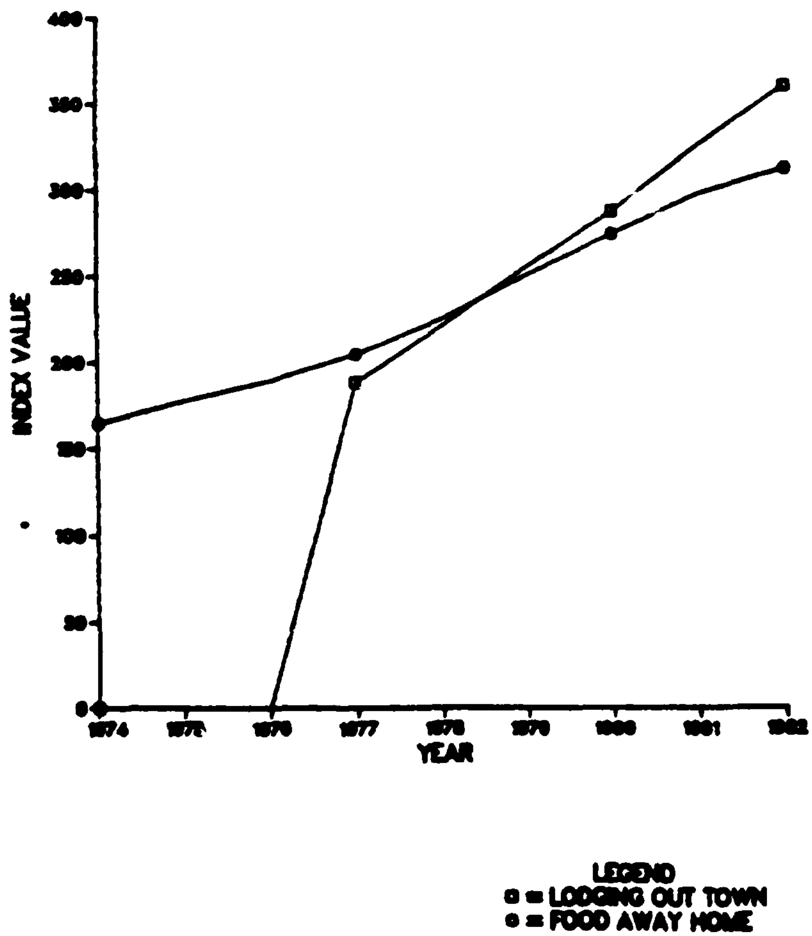


FIGURE C-16 OG20 TRUCK FREIGHT MATERIAL

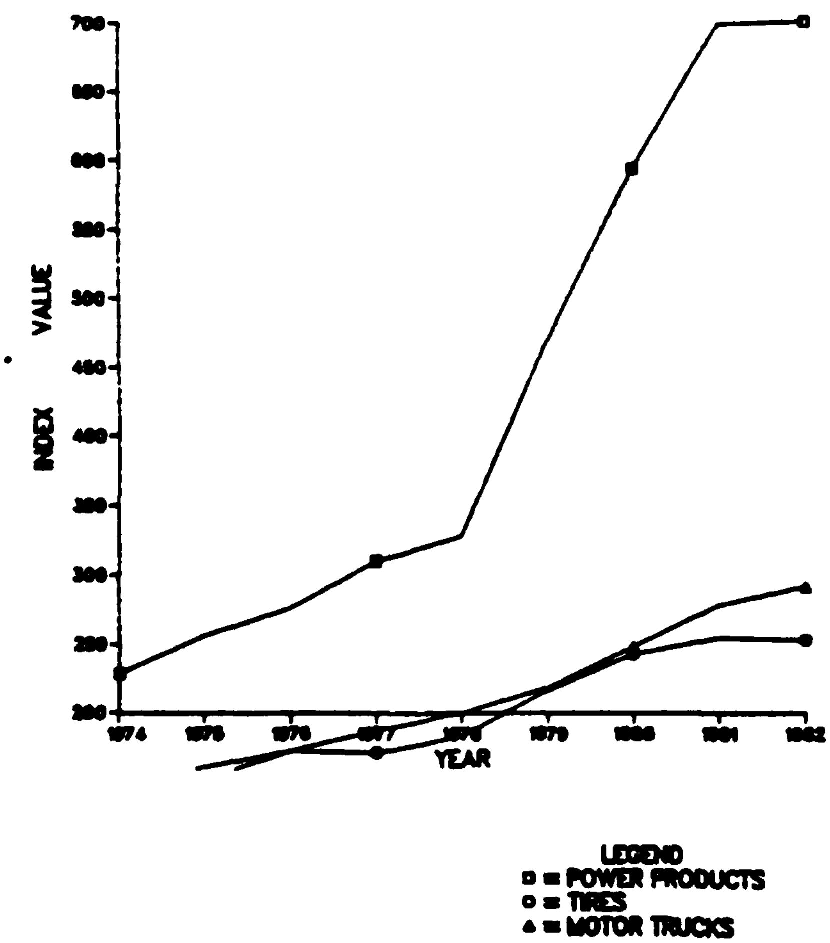


FIGURE C-17 OG20 RAIL FREIGHT MATERIAL

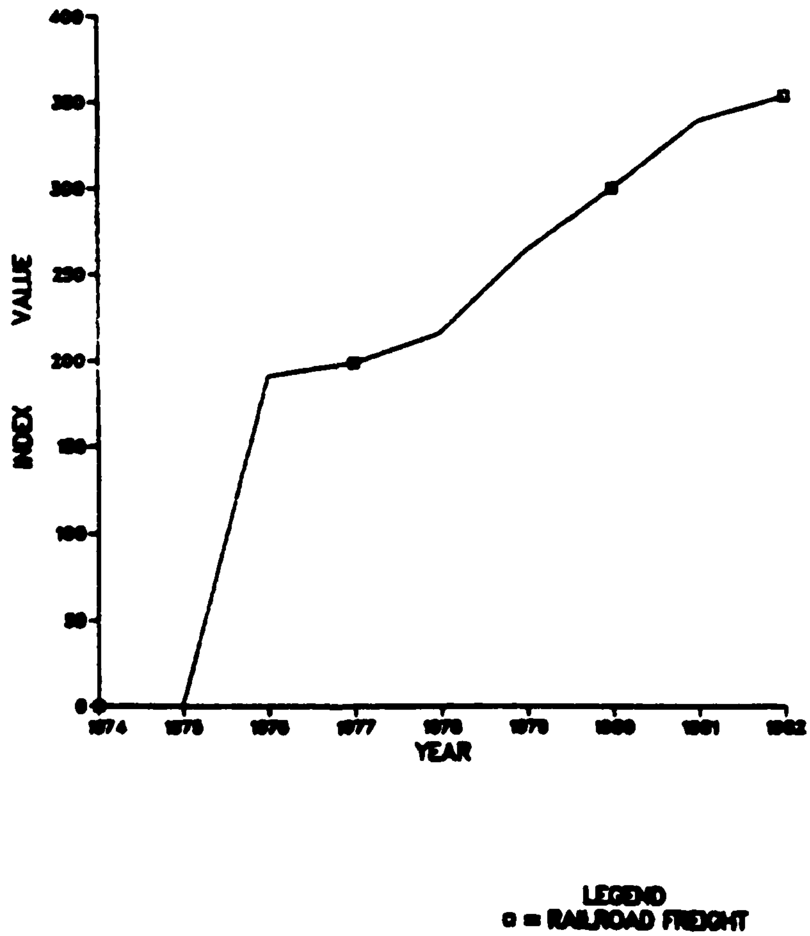


FIGURE C-18 OG20 POSTAL FREIGHT

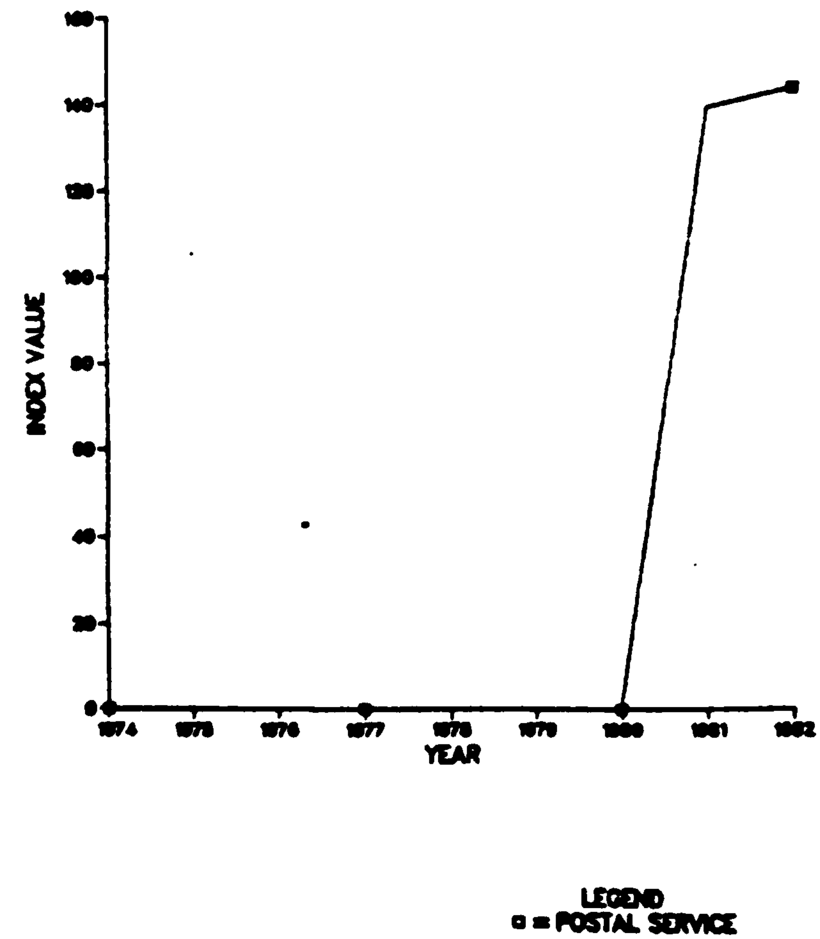


FIGURE C-19 OG20 AIR FREIGHT MATERIAL

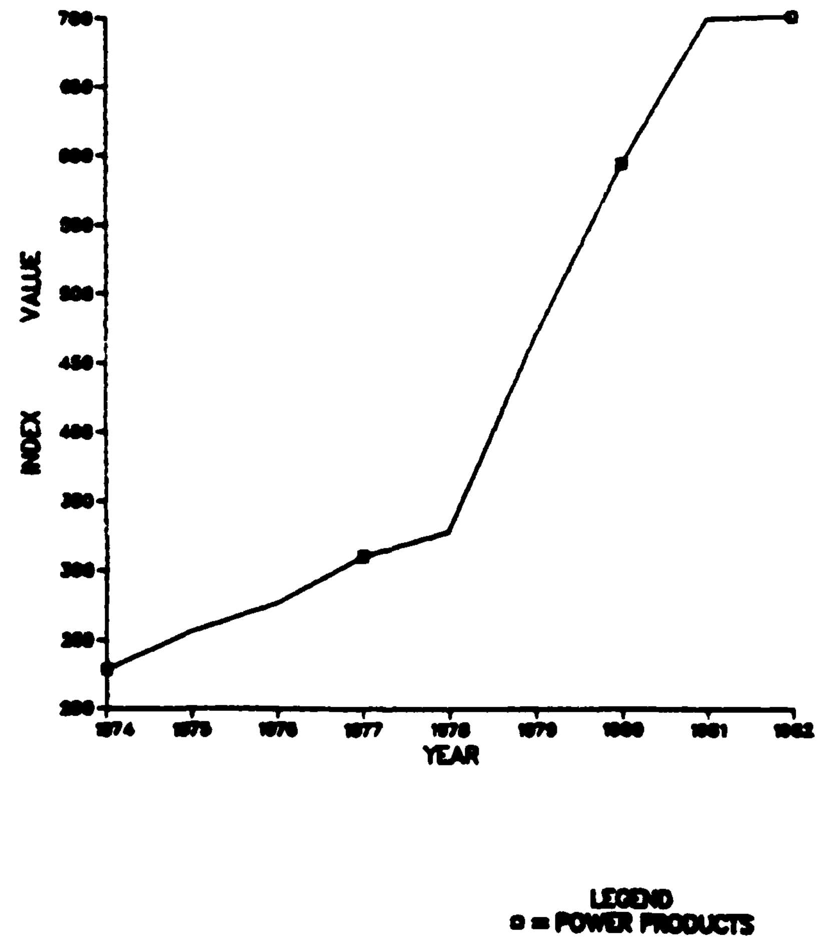
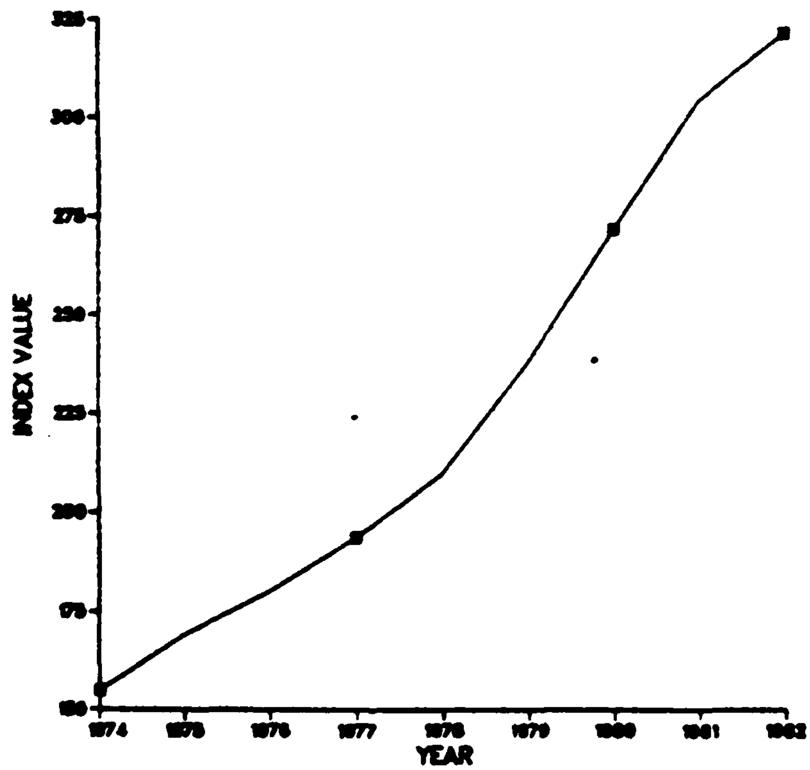


FIGURE C-20 0001 HOUSING



LEGEND
□ = HOUSING

FIGURE C-21 OG01 GENERAL MESS

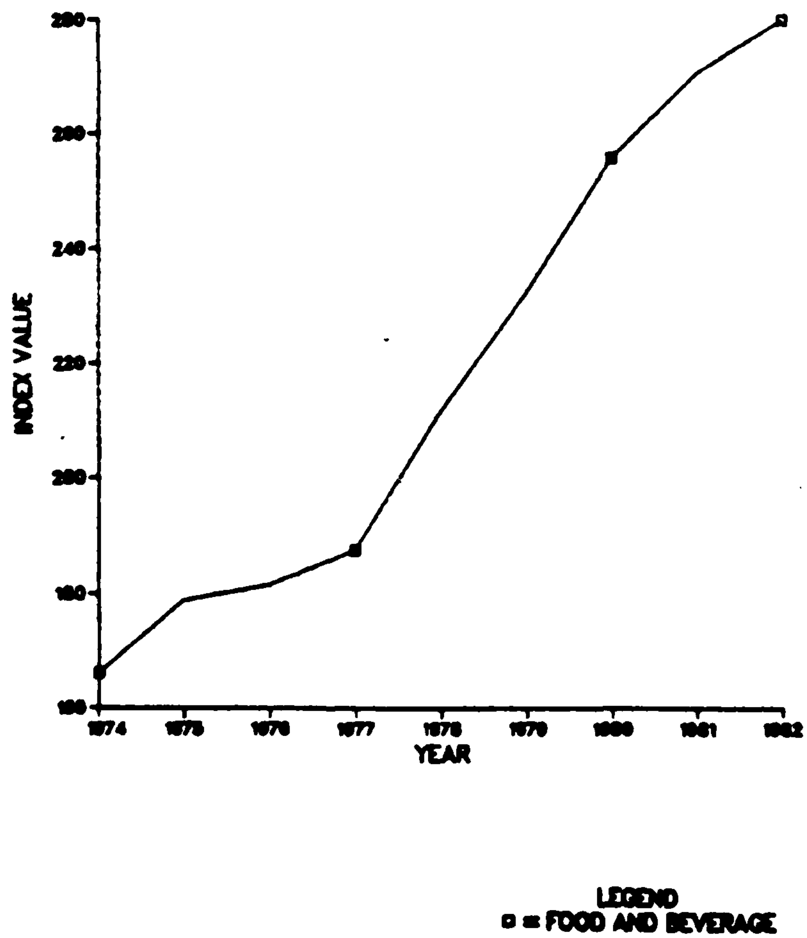


FIGURE C-22 FUEL ACCOUNT

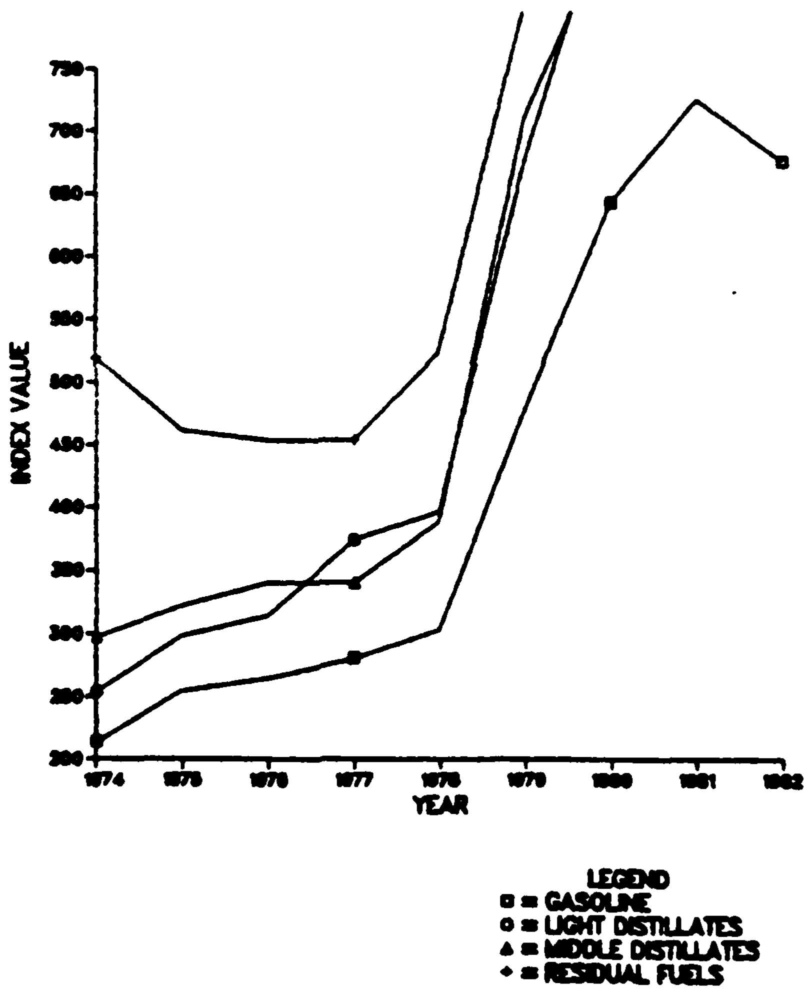


FIGURE C-23 OG30 LABOR

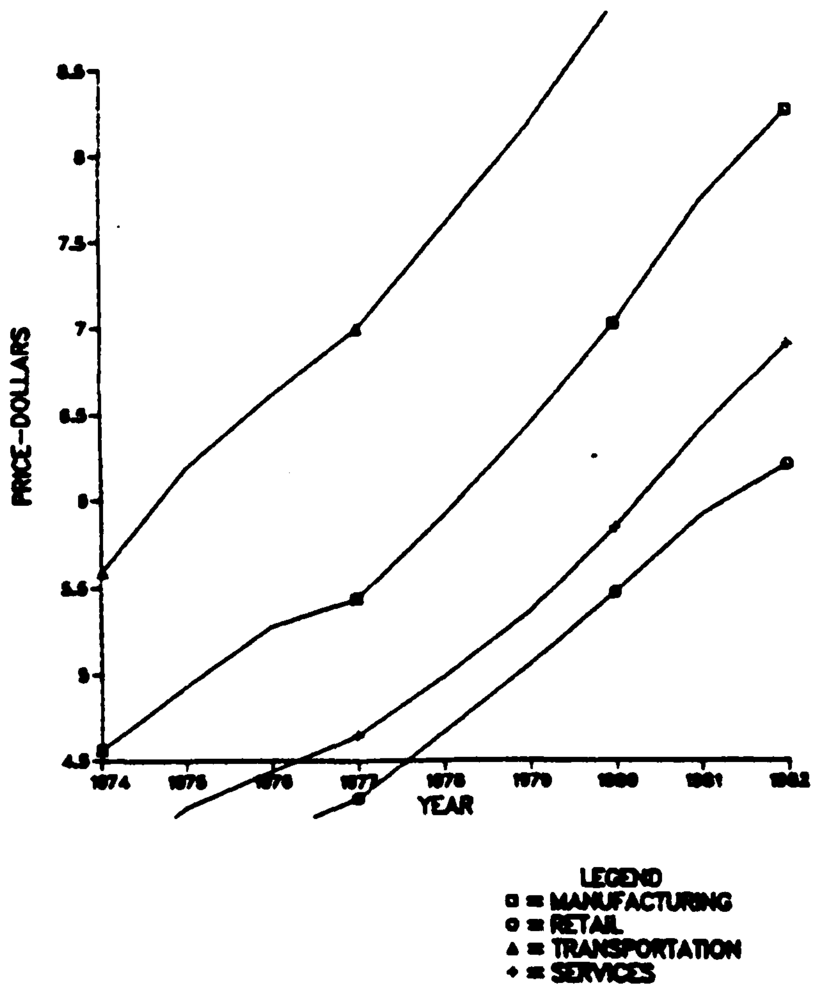


FIGURE C-24 AIRFRAME LABOR

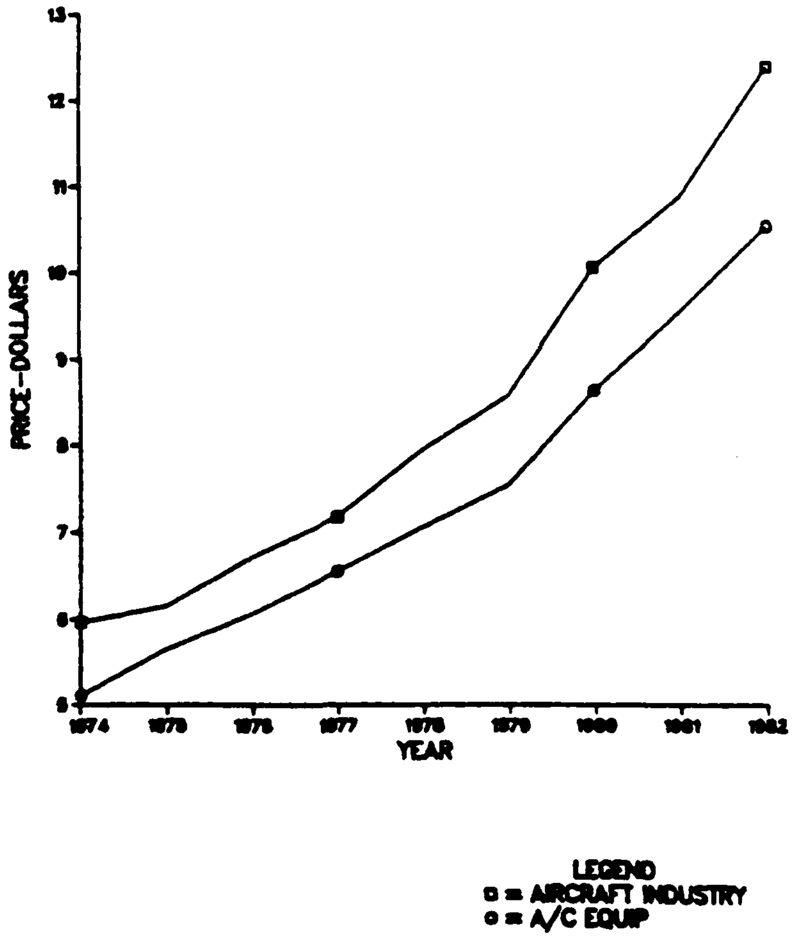


FIGURE C-25 OG41 ENGINE LABOR

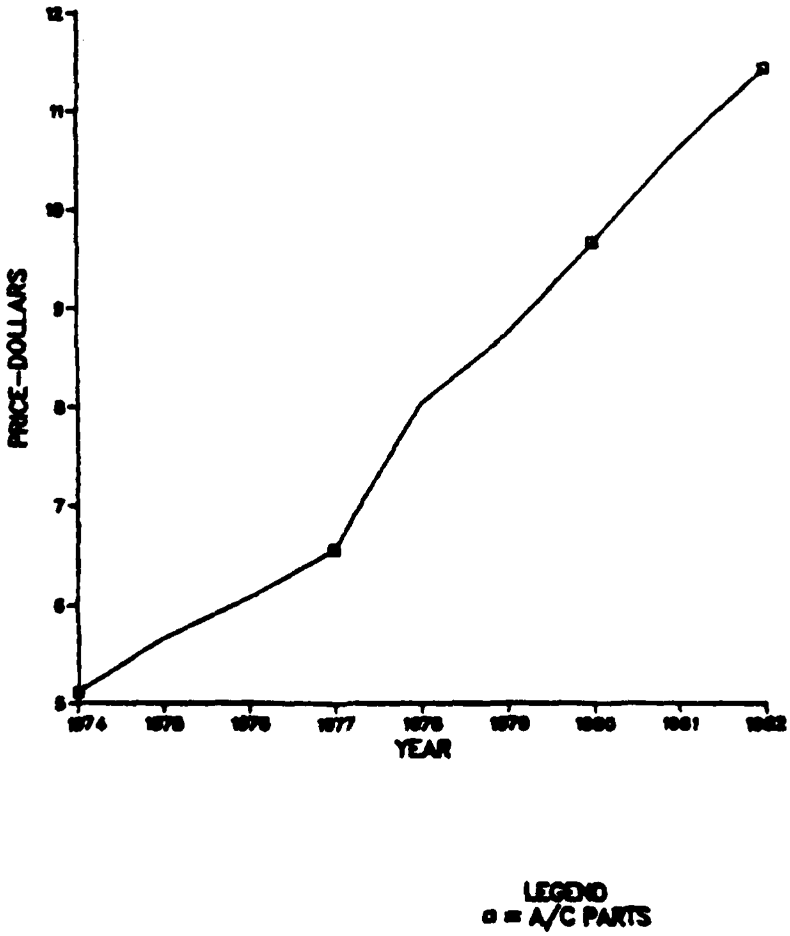


FIGURE C-26 OG41 ELECTRICAL LABOR

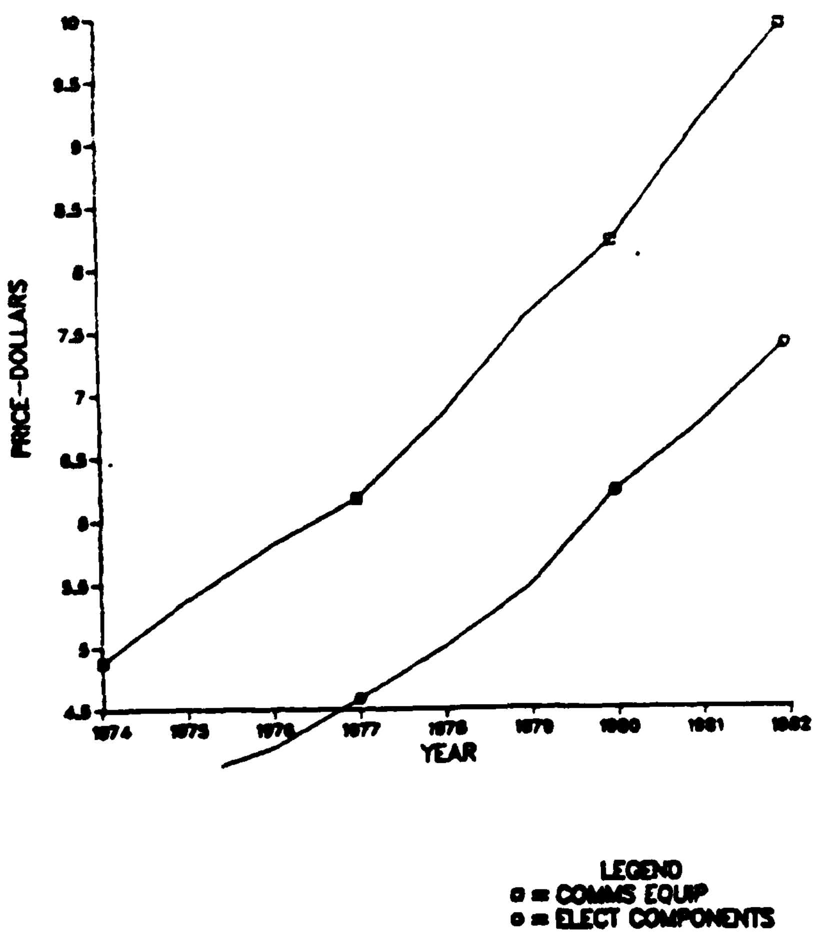


FIGURE C-27 OG42 LABOR

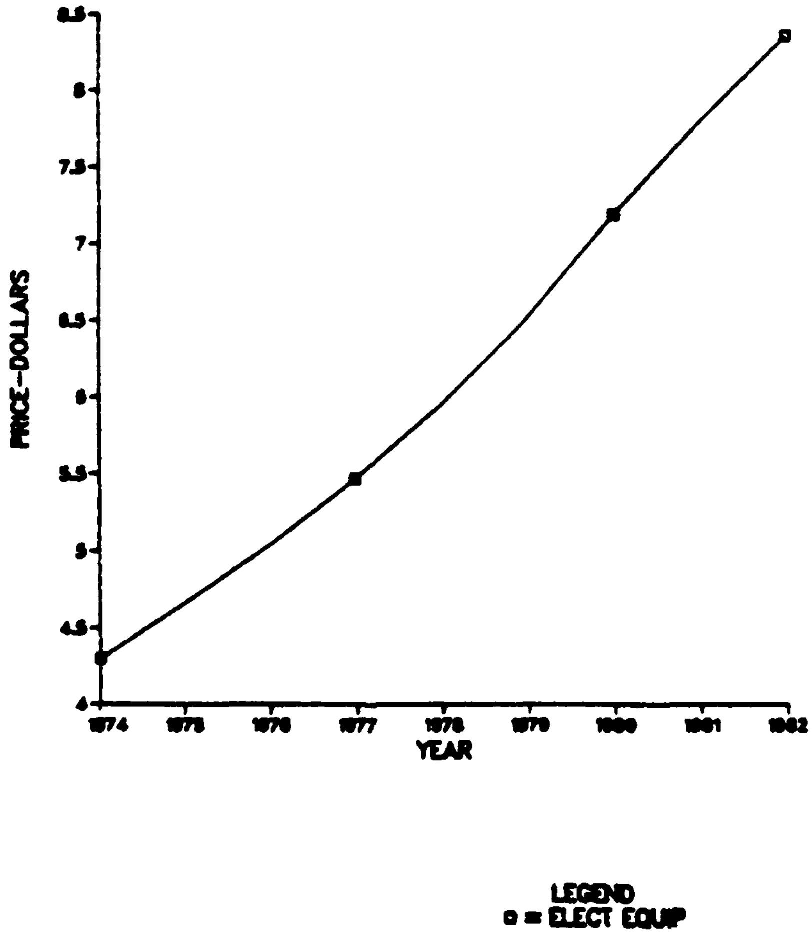
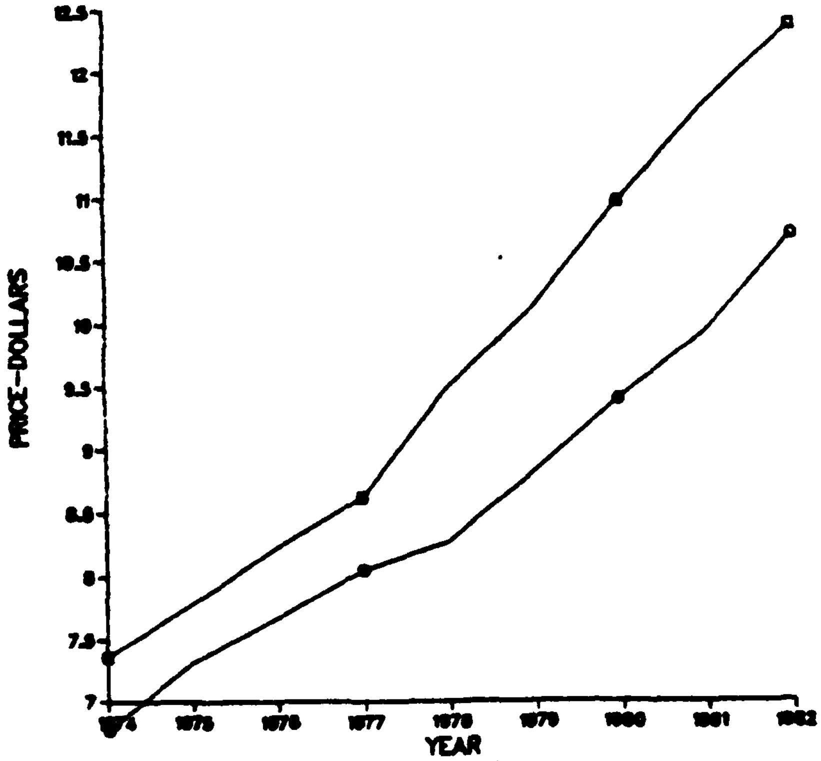


FIGURE C-28 OG43 LABOR



LEGEND
□ = SKILLED LABOR
○ = UNSKILLED LABOR

FIGURE C-29 OG45 LABOR

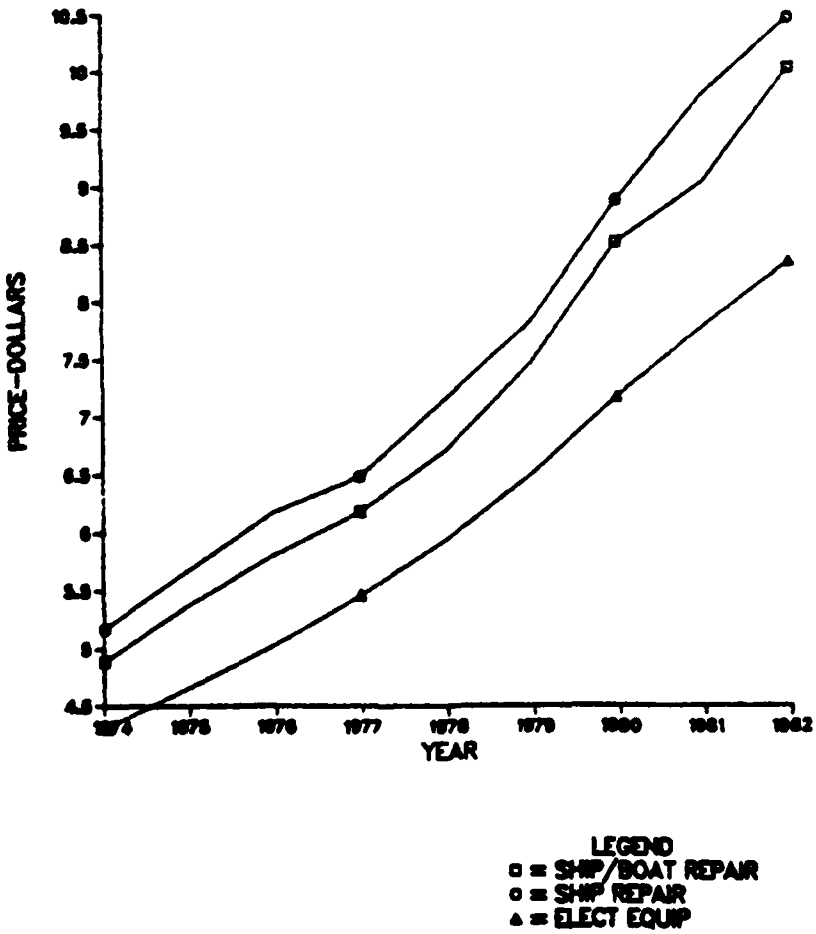


FIGURE C-30 OG46 LABOR

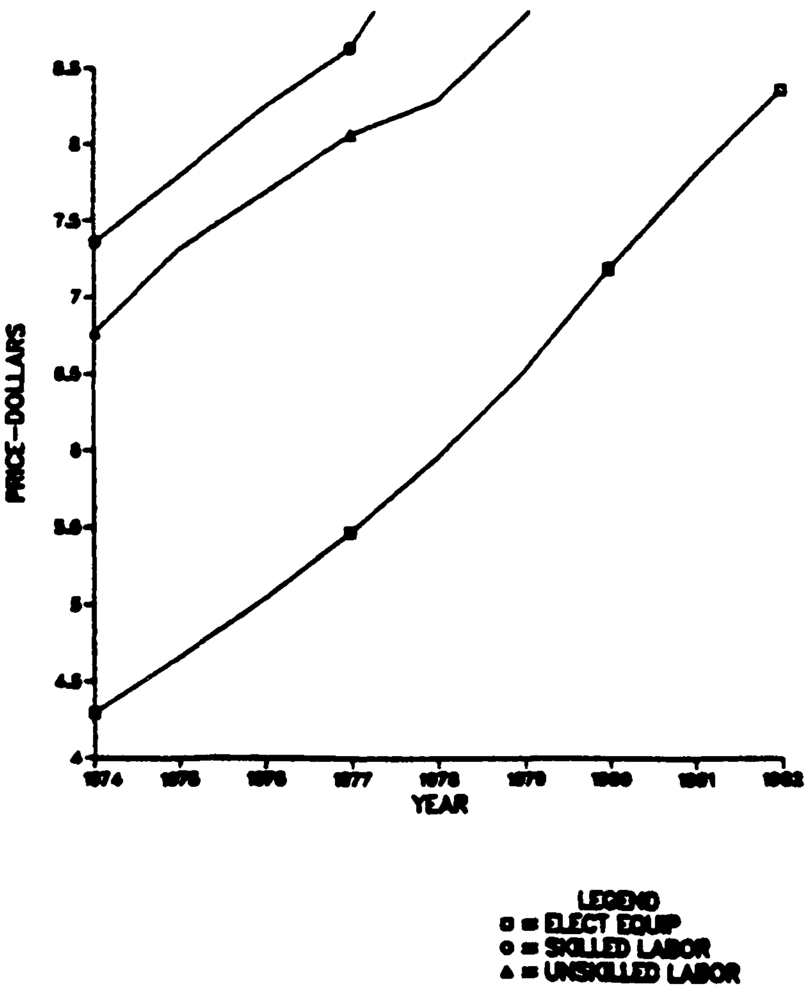


FIGURE C-31 OG57 LABOR

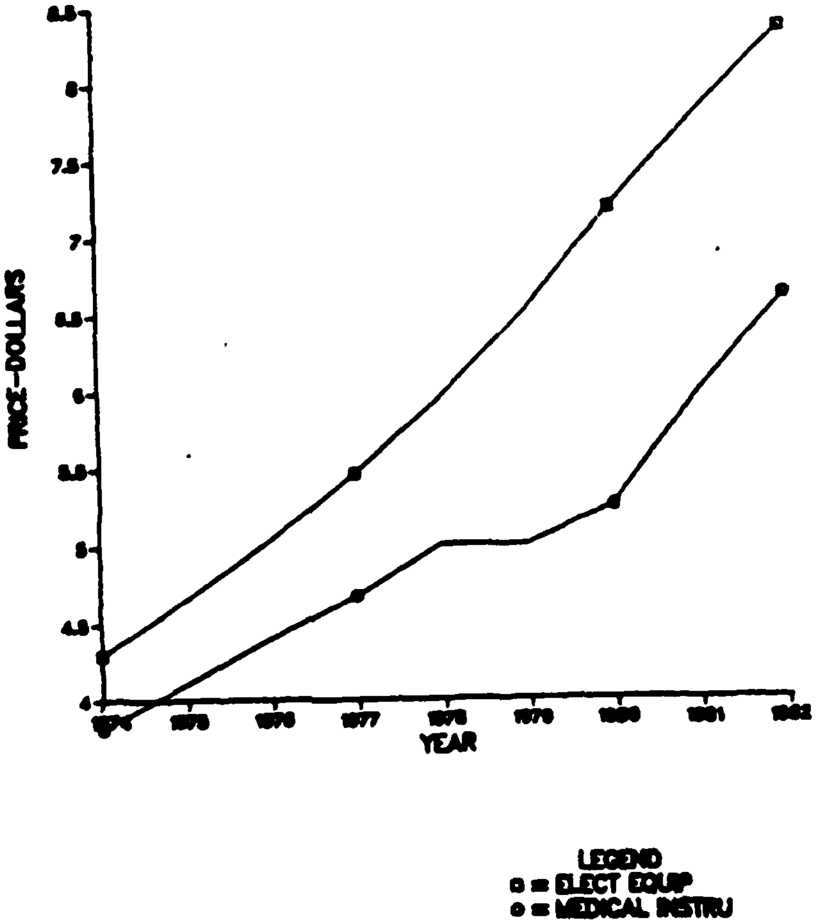


FIGURE C-32 OG20 TRUCK FREIGHT LABOR

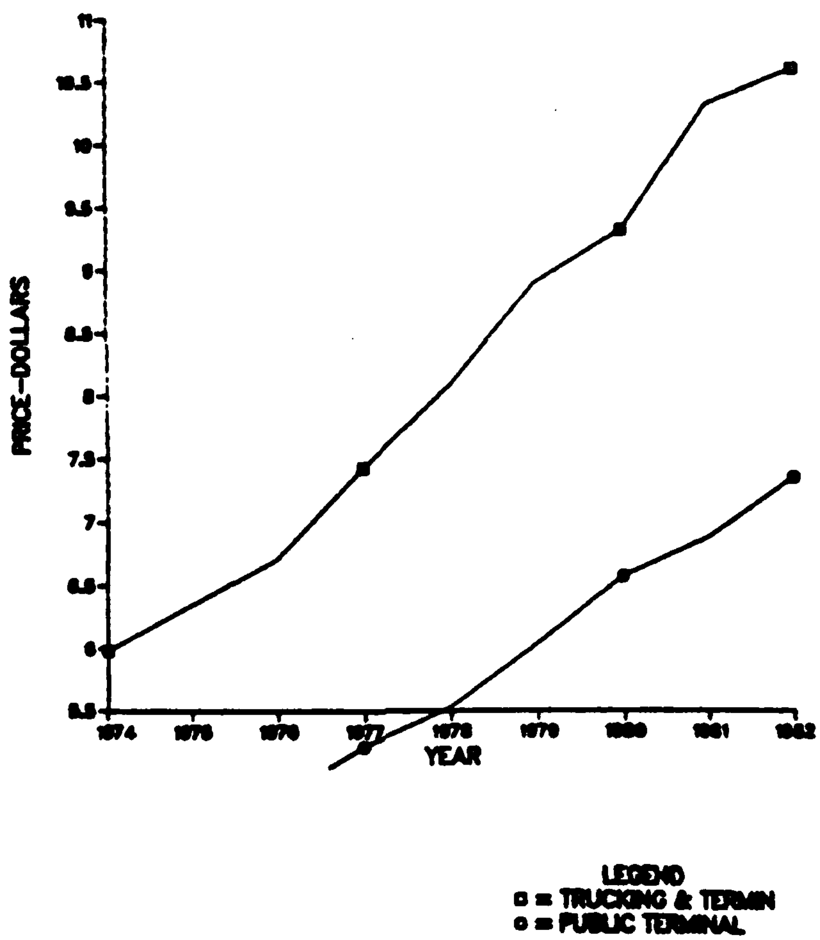


FIGURE C-33 OG20 POSTAL SERVICE LABOR

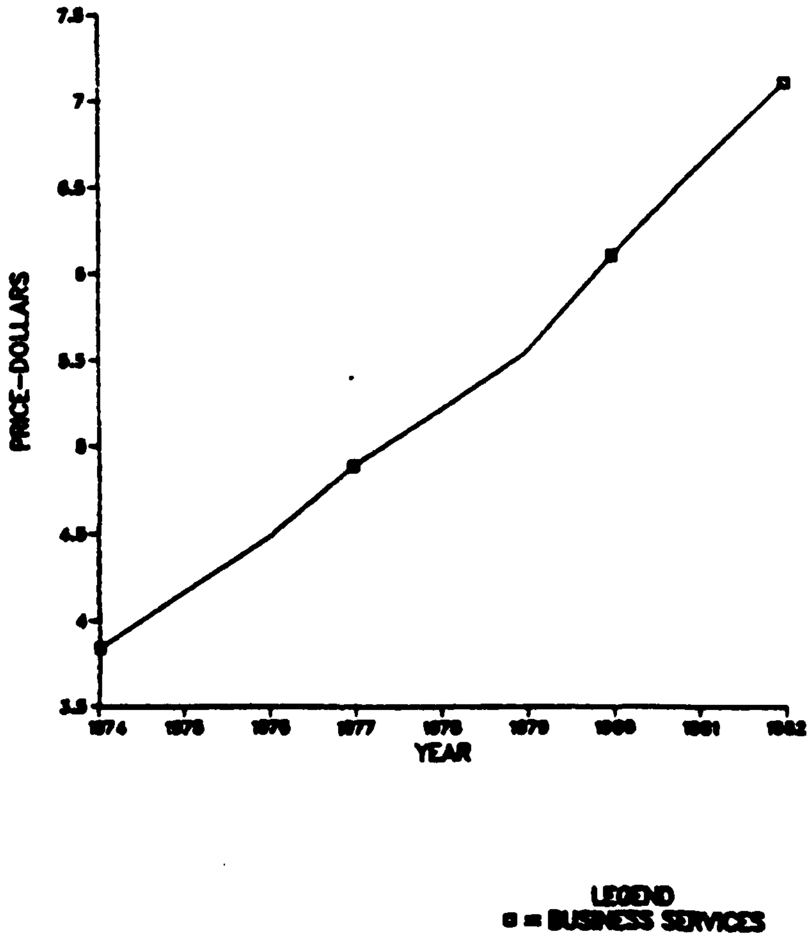
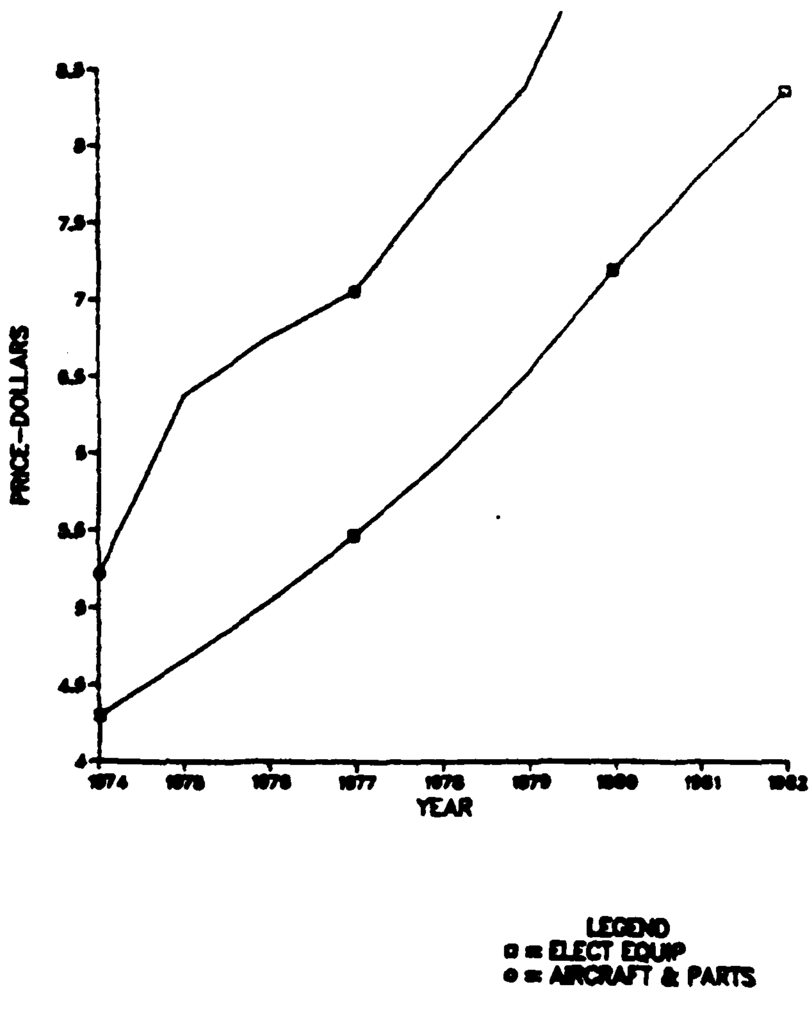


FIGURE C-34 OG20 AIR LABOR



LIST OF REFERENCES

1. Wildavsky, Aaron, Budgeting: A Comparative Theory of Budgetary Process, Little, Brown and Company, 1975.

2. Sovereign, Michael G., Budgeting For Inflation, Special Study for Comptroller (OSD), March 1981.

3. Wheelright, Steven C., "Management by Model During Inflation," Business Horizons, V. 18, No. 3, pp. 33-42, June 1975.

4. Katzner, Donald W., Static Demand Theory, The MacMillan Company, 1970.

5. Flynn, Thomas D., "Why We Should Account for Inflation," Harvard Business Review, V. 55, No. 5, pp. 145-157, September 1977.

6. Afriat, S.N., The Price Index, Cambridge University Press, 1978.

7. Ibid.

8. Idid.

9. Banerjee, Kali S., Cost of Living Index Numbers, Marcel Dekker, Inc., 1975.

10. Ibid.

11. Ibid.

12. Ibid.

13. U.S. Department of Labor, CPI Detailed Monthly Report, Bureau of Labor Statistics

14. Ibid.

15. Ibid.

16. U.S. Department of Labor, BLS Handbook of Methods, Bureau of Labor Statistics, 1976.

17. Ibid.

18. Office of Management and Budget, OMB Circular No. A-11, Preparation and Submission of Budget Estimates, Executive Office of the President, 1982.

19. House of Representatives 97th Congress, "Department of Transportation and Related Agencies Appropriations for 1982," Hearings Before a Subcommittee of the Committee on Appropriations, Government Printing Office, 1982.

20. Ibid.

21. Comptroller, Economic Review Division, Aviation Operating Cost, United States Coast Guard, 1980.

22. U.S. Department of Labor, CPI Detailed Monthly Report, Bureau of Labor Statistics.

23. Earl, Paul, Development of Cost Escalation Indexes for Operation and Maintenance Budget Categories, Data Resources, Inc., 1978.

24. Gorman, Paul R., Composition of Material Price Indices for Operation and Maintenance, Navy Budgetary Account, Master's Thesis, Naval Postgraduate School, Monterey, California, 1976.

25. "Index History, Construction Costs Tracked for US," Engineering News Record, V. 208, No. 11, 1982.

26. Ibid.

27. Thomas, Vincent C., "Today's Coast Guard: A Study in Insufficiency," Seapower, V. 26, No. 9, 1983.

28. Earl, Paul, Development of Cost Escalation Indexes for Operation and Maintenance Budget Categories, Data Resources, Inc., 1978.

29. Ibid.

30. Ibid.

31. Ibid.

32. Gandolfo, Giancarlo, Economic Dynamics Methods and Models, North-Holland Publishing Company, 1971.

33. Ibid.

34. Ibid.

35. Chatfield, C., The Analysis of Time Series, Chapman and Hall, 1982.

36. Coen, P.J., Gomme, E.D., and Kendall, M.G., Lagged Relationships in Economic Forecasting, paper presented before the Royal Statistical Society, London, 15 January, 1969.

37. Department of Transportation, U.S. Coast Guard, Manual of Budget Administration (CG-255).

38. Lennertz, Thomas P., An Investigation of the Forecasting of Aeronautical Price Indexes, Master's Thesis, Air Force Institute of Technology, Wright-Patterson AFB, 1976.

39. Weisberg, Stanford, Applied Linear Regression, Wiley, 1980.

40. Davies, Owen L., and Goldsmith, Peter L., Statistical Methods in Research and Production, Hafner Publishing Company, 1972.

BIBLIOGRAPHY

Allen, Roy G., Index Numbers in Theory and Practice, Aldine Publishing Company, 1975.

Eichhorn, Wolfgang, and others, Theory and Applications of Economic Indices, Physica-Verlag Würzburg, 1978.

Fisher, Franklin M. and Shell, Karl, The Economic Theory of Price Indices, Academic Press, 1972.

Geismer, Donald D., Composition of Material Price Indices for Naval Ship Contract Escalation, Master's Thesis, United States Naval Postgraduate School, Monterey, California, 1975.

Jones, Richard E., A Critical Analysis and Comparison of Selected Models of Inflation, Master's Thesis, Air Force Institute of Technology, Wright Patterson AFB, 1976.

Morgan, William, F., Aircraft Procurement, Navy (APN) Price Index Study, Center for Naval Analysis, Institute of Naval Studies, 1977.

U.S. Department of Commerce, Price Changes of Defense Purchases of the United States, Bureau of Economic Analysis, 1979.

U.S. Departmentof Transportation, U.S. Coast Guard, Comptroller Manual Volume I, Accounting--Headquarters and District Offices.

U.S. Department of Transportation, U.S. Coast Guard, Planning and Programming Manual (COMDTINST M16010.1).

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Technical Information Center Cameron Station Alexandria, Virginia 22314	2
2.	Library, Code 0142 Naval Postgraduate School Monterey, California 93943	2
3.	Professor Michael Sovereign, Code 74 Department of Operations Analysis Naval Postgraduate School Monterey, California 93943	2
4.	Professor Paul Carrick, Code 54Ca Department of Administrative Sciences Naval Postgraduate School Monterey, California 93943	2
5.	Professor Dan Boger, Code 54Bk Department of Administrative Sciences Naval Postgraduate School Monterey, California 93943	1
6.	Commandant (G-PTE) U.S. Coast Guard Headquarters Washington, D.C. 20593	3
7.	Commandant (G-CPA) U.S. Coast Guard Headquarters Washington, D.C. 20593	7
8.	Commandant (G-FP) U.S. Coast Guard Headquarters Washington, D.C. 20593	1
9.	Commandant (G-P) U.S. Coast Guard Headquarters Washington, D.C. 20593	2
10.	Commandant (G-EAE) U.S. Coast Guard Headquarters Washington, D.C. 20593	1
11.	Commandant (G-TPP) U.S. Coast Guard Headquarters Washington, D.C. 20593	1

12.	Commandant (G-ECV) U.S. Coast Guard Headquarters Washington, D.C. 20593	1
13.	Commandant (G-ENE) U.S. Coast Guard Headquarters Washington, D.C. 20593	1
14.	Commandant (G-EOE) U.S. Coast Guard Headquarters Washington, D.C. 20593	1
15.	Commandant (G-OMR) U.S. Coast Guard Headquarters Washington, D.C. 20593	1
16.	Commandant (G-KMA) U.S. Coast Guard Headquarters Washington, D.C. 20593	1

END

FILMED

02 — 84

DTIC