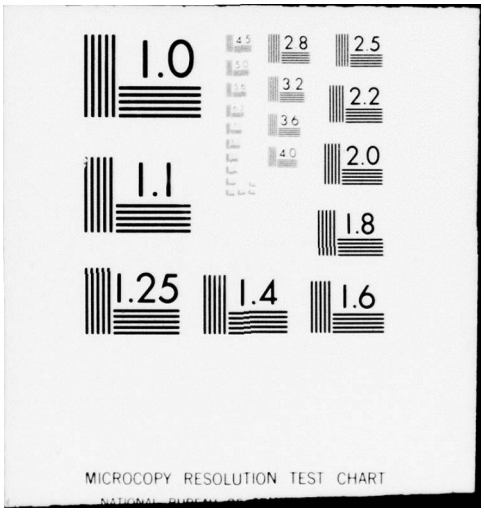
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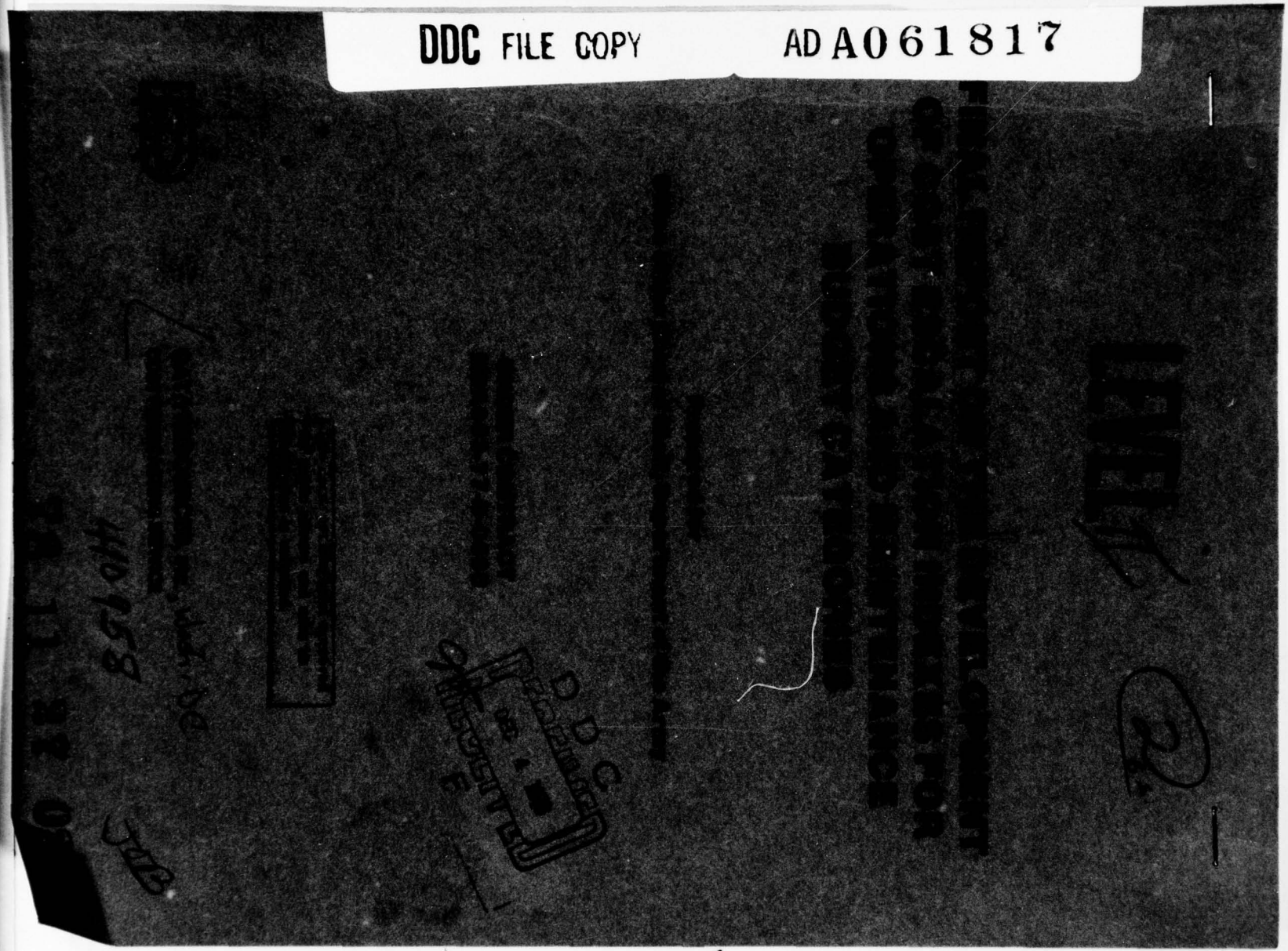
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High inflation rates are forcing the Services to take a more full and accurate account of probable escalation in the planning, programing and execution of their operating budgets. This report addresses the development of a comprehensive, disaggregated procedure for forecasting escalation in the Operations and Maintenance portion of the Army Budget.

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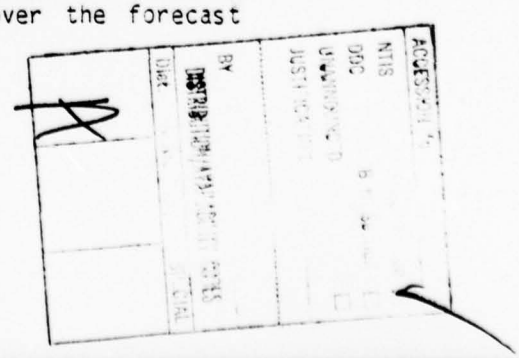
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EXECUTIVE SUMMARY

High inflation rates are forcing business and government to take a more full and accurate account of probable escalation in the planning and management of their operating budgets. A common response to this need has been to project budget escalation from forecasts for very aggregative measures of price behavior such as the Implicit Price Deflator for Gross National Product or the Consumer Price Index for Services. Unfortunately, these measures have often proven to be inaccurate guides to realized budget escalation. This inaccuracy usually results from the failure of the goods and services contained in these indexes to accurately reflect the commodity composition (types and weights) of an operating budget for a firm or government department. Thus, there is a need for more disaggregated measures.

Realizing the need for a more disaggregated commodity-specific approach to budget forecasting, the Office of the Chief of Staff, Department of the Army, has contracted Data Resources, Incorporated (under the terms of Contract MDA903-77-D-0080) to develop a comprehensive, disaggregated procedure for forecasting escalation in the Operations and Maintenance portion of the Army Budget. The results of this effort are presented in the report that follows.

The foundation of this forecasting procedure is a series of disaggregated econometric forecasting models, built to reflect the commodity and service composition of the Army's Operation and Maintenance budget at or below the three-digit Element of Expense level of detail. These forecasts, in conjunction with Army-specific budget weights, allow aggregation to escalation forecasts for the seven major Element of Expense categories and for the Total Operations and Maintenance account which they make up. The forecast outcome for the Total Operations and Maintenance account, termed Cost Escalation Index for O&M (CEIOM), is presented in the table below. As this table reveals, budget escalation is likely to be not only rapid, but varied from fiscal year to fiscal year, thus rendering any given year's experience a poor guide to future experience. Further, to suggest the difference in forecast escalation between this budget-specific Cost Escalation Index and the aggregative Price Deflator for GNP, the figure below presents a comparison plot of relative escalation rates for these two measures over the forecast period.

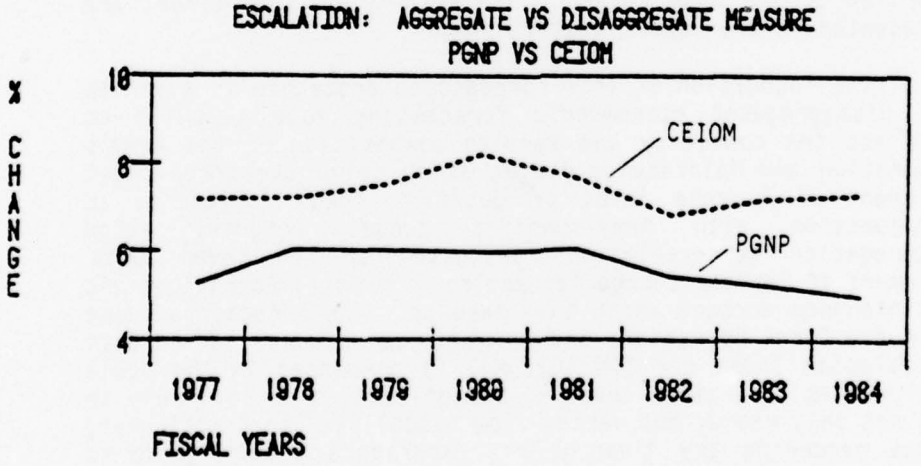


All escalation models are maintained and updated quarterly on the DRI time-sharing computer system so that the most timely economic data is incorporated into each forecast. Moreover, the tools and procedures developed here provide a comprehensive and consistent forecast capability useful in other phases of budget work such as "real program evaluation" and "budget outlay forecasts."

FORECAST: CEIOM
TOTAL OPERATIONS AND MAINTENANCE

(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984	% GROWTH 76 TO 84
CEIOM-TOTAL O & M									
TREND	1.000	1.072	1.153	1.248	1.344	1.436	1.539	1.651	7.46
%CH	7.2	7.2	7.5	8.2	7.7	6.8	7.2	7.3	



CEIOM - Cost Escalation Index, Operations and Maintenance

PGNP - Implicit Price Deflator, Gross National Product

TABLE OF CONTENTS

	Page
CHAPTER 1 - INTRODUCTION	1
CHAPTER 2 - METHOD OF ANALYSIS	5
CFS Model of Price Formation	5
Data	10
Developing Cost Escalation Indexes for Element of Expense Budget Categories	16
CHAPTER 3 - CEI MODEL SPECIFICATION AND FORECAST RESULTS	19
Alternate Forecasts	19
Operations and Maintenance	22
Travel and Transportation of Persons	24
Transportation of Things	28
Rents, Communication, and Utilities	35
Printing and Reproduction	41
Other Services	43
Supplies	62
Equipment	66
TECHNICAL APPENDIX	

INDEX OF TABLES

		Page
1.1	Cost Escalation Indexes: Categories and Codes	1
2.1	Variables Forecast by DRCFS	12
3.1	Forecast: Operations and Maintenance	22
3.2	Forecast for Travel and Transportation of Persons	27
3.3	Cost Specification: CEI221	28
3.4	Cost Measure: Rail Freight Model	30
3.5	Cost Measure: Parcel Post Model	31
3.6	Operating Cost: Air Freight Model	32
3.7	Escalation Forecasts for Transportation of Things	34
3.8	Cost Measure for Mail Model	37
3.9	Escalation Forecast for Rents, Communications and Utilities	39
3.10	Input Specification of Printing and Reproduction Model.	41
3.11	Escalation Forecasts for Printing and Reproduction.	42
3.12	Maintenance Cost Specification: Aircraft	44
3.13	Maintenance Cost Specification: Missiles	45
3.14	Maintenance Cost Specification: Combat Vehicles.	46
3.15	Maintenance Cost Specification: Ships.	47
3.16	Maintenance Cost Specification: Electronic and Ammunition Equipment	48
3.17	Maintenance Cost Specification: ADP Maintenance.	49
3.18	Maintenance Cost Specification: Base and Facility Maintenance.	50
3.19	Escalation Forecasts for Other Services	53
3.20	Trend Forecasts for Sensitivity Analysis.	56
3.21	Cycle Forecasts from Sensitivity Analysis	57
3.22	Specification of Costs: General Supplies	59
3.23	Specification of Costs: Aviation Repair Parts.	62
3.24	Escalation Forecasts for Supplies	65
3.25	Specification of WPI114NS	67
3.26	Escalation Forecasts for Equipment.	67

INDEX OF FIGURES

		Page
2.1	Competitive Price Response to Market Strength	8
2.2	Basic Model Interactive	11
3.1	Real GNP: CYCLE vs. TREND	20
3.2	Comparison Plot: Cost Escalation Index for Total Operations and Maintenance vs. Aggregate Measures of Escalation	23
3.3	CEIO&M: TREND vs. CYCLE	24
3.4	Comparison Plot: Cost Escalation Index for Transportation of Persons vs. CPI's	27
3.5	Comparison Plots: Cost Escalation Index for Rents, Communication, and Utilities vs. CPI for Services . .	40
3.6	Comparison Plot: BESTREND vs. WRSTCYCLE	58

Chapter 1

INTRODUCTION

The Cost Forecasting Service (CFS) of Data Resources, Incorporated (DRI) has developed for the Army Chief of Staff's Office, under the provisions of Contract MDA903-77-0-0080, Cost Escalation Indexes (CEI's) for Element of Expense (EOE) Categories and Subcategories of the Operation and Maintenance (O&M) portion of the Army budget (exclusive of personnel compensation). The foundation upon which these CEI's have been built is a series of highly disaggregated econometric forecasting models. These models have been built at or below the three-digit EOE level of detail with Army-specific budget weights allowing aggregation of base forecasts to two-digit EOE categories and these in turn to a forecast for the whole O&M account. Table 1.1 presents the budget CEI's for which forecasts are available and also illustrates the aggregation structure of the models (starred CEI categories are "base" econometric models; other CEI categories are aggregations from these base models).

Table 1.1

COST ESCALATION INDEXES (CEI'S)
FOR THE ARMY O&M BUDGET:
CATEGORIES AND CODES

CEIOM - Operations and Maintenance

- CEI21 - Travel and Transportation of Persons
  - CEI211 - Air Fares*
  - CEI212 - Per Diem
    - CEI2121 - Hotel/Motel Room*
    - CEI2122 - Meals Away From Home*
- CEI22 - Transportation of Things
  - CEI221 - Truck Freight*
  - CEI222 - Rail Freight*
  - CEI223 - Mail*
  - CEI225 - Air Freight*
- CEI23 - Rents, Communication, and Utilities
  - CEI231 - Rents
    - CEI2311 - Rents for Structures*
    - CEI2312 - Rents for Equipment*

Table 1.1 (cont'd.)

CEI232 - Communication

CEI2321 - Telephone*
CEI2322 - Mail*

CEI233 - Purchased Utilities

CEI2331 - Water and Sewerage*
CEI2332 - Natural Gas*
CEI2333 - Electricity*

CEI24 - Printing and Reproduction*

CEI25 - Other Services

CEI251 - Purchased Equipment Maintenance

CEI2511 - Aircraft Maintenance*
CEI2512 - Missile Maintenance*
CEI2513 - Combat Vehicle Maintenance*
CEI2514 - Ship Maintenance*
CEI2515 - Electronic/Communication Equipment Maintenance*

CEI252 - Purchased ADP Maintenance*
CEI257 - Other Purchased Services

CEI2571 - Base and Facility Maintenance*
CEI2572 - Management and Operations Research Studies*
CEI2573 - Other Contractual Services*

CEI26 - Supplies

CEI261 - General Supplies*
CEI262 - POL, Aircraft*
CEI263 - POL, Ship*
CEI264 - POL, Other*
CEI265 - Coal*
CEI266 - Medical Supplies*
CEI267 - Aviation Repair Parts*
CEI268 - ADP Supplies*

CEI31 - Equipment

CEI311 - Transportation Equipment*
CEI312 - Machinery*

This disaggregated approach to forecasting Army budget escalation is motivated by the experienced inaccuracy attendant to the use of more aggregative measures of escalation such as the GNP deflator or even the more aggregative Wholesale Price Indexes (WPI's). This inaccuracy stems from the

very typical phenomena that prices for different types of materials, commodities, or services will escalate at significantly different rates due to differences in the markets they are produced and sold in. Only with a disaggregated approach to budget forecasting, using econometric models that incorporate these market differences, are the different escalation patterns likely to be identified. This project is an attempt to put this essential economic wisdom to use for the Army budget process. To give the reader a better idea of how these models are constructed, Chapter 2 presents an overview of the DRCFS approach to price and wage forecasting and a general discussion of how this approach was applied to the O&M budget. In Chapter 3 the results of this application, both specifications of base CEI models and forecasts, are presented. A Technical Appendix follows Chapter 3 which presents more detailed technical information on certain models and forecasts for model variables not present in Chapter 3.

Chapter 2

METHOD OF ANALYSIS

In this chapter the CFS approach to price modeling, the stages-of-processing conception of model interaction, and the general method used to construct Cost Escalation Indexes for the Operation and Maintenance expense categories are discussed in broad detail.

CFS MODELS OF PRICE FORMATION

The general specification of CFS price models posits price change for any commodity or service to be primarily a function of two general phenomena: a change in the unit cost of production due to changing input prices (variable and fixed), and a change in market strength due to changing end-use demand relative to supply capability. This is a flexible format that allows the incorporation of price behavior consistent not only with the theory of profit maximization and market equilibrium, but also the more long-run perspective of target return theory and the more short-run perspective of market disequilibrium theory.

How this is achieved is made clearer when we examine the general form and construction of the cost and market arguments in a CFS price equation.

THE INPUT COST ARGUMENT: The input cost argument is composed of two subarguments — material costs and labor costs — where the material cost specification includes both energy and nonenergy costs. The nonenergy category would cover such inputs as consumable materials, fabricated components, and machinery and equipment used in the particular production process. The energy category would, if possible, distinguish between energy sources used such as electricity, natural gas, coal, etc. The complete material input cost specification can be expressed in the general form of (1) below.

$$PIN_t = a_M \sum_{i=1}^{I} a_i PM_{i,t-m} + b_K \sum_{j=1}^{J} b_j PK_{j,t-m} + c_E \sum_{l=1}^{L} c_l PE_{l,t-m} \qquad (1)$$

where:

a_M = materials share of total nonlabor costs

b_K = capital (equipment) share of total nonlabor costs

c_E = energy share of total nonlabor costs

$a_M + b_K + c_E = 1$

$i=1, \ldots, I$ = nonenergy materials

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$j=1, \ldots, J$ = machinery and equipment types

$l=1, \ldots, L$ = sources of energy

PM_i = material prices

PK_j = machinery and equipment prices

PE_l = energy prices

a_i = material coefficients

b_j = machinery and equipment coefficients

c_l = energy coefficients

$\Sigma a_i = \Sigma b_j = \Sigma c_l = 1$

$m=0, \ldots, T-1$ = lag (timing relation) indicator

Information on the specific materials, machinery and energy types, and energy sources used in production, as well as their relative share of total nonlabor input costs, is gleaned from data available from Input-Output Tables, the Census of Manufactures, and industry trade publications. Prices for these inputs are proxied in the equation by the Wholesale Price Index (WPI) most similar to each input.

A total input cost measure is arrived at by adding to the PIN term a measure of labor cost. Typically, this cost component is represented by industry-specific average hourly earnings (AHE) indicators, which cover straight-time wage, overtime premiums, and selected employee contributions. The labor cost term and material cost term can be combined into a total input cost (COST) factor, as in (2) below.

$$COST_t = \alpha_M PIN_{t-m} + \alpha_L AHE_{t-n} \qquad (2)$$

where:

α_M = total material share

α_L = labor share

$\alpha_M + \alpha_L = 1$

$n=0, \ldots, T-1$ = lag indicator

$m=0, \ldots, T-1$ = lag indicator

THE MARKET STRENGTH ARGUMENT: The essential construct in the market strength argument of a CFS price equation is a measure of market demand (intermediate and final) for the product or service. This takes the general form as in (3) below:

$$Q_t = \Sigma a_i Q_{i,t-m} + \Sigma b_j D_{j,t-M} \quad (3)$$

where:

a_i = intermediate and final production coefficients

b_j = demand coefficients

Q_i = intermediate and final production indicators

D_j = final demand indicators

$\Sigma a_i + \Sigma b_j = 1$

$m=1, \ldots, M$ = lag indicators

End-use markets are typically represented by production indexes and National Income and Product Accounts (NIPA) demand measures. The a_i and b_j in each equation are determined using information gained from industry association and input-output table data.

A representation of industry supply is more difficult due to the deficiencies of available industry data on production, shipments, inventories, etc. However, an indirect measure of supply capability can be developed if we assume that industry supply responds to meet experienced changes in end-use demand, and each industry will keep productive capacity and inventory levels in line with recent demand experience.

Thus a measure of demand over a recent historical period will give a reasonable representation of supply capability. Therefore, supply capability is defined as an "n"-term moving average of market demand (as measured by Q_t) up through the previous period, with "n" unique to the business production cycle of each commodity. The resulting market imbalance term becomes a key impact variable in the commodity price equation.

The form of the market strength term is commonly a difference formulation between the value of the demand measure in the current period and an "n" term moving average of that measure. This takes the form of (4):

$$MS = Q_t - \left(\sum_{i=1}^{L} Q_{t-i}/L \right) \quad (4)$$

where:

Q_t = current periods demand

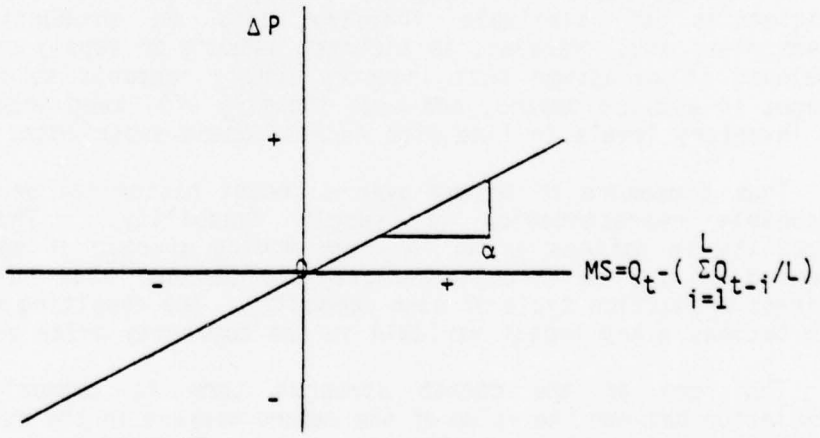
L = number of periods in term of moving average of Q_t

As an example of the hypothesized impact on prices consider the simplest characterization, that of a competitive market where prices react symmetrically to market strength variation. In this circumstance the following relations would hold:

ΔPrice		Market Strength
Increase	if	$Q_t > (\sum_{i=1}^{L} Q_{t-1}/L)$
None	if	$Q_t = (\Sigma Q_{t-1} L)$
Decrease	if	$Q_t < (\sum_{i=1}^{L} Q_{t-1}/L)$

Therefore, the responses determined empirically would be equal in magnitude yet opposite in direction in strong (QD>QS) and weak (QD<QS) markets. This response is appropriate for perfectly competitive situations, as shown in Figure 2.1 below:

Figure 2.1



Market Strength:	WEAK	STRONG
Capacity Utilization:	LOW	HIGH
Leadtimes:	SHORT	LONG
Inventories:	HIGH	LOW

Of course, many real world industries are not strongly competitive and that particular price/market strength response hypothesis is incorrect for models of those markets. Using this same general format, though, it is

possible to introduce price/market strength response hypotheses that better represent behavior of prices in less competitive, more oligopolistic markets.

Combining input cost and market strength arguments yields the general specification of a CFS price model for an individual commodity as presented in (5).

$$P_t = \alpha_0 + \alpha_1 PIN_{t-m} + \alpha_2 AHE_{t-n} + \alpha_3 (Q_t - (\sum_{i}^{L} Q_{t-L}/L))^* \qquad (5)$$

*The details of the market strength term will vary as more sophisticated price/market strength hypothesis are used.

Certain factors embodied within these theories are not explicitly incorporated in the specification of the price equations, primarily due to data deficiencies. Labor productivity measures are not included, with their impacts being implicitly captured, in part, by both the magnitude and direction of the constant term, as well as the magnitude of the coefficient on average hourly earnings. Productivity of materials and capital are also difficult to measure and are normally excluded from the specifications. The absence of productivity measures makes the distinction between unit cost and factor price markup hypotheses of price formation difficult. The target return theory of pricing price mechanism is also not directly incorporated in the price equations. Measures such as long-term bond rates and profit-sales or profit-equity ratios could be used to represent target return. However, the data available is too aggregate to provide information at the commodity-specific level of price behavior.

MODEL INTERACTION: A major strength of the CFS price models is the form of interaction that is specified among the price models and, further, among other DRI models. The individual price equations are linked through the stages of processing. That is, crude material prices (e.g., coal, iron ore, scrap, petroleum) impact various intermediate material prices (e.g., iron, steel, aluminum, fabricated metal, etc.) which in turn impact final product prices (e.g., machinery, equipment, tires, trucks, electronic instruments). Thus the price forecasts at lower stages of processing become the input price forecasts at higher stages of processing. This ability to trace price change from raw materials through final product gives the CFS approach a consistency with the production process, providing a superior structural framework in which to analyze the price formation process. Currently over 100 commodity forecasts are available at various stages of processing.

Forecasts for variables exogeneous to the CFS price models are provided by other models in the DRI system. The DRI Macro Model provides forecasts for measures of industrial production and demand needed to determine market strength in the various commodity models. The DRI Energy Model provides price and energy share information on the important energy sources which are included in the input cost measures of the price models. The DRI Steel Model provides forecasts for the prices of ferrous scrap, ore, and metallurgical

coal necessary for the CFS ferrous metal models. A general overview of this interaction is gained upon examination of Figure 2.2, illustrating the basic model interactions.

DATA

The development of cost escalation indexes for the EOE categories of the Army O&M budget requires historical measures for a wide selection of prices and wages for various material and labor types. The source of this data is the Bureau of Labor Statistics (BLS), which maintains and updates over 6,000 monthly price and wage series. DRCFS currently forecasts over 150 of these series. This includes over 16 new series added to the CFS model system for use in this project. These forecasted series are listed in Table 2.1. Forecasts for each are provided quarterly through the year 1990, with updates occurring as new BLS data comes available. As Table 2.1 reveals, forecasts are available over a wide spectrum of commodities and services at a significant degree of disaggregation.

Figure 2.2

BASIC MODEL INTERACTIONS

The flowchart below represents the general interaction of prices, both through the stages of processing and with the macro, wage, and energy models. The numbers in each box indicate an approximate number of commodities forecasted in each category.

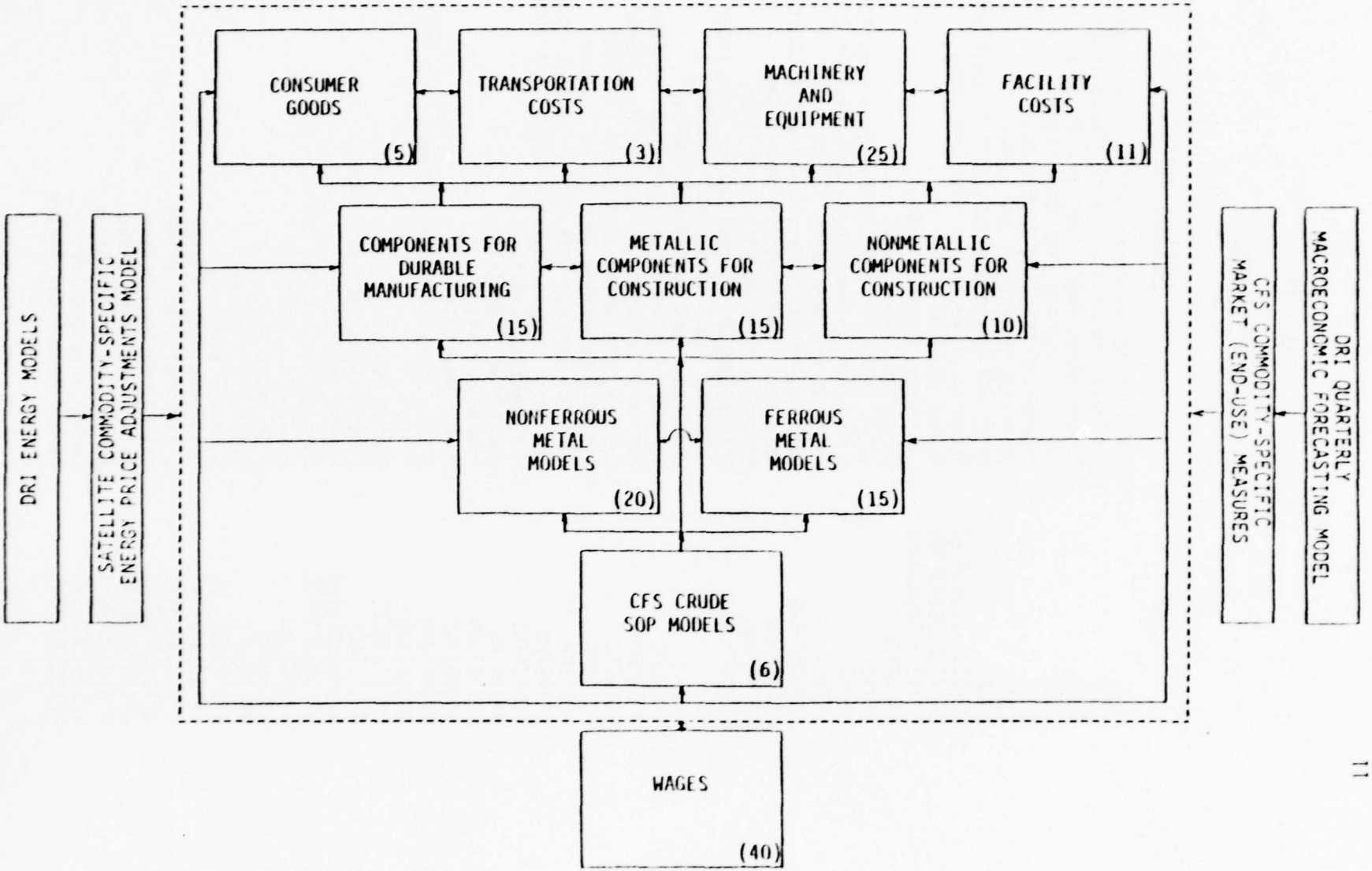


Table 2.1

LIST OF VARIABLES

Code	Variable Definition
CIAM	Aircraft Maintenance Facility Cost Index
CIAP	Airfield Paving and Lighting Cost Index
CIBH	Boiler House Modernization Cost Index
CIFO	Fuel Oil Storage Tank Cost Index
CIIT	Interstate Trucking Cost Index
CIUE	Utilities Expansion Cost Index
CIWP	Water Pollution Control Facility Cost Index
CPI22311259NS@099	Residential Water and Sewerage Index
CPI23212399NS@099	Postal Charges
CPI42111792NS@099	Air Fares, Chiefly Coach
CPIHOTEL	Hotel/Motel Room Rates
ENRBCI	DRCFS Proxy for the ENR Building Cost Index
HOUSE	Single-Family Dwelling - Construction Cost Index
LRTTL	Railroad Freight Rates, Total
MATHCFCPIWA	Health Care Facility - Construction Cost Index
MATHCPIWA	Hospital - Construction Cost Index
MATMCPIWA	Factory - Construction Cost Index
MATOCCPIWA	Office Complex - Construction Cost Index
PCI	Chemical Plant Cost Index (AHECNS)
PCIA	Chemical Plant Cost Index (AHEHO)
PCIREFC	Refinery Construction Cost Index (AHECNS)
PCIREFCH	Refinery Construction Cost Index (AHEHO)
PCIREFO	Refinery Operating Cost Index (AHECNS)
PCIREFOH	Refinery Operating Cost Index (AHEHO)
PCIREFP	Refinery Process Unit Operating Cost Index (AHECNS)
PCIREFPH	Refinery Process Unit Operating Cost Index (AHEHO)
TURBINECI	Turbine Cost Index
WPI061NS	Industrial Chemicals
WPI0621NS	Prepared Paint
WPI0622NS	Paint Materials
WPI0679NS	Miscellaneous Chemical Products and Preparations
WPI071201NS	Tires
WPI071303NS	Rubber Belts
WPI0721NS	Plastic Construction Products
WPI09130131NS	Paper, Wood Bond
WPI09150323NS	Corrugated Shipping Containers
WPI0921NS	Insulation Board
WPI101NS	Iron and Steel
WPI1013NS	Steel Mill Products
WPI10130246NS	Carbon Plates
WPI10130247NS	Stainless Steel Plates
WPI10130248NS	Structural Steel Shapes
WPI10130254NS	Hot-Rolled Carbon Bars
WPI10130263NS	Galvanized Steel Sheet
WPI10130268NS	Hot-Rolled Carbon Strip
WPI10130275NS	Carbon Pressure Tubing
WPI10130276NS	Carbon Mechanical Tubing

Table 2.1 (cont'd.)

Code	Variable Definition
WPI10130277NS	Carbon Seamless Mechanical Tubing
WPI1015NS	Foundry Shop Products
WPI10150101NS	Gray Iron Castings
WPI10150103NS	Malleable Iron Castings
WPI102NS	Nonferrous Metals
WPI1022NS	Primary Nonferrous Shapes
WPI10220101NS	Primary Aluminum Ingot
WPI10220106NS	Copper Wirebar, Domestic Origin
WPI10220111NS	Lead, Pig, Common
WPI10220113NS	Copper Wirebar, Imported
WPI10220116NS	Nickel, Cathode Sheets
WPI1023NS	Nonferrous Scrap
WPI102301NS	Copper Base Scrap
WPI102302NS	Aluminum Base Scrap
WPI1024NS	Secondary Metal and Alloy Basic Shapes
WPI10240151NS	Zinc, Die Casting Alloy, #3
WPI1025NS	Mill Shapes
WPI102501NS	Aluminum Shapes
WPI10250102NS	Aluminum Sheet, Heat-Treatable
WPI10250103NS	Aluminum Sheet, Siding Coil
WPI10250113NS	Aluminum Rods
WPI10250117NS	Aluminum Extrusions
WPI102505NS	Titanium Mill Shapes
WPI10251991NS	Magnesium Extrusions
WPI1026NS	Wire and Cable
WPI104NS	Hardware
WPI105NS	Plumbing Fixtures
WPI106NS	Heating Equipment
WPI107NS	Fabricated Structural Metal Products
WPI1071NS	Metal Doors
WPI1072NS	Metal Tanks
WPI1073NS	Sheet Metal Products
WPI1074NS	Structural Metal Products
WPI10740195NS	Fabricated Steel Pipes and Fittings
WPI108NS	Miscellaneous Metal Products
WPI1081NS	Bolts, Nuts, Screws, and Rivets
WPI1083NS	Lighting Fixtures
WPI1089NS	Other Miscellaneous Metal Products
WPI112NS	Construction Machinery and Equipment
WPI113NS	Metalworking Machinery and Equipment
WPI11340431NS	Atmosphere Generator, Endothermic
WPI1136NS	Abrasive Products
WPI114NS	General-Purpose Machinery and Equipment
WPI1141NS	Pumps and Compressors
WPI114102NS	Pumps
WPI114103NS	Air Compressors
WPI114104NS	Gas Compressors
WPI1143NS	Fluid Power Equipment
WPI1144NS	Industrial Material Handling Equipment
WPI1145NS	Mechanical Power Transmission Equipment
WPI1147NS	Fans and Blowers
WPI114901NS	Valves and Fittings
WPI114905NS	Ball and Roller Bearings
WPI116NS	Special Industrial Machinery and Equipment

Table 2.1 (cont'd.)

Code	Variable Definition
WPI117NS	Electrical Machinery and Equipment
WPI1171NS	Wiring Devices
WPI1172NS	Integrating and Measuring Instruments
WPI117201NS	Electrical Instruments
WPI117202NS	Electronic Instruments
WPI1173NS	Motors and Generators
WPI117301NS	Electric Motors
WPI1174NS	Transformers and Power Regulators
WPI1175NS	Switchgear, Switchboards and Equipment
WPI1178NS	Electronic Components
WPI117811NS	Capacitors
WPI117812NS	Resistors
WPI117821NS	Relays
WPI117824NS	Connectors
WPI117825NS	Magnetic Tape
WPI117835NS	Transistors
WPI117841NS	Digital Bi-Polar Integrated Circuits
WPI117842NS	Digital M.O.S. Integrated Circuits
WPI117845NS	Linear Integrated Circuits
WPI117901NS	Storage Batteries
WPI11790324NS	Electrode, Graphite
WPI1191NS	Oil Field Machinery and Tools
WPI119102NS	Oil Field Machinery and Drilling Equipment
WPI119104NS	Oil Field Production Machinery and Equipment
WPI1192NS	Mining Machinery and Equipment
WPI1194NS	Internal Combustion Engines
WPI1311NS	Flat Glass
WPI133NS	Concrete Products
WPI134NS	Structural Clay Products
WPI135NS	Refractories
WPI136NS	Asphalt Roofing
WPI1392NS	Insulation Materials
WPI141102NS	Trucks
WPI151301NS	Small Arms
WPI151302NS	Ammunition

Table 2.1 (cont'd.)

Code	Variable Definition
AHECNS	Average Hourly Earnings, Construction, United States
AHEATCOAL	Average Hourly Earnings, Coal Power Facility - Atlanta
AHEATNUC	Average Hourly Earnings, Nuclear Power Facility - Atlanta
AHEBRCOAL	Average Hourly Earnings, Coal Power Facility - Birmingham
AHEBRNUC	Average Hourly Earnings, Nuclear Power Facility - Birmingham
AHEHO	Average Hourly Earnings, Refinery Construction - Houston
AHEMINS	Average Hourly Earnings, Mining
AHE12NS	Average Hourly Earnings, Bituminous Coal and Lignite Mining
AHE19NS	Average Hourly Earnings, Ordnance and Accessories
AHE192NS	Average Hourly Earnings, Ammunition Except for Small Arms
AHE1925NS	Average Hourly Earnings, Completed Guided Missiles
AHE27NS	Average Hourly Earnings, Printing and Publishing
AHE281NS	Average Hourly Earnings, Industrial Chemicals Production
AHE291NS	Average Hourly Earnings, Petroleum Refining
AHE30NS	Average Hourly Earnings, Rubber and Miscellaneous Plastics
AHE33NS	Average Hourly Earnings, Primary Metals
AHE331NS	Average Hourly Earnings, Blast Furnaces and Works
AHE333&4NS	Average Hourly Earnings, Nonferrous Metals
AHE34NS	Average Hourly Earnings, Fabricated Metal Products
AHE35NS	Average Hourly Earnings, Nonelectrical Machinery
AHE36NS	Average Hourly Earnings, Electrical Machinery
AHE37NS	Average Hourly Earnings, Transportation Equipment
AHE372NS	Average Hourly Earnings, Aircraft and Parts
AHE3721NS	Average Hourly Earnings, Aircraft
AHE373NS	Average Hourly Earnings, Ship and Boat Building and Repairing
AHE3731NS	Average Hourly Earnings, Ship Building and Repairing
AHE421NS	Average Hourly Earnings, Trucking
AHE422NS	Average Hourly Earnings, Public Warehousing
AHE481NS	Average Hourly Earnings, Telephone Communication
AHE498NS	Average Hourly Earnings, Water and Sanitary Systems
AHE701NS	Average Hourly Earnings, Hotels, Tourist Courts, and Motels
AHEPOST	Average Hourly Earnings, Postal Service Workers

DEVELOPING CEI'S FOR EOE BUDGET CATEGORIES

As was stated in the introduction, more accurate O&M budget forecasts can be gained by utilizing a more disaggregated forecasting procedure which can detect the differential rates at which prices for different commodities and services in the budget escalate. To this end, DRCFS has broken down the O&M budget into a series of what we term "base commodities and services," that are defined on the basis of budgetary significance and likely differences in the economic environment these goods are produced and sold in. Of course, in each case the extent of disaggregation achieved is limited by the available data on budget composition. Once disaggregation has proceeded to a set of base commodities and services, it then becomes necessary to assign to each of these categories a representative price proxy from existing Wholesale Price Indexes (WPI's). For example, the O&M EOE category, Travel and Transportation of Persons is broken down into two subcategories: Air Fares and Per Diem. Then Per Diem is further broken down into two essential components: Hotel/Motel Expense and Meals Away from Home. The inclusion of only air fares is based on the Army's knowledge of the dollar insignificance of other transport modes in the budget. On the other hand, the further division of Per Diem is prompted by the knowledge that two economically distinct services are included under that heading.

Once the desired (or allowable) disaggregation to base commodities is achieved it is then necessary to assign to each of these categories price series, chosen from existing Wholesale Price Indexes (WPI's) and the Consumer Price Indexes (CPI's), that are likely to be most representative of the prices of commodities or services purchased under that budget heading. To use Travel and Transportation of Persons as an example again, the price proxies used are Air Fares, Chiefly Coach (CPI42111792NS@099), Consumer Price Index, Hotel/Motel Room Rates (CPIHOTEL), and Consumer Price Index, Meals Away from Home (CPI12000000NS@099). The next step is to forecast the behavior of these price series using structural econometric models. (Discussion of these models will be undertaken in the next chapter.) The forecasts of price increases (or decreases) for each of the "base commodities" are then aggregated, using Army-specific budget weights, to provide a forecast of escalation for each three-digit and two-digit EOE budget category. Combining forecasts of escalation for each two-digit EOE category, again using Army-specific weights, provides an escalation forecast for the overall O&M budget, based on detailed commodity- and service-specific forecasts.

The weights used to aggregate from the base forecasts are an important element to the achievement of accurate forecasts. Weights needed for aggregation from the three-digit CEI categories (e.g., CEI251 – Purchased Equipment Maintenance, CEI252 – Purchased ADP Maintenance, etc.) to the two-digit level (CEI25 – Purchased Services) on to the complete O&M category (CEIO&M) were developed from dollar expenditure data for the corresponding two- and three-digit EOE categories available from the Army O&M budget. Examination of the budgets for the last four (4) fiscal years indicated a great degree of stability in the weights making this part of the aggregation procedure an unlikely source of error in the escalation forecasts. (However,

if new evidence suggests a change in these weights at this level, it is an easy task to change them to a more correct specification. How this change can be incorporated is explained in the user's manual that accompanies this report.)

Aggregation weights below the three-digit EOE categories are more difficult to obtain. In some instances, such as for the components of the EOE 231, 232, and 233 categories, estimates of weights are made using a combination of anecdotal observations from Army personnel and typical industrial experience. Again, where prior information would suggest a different weighting scheme, the change can be easily effected in the system format. (The details of the particular weighting scheme presently used are discussed in the appropriate section of the next chapter.) Particularly problematic was the development of model specifications and weighting schemes for the several equipment maintenance categories (i.e., EOE 2511, 2512, 2513, 2514, and 2515). Though data is available on gross materials, labor, and overhead, more detailed data is not available. This is particularly unfortunate since this is an area where cost escalation is likely to differ greatly across different equipment categories. Further, DRCFS has sufficiently broad material and labor coverage that knowledge of weighting factors would allow these escalation differences to be identified and anticipated in budget projections.

As a surrogate for a more precise material specification in each equipment maintenance category, DRCFS has adopted the following procedure. Materials likely to be used in a maintenance act are specified using equipment material composition data gained from the DRCFS/Army Procurement Study* and other sources. Appropriate WPI's are assigned and given equal weights in this material vector. A sensitivity analysis is then applied to this vector, where forecasted material cost escalation using even weighting of included materials is determined. Then two alternative forecasts are generated by allowing the complete material vector to increase at the rate of the most rapidly escalating element of that vector and, alternatively, at the rate of the least rapidly escalating element, thus determining the most likely extremes for escalation in each equipment category. (More details on this procedure are presented in the section on CEI251 in Chapter 3.)

The discussion in this chapter was undertaken with the intent of providing the interested reader with a reasonably complete overview of the DRCFS system of commodity forecasting models, data, our general approach to the explanation of price behavior, and most importantly for the matter at hand, how we have proceeded to construct Cost Escalation Indexes for the O&M budget categories. In the next chapter, we present the results of our efforts.

*"Investment Appropriation Categories Cost Escalation Indexes: Technical Report," prepared for the Office of the Comptroller, Department of the Army, by Data Resources, Inc., under Contract MDA903-75-0-027, October, 1976.

Chapter 3

CEI MODEL SPECIFICATION AND FORECAST RESULTS

In this chapter the results, models and forecasts for the Army O&M budget Cost Escalation Indexes are presented. The discussion is structured so as to conform to the O&M and Element of Expense (EOE) accounting framework. First, we will examine the forecast for the complete O&M budget and its major EOE components. Then we proceed to examine the models and forecasts underlying each major EOE category. This discussion will include the essential details of model structure and will present forecasts under both TRENDLONG and CYCLELONG macroeconomic scenarios. (For the interested reader, more detailed model specifications and forecasts not touched on in this chapter are presented in the Technical Appendix.)

ALTERNATE FORECASTS: PHILOSOPHY AND PROCEDURE

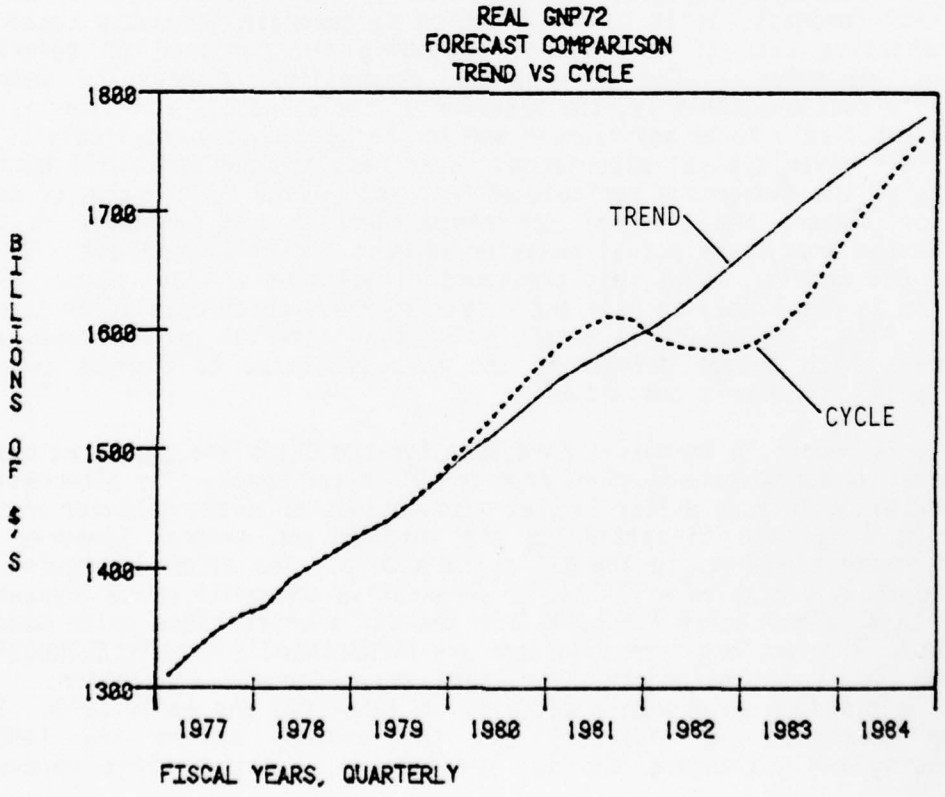
The wise user of escalation forecasts will recognize that in general any forecast is subject to error, and moreover, that this error is likely to increase as the forecast extends further into the future. The basic source of this error is the inevitable imprecision in predicting what the actual behavior of the exogenous variables in the model(s) will be over the forecast period. Certainly a good structural model in the hands of a good analyst will generate forecasts with a minimum of error, but error cannot be eliminated entirely. Thus, out of deference to the likelihood of error in any "point" forecast, it is common practice to generate forecasts based on two alternative sets of assumptions regarding the behavior of selected exogenous variables. The alternative assumptions attempt to embody "extreme" situations, that is, the behavior of the exogenous variables is in one case not likely to be any "worse" and in the second case not likely to be any "better" given typical experience. What results from this will be two forecasts of the endogenous variable of interest (in our case, rates of cost escalation), where the interval (or range) between the forecasts in any period is the area where actual behavior is most likely to manifest. So in terms of CEI models, using this procedure establishes a floor below which escalation is not likely to fall and a ceiling above which escalation is not likely to rise. Moreover, in establishing this interval of variation, we also learn which budget categories are most sensitive to changes in the general pace of economic activity.

In this report, alternative forecasts for the CEI's are generated based on alternative long-term solutions from the DRI Macro Model. The alternative macroeconomic solutions differ in their assumptions as to the behavior of the economy at large and in particular the behavior of several measures of product demand exogenous to the CFS price models. The altered behavior of these exogenous variables will lead to alternative commodity price forecasts and, in turn, alternative forecasts for the CEI's which these price models enter into. The two long-term solutions are TRENDLONG0378 and CYCLELONG0378. TRENDLONG is a smooth-growth, long-term macroeconomic simulation. It projects a slowdown in economic activity in late-1978 and early-1979. The recovery commences in late-1979 and the economy enters the 1980's experiencing well-balanced, but not spectacular, growth. This recovery

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proceeds slowly but smoothly in the early-1980's and the economy approaches a steady-state growth path in the mid-1980's. This is a very optimistic scenario and escalation rates generated with this solution are probably the lowest that can be expected, other things being equal. In contrast, CYCLELONG0378 is a long-term solution which embodies less optimistic assumptions of the course of future events than the TRENDLONG0378 solution. In this solution, the U.S. economy experiences cycles of increasing severity through the 1980's. In contrast to TRENDLONG0378, the problem of macro instability, inflation, and unemployment worsen over the next decade. After a mini-recession in 1979, the economy enters the 1980's with a very strong recovery. Spurred by overstimulative monetary and fiscal policy, final demands increase too rapidly, capacity bottlenecks appear, and wholesale price inflation moves well into the double-digit range. Late in mid-1982, a recession occurs that carries through to late-1983. Given these characteristics of CYCLELONG, we can expect CEI's to increase much more rapidly under this scenario than under the Trend alternative. Since actual experience is not likely to be as severe as CYCLE suggests, the escalation forecasts from it represent a pessimistic assessment indicating "ceilings" above which revealed escalation is not likely to rise, other things being equal. To help the reader grasp the essential difference of pattern between the Trend and Cycle alternatives, Figure 3.1 presents a comparison plot of Gross National Product (GNP) under Trend and Cycle assumptions. (In interpreting the results that follow, DRCFS recommends that the reader consider the Trend solution as the most probable outcome.)

Figure 3.1



CEI - OPERATIONS AND MAINTENANCE

Forecasted escalation for the total O&M account is based on an aggregation of forecasts for the 7 two-digit EOE categories that make it up. (*Of course, as we will discuss in more detail, these two-digit forecasts are also aggregations.*) The forecast for O&M and its two-digit EOE components, under Trend and Cycle macro assumptions, are presented in Table 3.1. Considering the Trend solution first, what we observe is the CEI for total O&M achieving a 6.8% growth rate over the forecasted interval (fiscal 1978 to 1984). The annual pattern of change, in line with TRENDLONG demand behavior, is one of acceleration through 1981, a modest dampening in fiscal 1982, and a second period of acceleration beginning in fiscal 1983. Both in pattern and magnitude, the forecast escalation for the O&M budget is different from that suggested by more aggregative measures of price behavior. This point is revealed quite clearly in Figure 3.2, which presents comparison plots for CEI-O&M with the GNP price deflator and the CPI for services (CPIS).

The behavior of CEI-O&M is, of course, explained by the escalation behavior of the component two-digit EOE categories. The general pattern of annual change is essentially the same in detail, but the magnitude of annual escalation does show significant variation (e.g., compare CEI22 – Transportation of Things to CEI31 – Equipment). Of particular importance to the behavior of CEI-O&M is the pattern and magnitude of escalation in CEI25 – Other Services and CEI26 – Supplies which, with combined budget weights of over 60% have a strong molding impact on CEIO&M.

Consider now forecasts for CEI-O&M and its major components under Cycle macro assumptions also presented in Table 3.1.

Relative to the Trend solution, the Cycle scenario leads to a pattern of steadily accelerating escalation in CEI-O&M culminating in fiscal 1982 when the annual rate of escalation is forecasted at a 9.7% per annum rate, a sizable 3.3 percentage points above the Trend forecast for that year. As before, the behavior of CEI-O&M reflects the behavior of the several two-digit CEI's of which it is an aggregation. Looking at the Cycle forecasts for these component CEI's reveals a similar pattern of annual escalation but with significant differences in the magnitude of change between categories in a given year. Two-digit CEI's that are escalating far more rapidly than Total O&M are CEI22 – Transportation of Things, increasing at an 8.7% interval pace; CEI23 – Rents, Communication, and Utilities, increasing at a 9.1% rate; and CEI26 – Supplies, achieving a forecasted interval growth rate of 8.8%. The reasons underlying the behavior of the two-digit CEI's are examined in the sections that follow.

To give the reader a better feel for the differences between the Trend and Cycle forecasts and in turn a more aggregative measure of escalation, *Figure 3.3 presents a comparison plot between the Trend and Cycle forecasts* for Total O&M (CEI-O&M) and the GNP deflator (PGNP). Over the fiscal 1978 to fiscal 1984 period, the GNP deflator is on average 1.5% and 3% below the respective Trend and Cycle O&M forecasts.

Table 3.1

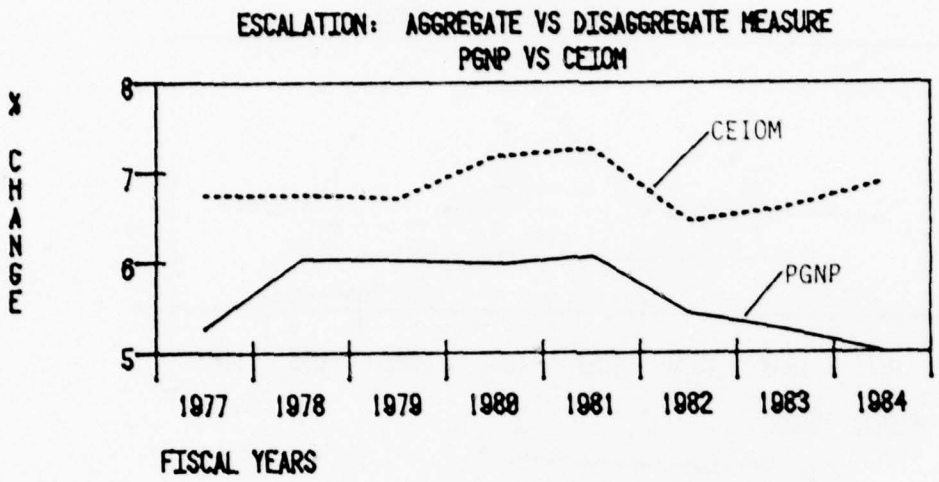
FORECAST: CEIOM
TOTAL OPERATIONS AND MAINTENANCE
AND MAJOR ELEMENT OF EXPENSE CATEGORIES
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984	% GROWTH 78 TO 84
CEIOM-TOTAL O & M									
TREND	1.000	1.068	1.139	1.221	1.310	1.395	1.487	1.589	6.80
%CH	6.8	6.8	6.7	7.2	7.3	6.5	6.6	6.9	
CYCLE	1.000	1.068	1.145	1.230	1.349	1.461	1.585	1.694	8.02
%CH	6.8	6.8	7.0	7.6	9.7	8.3	7.8	6.9	5.28
CE121-TRAV. & TRANSP. OF PERSONS [.043]									
TREND	1.000	1.083	1.162	1.242	1.329	1.417	1.511	1.610	6.84
%CH	7.3	8.3	7.3	6.9	7.0	6.7	6.6	6.5	
CYCLE	1.000	1.074	1.142	1.220	1.313	1.424	1.535	1.634	7.25
%CH	7.3	7.4	6.4	6.8	7.6	8.5	7.8	6.4	0.50
CE122-TRANSP. OF THINGS [.075]									
TREND	1.000	1.084	1.192	1.318	1.448	1.566	1.693	1.825	9.07
%CH	9.0	8.4	10.0	10.5	9.9	8.1	8.1	7.8	
CYCLE	1.000	1.087	1.198	1.329	1.487	1.638	1.784	1.946	10.20
%CH	9.0	8.7	10.2	11.0	11.9	10.2	8.9	9.1	
CE123-RENTS, COMMUN., & UTILITIES [.090]									
TREND	1.000	1.118	1.189	1.294	1.407	1.508	1.624	1.739	7.68
%CH	12.2	11.8	6.4	8.9	8.7	7.1	7.7	7.1	
CYCLE	1.000	1.120	1.195	1.304	1.454	1.621	1.760	1.890	9.33
%CH	12.2	12.0	6.7	9.1	11.5	11.4	8.6	7.4	
CE124-PRINTING & REPRODUCTION [.005]									
TREND	1.000	1.053	1.118	1.200	1.293	1.388	1.486	1.595	7.14
%CH	5.2	5.3	6.1	7.4	7.8	7.3	7.1	7.2	
CYCLE	1.000	1.055	1.124	1.206	1.305	1.438	1.548	1.654	7.77
%CH	5.2	5.5	6.5	7.3	8.2	10.2	7.7	6.9	
CE125-OTHER SERVICES [.485]									
TREND	1.000	1.068	1.141	1.217	1.304	1.392	1.484	1.587	6.82
%CH	6.8	6.8	6.9	6.6	7.2	6.8	6.6	6.9	
CYCLE	1.000	1.068	1.142	1.221	1.330	1.458	1.560	1.664	7.68
%CH	6.8	6.8	7.0	6.9	9.0	9.6	7.0	6.7	
CE126-SUPPLIES [.273]									
TREND	1.000	1.043	1.101	1.176	1.248	1.312	1.388	1.479	5.99
%CH	4.4	4.3	5.5	6.8	6.2	5.1	5.8	6.6	
CYCLE	1.000	1.045	1.112	1.198	1.320	1.444	1.530	1.631	7.69
%CH	4.4	4.5	6.3	7.7	10.2	9.4	5.9	6.6	
CE131-EQUIPMENT [.029]									
TREND	1.000	1.068	1.146	1.218	1.301	1.381	1.463	1.559	6.51
%CH	6.2	6.8	7.3	6.3	6.9	6.1	5.9	6.6	
CYCLE	1.000	1.067	1.143	1.220	1.324	1.454	1.537	1.632	7.34
%CH	6.2	6.7	7.2	6.7	8.6	9.8	5.7	6.2	

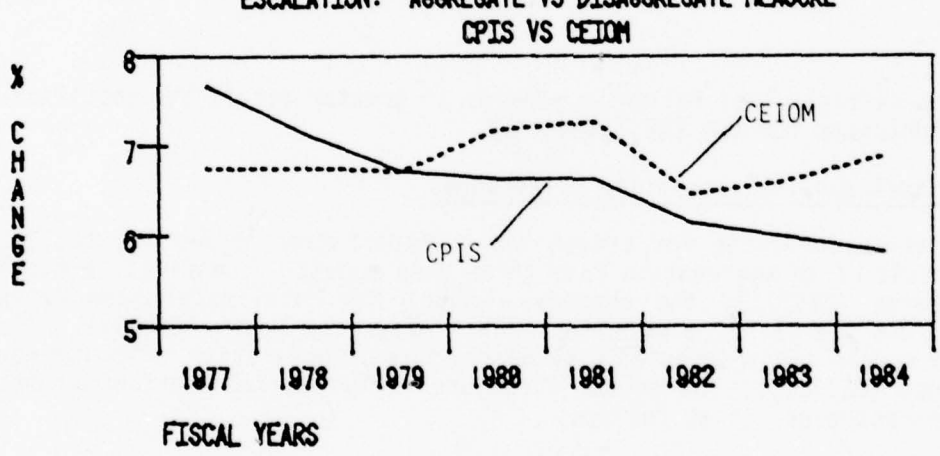
NOTE: WEIGHTS GIVEN IN BRACKETS SUM TO ONE.

Figure 3.2

PANEL A



PANEL B

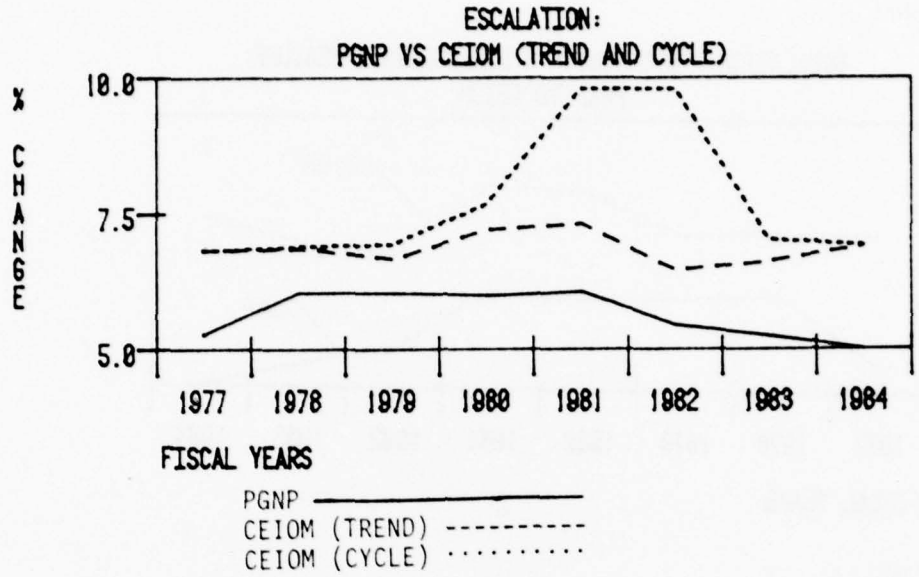


CEIOM - Cost Escalation Index, O & M

PGNP - Implicite Price Deflator, GNP

CPIS- Consumer Price Index, Services

Figure 3.3



In the sections that follow we examine in greater detail the specification and forecasts for the EOE categories.

CEI21 - Travel and Transportation of Persons

Escalation forecasts for travel and transportation of persons (CEI21) are the result of an aggregation from three base models: the first, a model for Air Fares (CEI211); the second, a model for Hotel/motel Room Rates (CEI2121); and the third, a model for Meals Away from Home (CEI2122). The latter two models are aggregated together to form an escalation index for Per Diem expense (CEI212). The formal structure including aggregation weights used (in parentheses) is as follows:

CEI21 - Travel and Transportation of Persons

CEI211 - Air Fares (0.5)
CEI212 - Per Diem (0.5)

CEI2121 - Hotel/Motel Room Rates (0.667)
CEI2122 - Meals (0.333)

The aggregation weights used are based on typical travel experience of personnel in industry and the military.

We now examine in broad detail the construction and character of the base models that make up this CEI.

CEI211 - Air Fares

Escalation in CEI211 is proxied by forecasted price behavior of Air Fares, Chiefly Coach (CPI42111792NS@099). The model embodies three economic factors: input costs (principally labor), the general level of demand in the economy, and the pattern of regulatory constraint in the industry. The specific specification is as follows. The percent change in the CPI for Air Fares (CPI42111792NS@099) is specified to be a function of changes in: labor cost — as proxied by the Index of Average Hourly Earnings of Production Workers (JAHEADJEA), lagged over three quarters; the strength of demand in the economy generally — as proxied by the inverse of the economy-wide unemployment rate (RUI); and a seasonal dummy that picks up the tendency for rate increases to occur in the third quarter of each year (SEASONQ3). Detail on precise equation form including regression coefficients is presented in the Technical Appendix.

CEI212 - Per Diem Expense

CEI2121 -Hotel/Motel Expense

This budget component is proxied by the CPI for Hotel/Motel Room Rates collected by the Bureau of Labor Statistics (BLS). This is an unpublished series due to the fact that the BLS collects data in only 35 of its 56 sampling areas. However, we believe this series adequately represents the movement of national hotel/motel room rates to serve as a base for estimation.

The estimation of this index required the isolation of three factors: operation and maintenance costs, seasonal variation in demand, and price control effects. The cost variable (COST2121) includes three indexes with corresponding weights as suggested in Trends in the Hotel/Motel Business, 1976, prepared by Harris, Kerr, Forster & Company. These include proxies for labor costs (AHE701NS and JAHEADJEA), for energy and power costs (WPISOP2400NS), and for capital costs (ICNRCOST). As expected, labor accounts for the largest portion of costs with a weight of 0.60. Energy and capital costs are given weights of 0.30 and 0.10, respectively.

Strong seasonal price fluctuations and the effect of price controls required the use of four dummy variables. SEASONQ2, SEASONQ3, SEASONQ4 accurately explain rate increases in the second and third quarters and subsequent decreases in the fourth quarter. PCDUM captures the dampened rate increases resulting from price controls in the five quarters from 1971:4 through 1972:4.

A more detailed discussion of these base models is found in the Technical Appendix to this chapter.

CEI2122 - Meals Away from Home

The index chosen as a proxy for this EOE subcomponent is the CPI for Food Away from Home (CPI12000000NS@099), compiled by the Bureau of Labor Statistics. The econometric model used to forecast escalation in this index specifies the percent change of this CPI to be a function of three arguments — these are: operating cost (labor, material and capital), strength of demand for meals away from home, and the effect of seasonality on the price of a meal. A more specific specification, along with relevant statistics, is presented in the Technical Appendix.

Forecasts for CEI21 and its Components

Trend escalation forecasts for CEI21 – Travel and Transportation of Persons and its components are presented in Table 3.2. The escalation behavior over the 1978-1984 interval is somewhat more moderate than is true for the total O&M account. The factor underlying this behavior is the relatively moderate pace at which CEI211 – Air Fares is increasing. The behavior of air fares generally reflects the dampening influence of the more competitive rate-making behavior of most major carriers. The per diem category, CEI212, achieves an interval growth rate of 7.46, effectively the same as for the whole O&M account, but annual differences occur. The factor pushing this category up is the Meals Away from Home component which is forecasted to increase at a brisk 8.4% growth pace over the interval, where in no year does the annual rate of change fall below 8.2%. Underlying this behavior are strong increases in operating cost, particularly labor, rent, and energy costs. (See the Technical Appendix for more forecast detail.) To reveal more clearly the difference disaggregation makes, Figure 3.4 presents a historical and forecast comparison of CEI21 with the more aggregative measure CPI for Services (CPIS).

Table 3.2 also presents forecasts for CEI21 under the Cycle alternative. In this solution, weak demand in fiscal 1978 and 1979 brings escalation forecasts in this category below the Trend values. There is a steady acceleration of demand and escalation after 1979 culminating in fiscal 1982. In that year, escalation in CEI21 is forecasted at a per annum rate of 8.5% (2.1% above the Trend forecast). Looking now at the Cycle forecasts for the three- and four-digit components of CEI21, we see that as in the Trend solution CEI212 – Per Diem is escalating the most rapidly, fueled by forecasts for particularly strong increases in CEI2122 – Meals Away from Home, which achieves a rapid 9.4% interval escalation rate. The factors underlying the escalative behavior of these base indexes are the same as discussed in the Trend solution only their impact has been amplified due to the more volatile and more rapid pace of economic activity in the Cycle solution.

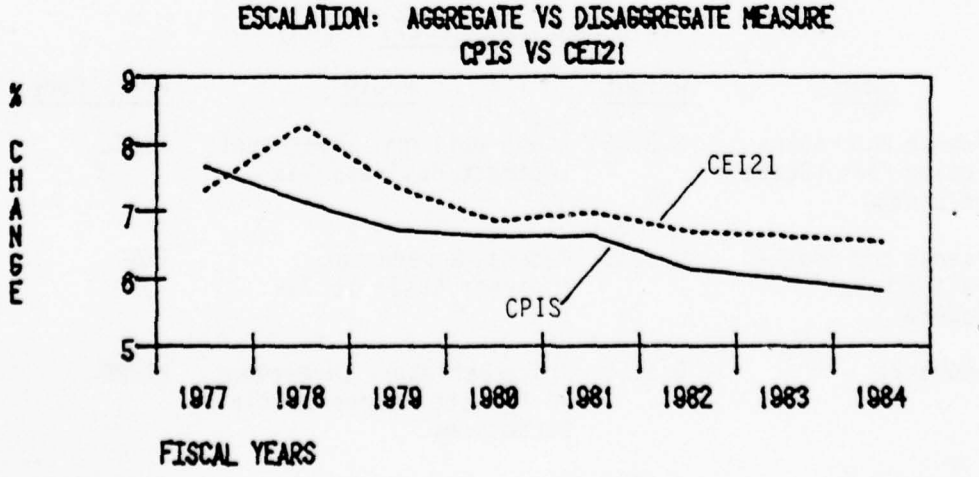
Table 3.2

FORECAST: CEI21
TRAVEL AND TRANSPORTATION OF PERSONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
CEI21-TRAV. & TRANSP. OF PERSONS								
TREND	1.000	1.083	1.162	1.242	1.329	1.417	1.511	1.610
%CH	7.3	8.3	7.3	6.9	7.0	6.7	6.6	6.5
CYCLE	1.000	1.074	1.142	1.220	1.313	1.424	1.535	1.634
%CH	7.3	7.4	6.4	6.8	7.6	8.5	7.8	6.4
CEI211-AIR FARES (0.500)								
TREND	1.000	1.067	1.136	1.206	1.281	1.359	1.440	1.524
%CH	6.7	6.7	6.5	6.2	6.2	6.1	5.9	5.8
CYCLE	1.000	1.064	1.130	1.199	1.279	1.384	1.493	1.576
%CH	6.7	6.4	6.2	6.0	6.7	8.2	7.9	5.5
CEI212-PER DIEM (0.500)								
TREND	1.000	1.099	1.189	1.278	1.376	1.476	1.582	1.697
%CH	7.9	9.9	8.2	7.5	7.7	7.2	7.2	7.2
CYCLE	1.000	1.083	1.154	1.242	1.347	1.464	1.578	1.693
%CH	7.9	8.3	6.6	7.6	8.4	8.7	7.8	7.3
CEI2121-HOTEL/MOTEL ROOM (0.667)								
TREND	1.000	1.111	1.200	1.284	1.375	1.468	1.566	1.671
%CH	8.4	11.1	8.0	7.0	7.1	6.7	6.7	6.7
CYCLE	1.000	1.087	1.149	1.229	1.319	1.415	1.513	1.615
%CH	8.4	8.7	5.7	7.0	7.3	7.2	6.9	6.8
CEI2122-MEALS AWAY FROM HOME (0.333)								
TREND	1.000	1.075	1.166	1.266	1.378	1.492	1.614	1.747
%CH	7.1	7.4	8.5	8.6	8.9	8.2	8.2	8.2
CYCLE	1.000	1.075	1.165	1.268	1.402	1.561	1.708	1.848
%CH	7.1	7.4	8.4	8.8	10.6	11.3	9.4	8.2

NOTE: WEIGHTS GIVEN IN BRACKETS FOR 3-DIGIT CEI'S SUM TO ONE.
WEIGHTS GIVEN IN PARENTHESES FOR 4-DIGIT CEI'S SUM TO ONE

Figure 3.4



CEI22 - Transportation of Things

The CEI for this EOE category is a composite of four subindexes: CEI221 (Truck Freight), CEI222 (Rail Freight), CEI223 (Parcel Post), and CEI224 (Air Freight). The specification of this index including aggregation weights is:

CEI22 - Transportation of Things

CEI221 - Truck Freight (0.780)
CEI222 - Rail Freight (0.140)
CEI223 - Parcel Post (0.040)
CEI224 - Air Freight (0.040)

These subindexes are considered below in sequence.

CEI221 - Truck Freight

Truck freight rates are largely based on operating costs of the trucking industry. The Interstate Commerce Commission (ICC) has usually permitted truck freight rate adjustments when operating ratios have increased beyond ninety-five percent. (An operating ratio is defined as the ratio of operating expenses to operating revenue.) In addition, the ICC is considering the possibility of exempting the transport of military goods from regulated tariffs. Under this condition, increases in freight rate costs would probably be translated into increased freight rates very rapidly. For the above reasons, a comprehensive model of truck transport operating costs was developed.

CEI221 has three general arguments: fixed cost, variable material cost, and variable labor cost. As a percent of total cost, these are weighted 27%, 40%, and 33%, respectively. Within each cost argument, variables from DRI Cost Forecasting and Macro Models proxy specific fixed and variable cost items. These cost items, their proxies, and weights are as presented in Table 3.3.

Table 3.3

COST SPECIFICATION:
TRUCK FREIGHT (CEI221)

Fixed Cost (0.27)

Item	Weight	Proxy	Proxy Code
License and registration fees (State and Local)	0.3033	State and Local Government Indirect Business Tax	TXGSL
License and registration fees (Federal)	0.3033	Federal Government Indirect Business Tax	TXGF
Insurance	0.1150	Price Deflator, Investment in Private Nonresidential Structures	PICNR
Superintendance	0.2717	Index of Hourly Earnings of Production Workers, Total Private Nonfarm	JAHEADJEA

Table 3.3 (cont'd.)

Variable Material Costs (0.40)

Item	Weight	Proxy	Proxy Code
Fuel	0.70	Wholesale Price Index, Fuels and Related Products, and Power	WPI05
Tires	0.10	Wholesale Price Index, Tires	WPI071201NS
Trucks	0.10	Wholesale Price Index, Trucks	WPI141102NS
Insurance (cargo)	0.10	Wholesale Price Index, Industrial Commodities	WPIIND

Variable Labor Costs (0.33)

Item	Weight	Proxy	Proxy Code
Trucking	0.50	Average Hourly Earnings, Trucking	AHE421NS
Warehousing	0.50	Average Hourly Earnings, Warehousing	AHE422NS

CEI222 - Rail Freight

Cost escalation in this subindex is proxied by a model for LRTTL (a BLS total rail rate index). Using data in percent change form, the model was developed by regressing LRTTL on a cost element (COSTLRTTL) and a market element (QGNP72). Two dummy variables (DUMLRTTL1 and DUMLRTTL2) were also included to explain irregular price changes during and immediately following price controls. The cost and market elements, their components, and relevant weights are listed in Table 3.4.

Table 3.4

COST ELEMENT (COSTLRTTL)
RAIL FREIGHT (CEI222)

Variable	Code	Weight
Index of Hourly Earnings of Production Workers, Total Private Nonfarm	JAHEADJEA	0.500
Wholesale Price Index, Fuels and Related Products, and Power	WPI05	0.202
Wholesale Price Index, Industrial Chemicals	WPI061NS	0.010
Wholesale Price Index, Tires	WPI071201NS	0.005
Wholesale Price Index, Rubber Belts	WPI071303NS	0.010
Wholesale Price Index, Lumber and Wood Products	WPI08	0.050
Wholesale Price Index, Paper, Wood Bond	WPI09130131NS	0.010
Wholesale Price Index, Steel Mill Products	WPI1013NS	0.135
Wholesale Price Index, Foundry Shop Products	WPI1015NS	0.037
Wholesale Price Index, Ball and Roller Bearings	WPI114905NS	0.005
Wholesale Price Index, Electrical Machinery and Equipment	WPI117NS	0.036

Market Element (QGNP72)

Variable	Code	Weight
Gross National Product, 1972 Dollars	GNP72	1.000

In the actual forecasting model, each of these explanatory elements is divided into two components: large versus small cost increases and strong versus weak demand. Although the components enter one at a time, the large cost increases and strong demand pressure components each have regression coefficients that differ from their respective counterparts.

CEI223 - Parcel Post

The CEI for this subindex is proxied by CPI23212399NS@099 (Consumer Price Index, Residential Postage Rates). This measure includes mail going by first class, air mail, fourth class, and parcel post. As one might expect, the historical series shows very little movement on a percent change basis since postal rate increases occur at sporadic intervals. The regulatory nature of the U.S. Postal Service is the cause of this atypical price movement.

XCOST is a cost measure which is devised to account for the regulatory process. The first step in constructing XCOST is to specify an equation that would adequately represent those inputs which most affect postage rates. The basic cost measure is called COST and is specified in Table 3.5.

Table 3.5

COST MEASURE (COST)
PARCEL POST (CEI223)

Variable	Code	Weight
Average Hourly Earnings, Postal Service	AHEPOST	0.700
Cost Escalation Index, Air Fares	CEI211	0.024
Cost Escalation Index, Truck Freight	CEI221	0.215
Cost Escalation Index, Rail Freight	CEI222	0.061

This specification reflects the fact that the postal service is highly labor-intensive (weight of 0.7 on AHEPOST). AHEPOST (modeled specifically for use in this CEI) is discussed in detail in the Technical Appendix. The weighting scheme is derived from information supplied by the U.S. Postal Service.

The cost measure is built on the theory that the Postal Service is allowed rate increases which are based on the percentage increase in costs that have occurred since the last rate hike. Further, rate increases, which occur in several consecutive periods, are presumed to reflect the fact that the entire cost increase is not translated into a rate increase in period one. Therefore, in period two not only is the actual cost increase recouped, but also the difference between costs in period one and the postal rate in period one. This theoretical construct is then translated into a special type of dummy cost variable, XCOST. In effect, XCOST allows costs to build up to a critical level before a rate increase is permitted.

CEI224 - Air Freight

This CEI is proxied by a cost buildup model designed to reflect the operating and maintenance costs intrinsic to the air cargo industry. As is the case with all cost buildup models, it is assumed that cost increases are passed through within a short period of time. Information published by the Civil Aeronatics Board (CAB) indicates that this assumption is valid. The CAB also provided information required to specify the costs involved. Accordingly, this cost build-up model contains two cost elements: 1) operating cost, and 2) maintenance cost. Each of these is defined and weighted as presented below in Table 3.6.

Table 3.6

COST SPECIFICATION:
AIR FREIGHT (CEI224)

Operating Cost

Item	Weight	Proxy	Proxy Code
Equipment Rentals	0.044	Rental Price of Capital, Equipment	IPDENRCOSTNET
Flight Crew and Superintendence	0.266	Index of Compensation per Man-hour, Nonfarm Business Sector	JRWSSNF
Insurance	0.007	Implicit Price Deflator, Investment, Private Nonresidential Structures	PICNR
Fuel	0.422	Wholesale Price Index, Fuels and Related Products, and Power	WPI05

Maintenance Cost

Item	Weight	Proxy	Proxy Code
Repair and Maintenance	0.047	Average Hourly Earnings, Electrical Machinery	AHE36NS
Repair and Maintenance Labor	0.047	Average Hourly Earnings, Aircraft	AHE372NS
Equipment Rental	0.014	Rental Price of Capital, Equipment	ICNRCOSTNET
Facility Cost	0.014	Rental Price of Capital, Structures	IPDENRCOSTNET

Table 3.6 (cont'd.)

Item	Weight	Proxy	Proxy Code
Administration	0.070	Index of Hourly Earnings of Production Workers, Total Private Nonfarm	JAHEADJEA
Rubber and Plastic Repair Parts	0.010	Wholesale Price Index, Rubber and Plastic Products	WPI07
Iron and Steel Repair Parts	0.010	Wholesale Price Index, Iron and Steel	WPI101NS
Structural Aluminum Repair Parts	0.010	Wholesale Price Index, Mill Shapes	WPI1025NS
Sheet Aluminum Repair Parts	0.010	Wholesale Price Index, Aluminum Sheet, Heat-treatable	WPI10250102NS
Electronic Repair Parts	0.010	Wholesale Price Index, Electronic Components	WPI1178NS
General Supplies	0.019	Wholesale Price Index by Stages of Processing, Supplies for Manufacturing Industries	WPISOP2610NS

Forecasts for CEI22

The forecasts for CEI22 and its component subindexes are given in Table 3.7. The Trend forecasts indicate that all four base indexes generally exhibit above-average inflation through the forecast period. Consequently, annual inflation rates in the major EOE category are expected to hover around 9% or 10% through 1981 and around 8% for the 1982 through 1984 period. The reason for this inflation stems from the relative importance of the rapidly escalating fuel and energy costs in each of the subindexes. (Detailed forecasts of each subindex are presented in the Technical Appendix.)

Cycle-like conditions push the interval escalation rate for CEI22 up to a 9.9% pace. The annual pattern of change sees rates of increase in fiscal 1980 and 1981 of 11% and 11.9%, respectively — approximately 2 percentage points above the Trend values in these years. Further examination of Table 3.7 indicates that the escalation behavior of CEI22 is forced by strong increases across all of its constituent three-digit categories. Though there are differences in degree, the strong escalation in each of the included transport modes is forced by sizable pressure on operating cost of rising labor costs and fuel prices. (See the Technical Appendix for more detailed forecasts.)

Table 3.7

FORECAST: CEI22
TRANSPORTATION OF THINGS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
CEI22-TRANSP. OF THINGS								
TREND	1.000	1.084	1.192	1.318	1.448	1.566	1.693	1.825
%CH	9.0	8.4	10.0	10.5	9.9	8.1	8.1	7.8
CYCLE	1.000	1.087	1.198	1.329	1.487	1.638	1.784	1.946
%CH	9.0	8.7	10.2	11.0	11.9	10.2	8.9	9.1
CEI221-TRUCK FREIGHT (0.780)								
TREND	1.000	1.088	1.199	1.328	1.462	1.572	1.690	1.812
%CH	9.5	8.8	10.3	10.7	10.1	7.5	7.5	7.2
CYCLE	1.000	1.091	1.205	1.338	1.502	1.653	1.789	1.929
%CH	9.5	9.1	10.5	11.0	12.2	10.1	8.2	7.8
CEI222-RAIL FREIGHT (0.140)								
TREND	1.000	1.064	1.157	1.262	1.392	1.539	1.708	1.892
%CH	6.8	6.4	8.8	9.1	10.3	10.5	11.0	10.8
CYCLE	1.000	1.067	1.166	1.284	1.433	1.568	1.765	2.058
%CH	6.8	6.7	9.3	10.2	11.5	9.5	12.6	16.6
CEI223-PARCEL POST (0.040)								
TREND	1.000	1.072	1.175	1.325	1.387	1.571	1.716	1.862
%CH	7.6	7.2	9.6	12.8	4.6	13.3	9.2	8.5
CYCLE	1.000	1.073	1.177	1.326	1.391	1.584	1.750	1.916
%CH	7.6	7.3	9.7	12.6	4.9	13.9	10.5	9.5
CEI224-AIR FREIGHT (0.040)								
TREND	1.000	1.089	1.191	1.309	1.436	1.546	1.664	1.788
%CH	10.1	8.9	9.4	9.9	9.7	7.6	7.7	7.4
CYCLE	1.000	1.091	1.194	1.314	1.474	1.640	1.786	1.928
%CH	10.1	9.0	9.5	10.1	12.1	11.3	8.9	8.0

NOTE: WEIGHTS GIVEN IN BRACKETS FOR 3-DIGIT CEI'S SUM TO ONE.

CEI23 - Rents, Communication, and Purchased Utilities

As the title may suggest, this CEI is an aggregation constructed from CEI's for three-digit EOE categories: CEI231 – Rents, CEI232 – Communication, and CEI233 – Purchased Utilities. In turn, each of these three-digit CEI's is also an aggregation from a series of four-digit commodity-specific "base models." The formal structure (aggregation weights in parentheses) for the complete two-digit EOE category is as follows:

CEI23 - Rents, Communication, and Purchased Utilities

CEI231 - Rents (0.315)

CEI2311 - Rent for Structures (0.50)
CEI2312 - Rent for Equipment (0.50)

CEI232 - Communication (0.295)

CEI2321 - Telephone (0.95)
CEI2322 - Mail (0.05)

CEI233 - Purchased Utilities (0.390)

CEI2331 - Water and Sewerage (0.10)
CEI2332 - Gas (0.45)
CEI2333 - Electricity (0.45)

The weights for the three-digit categories are based on Army-specific Budget experience. The weights for the four-digit categories are estimates based on typical industry experience.

We turn now to an examination of the character of each of these sub-indexes:

CEI231 - Rents

CEI2311 - Rent for Structures

Escalation in this budget subcomponent is proxied by the variable ICNRCOST, a measure of the rental price of nonresidential structures. The equation that generates ICNRCOST is of standard economic form for a rental price equation, incorporating four essential arguments: the average dollar cost of capital structures, an adjustment for the effect of taxation, a measure of price inflation for nonresidential structures, and a measure of depreciation. The precise specification is as follows:

```
ICNRCOST = PICNR*(DELTAICNR72 + COSTCAPA*.01*
           (1 - RTCGFS*ICNRDPNDIS)/(1 - RTCGFS)
```

where:

PICNR = Implicit Price Deflator, Investment in Private Nonresidential Structures

DELTAICNR72 = Depreciation Rate on Producers Real Capital, Nonresidential Structures

COSTCAPA = Average Cost of Capital after Taxes

RTCGFS = Statutory Corporate Tax Rate

ICNRDPNDIS = Present Value of One Dollar Depreciation, Expenditures for Nonresidential Structures

CEI2312 - Rent for Equipment

Escalation in this budget subcomponent is proxied by the variable IPDENRCOST, a measure of the rental price of producers durable equipment. The specification of the equation that generates it is of the same general form as that for structures save for the inclusion of a term to adjust for the influence of the Federal Investment Tax Credit. The precise specification is as follows:

```
IPDENRCOST = PIPDENR*(DELTAIPDENR72 + COSTCAPA*.01)*
             (1 - RTCGFS*IPDENRDPNDIS - RITC +
             DMYLONGAMENDMENT*RTCGFS*IPDENRDPNDIS*
             RITC)/(1 - RTCGFS)
```

where:

PIPDENR = Implicit Price Deflator, Nonresidential Producers Durable Equipment

DELTAIPDENR72 = Depreciation Rate on Producers Real Equipment Expenditures

COSTCAPA = Average Cost of Capital after Taxes

RTCGFS = Statutory Corporate Tax Rate

IPDENRDPNDIS = Present Value of One Dollar Depreciation for Nonresidential Investment in Producers Durable Equipment

RITC = Effective Rate of the Investment Tax Credit

DMYLONGAMENDMENT = Dummy Variable for 'Long Amendment' to Investment Tax Credit

CEI232 - Communication

CEI2321 - Telephone

Extensive historical analysis indicated to us that the best proxy (for escalation in this category) among existing forecasted time series was the CPI for services (CPIS). Of course, we do not pretend that this measure will pick up as accurately ecalation in this budget area as a more structurally specific model, but it should provide an adequate measure of future escalation in telephone and communications costs.

CEI2322 - Mail

The specification of this index is identical with CEI223 but to assist the reader, it is presented again in Table 3.8.

Table 3.8

COST MEASURE (COST)
MAIL (CEI2322)

Variable	Code	Weight
Average Hourly Earnings, Postal Service	AHEPOST	0.700
Cost Escalation Index, Air Fares	CEI211	0.024
Cost Escalation Index, Truck Freight	CEI221	0.215
Cost Escalation Index, Rail Freight	CEI222	0.061

CEI233 - Purchased Utilities

CEI2331 - Water and Sewerage

The index chosen as a proxy for this subcomponent category is the CPI for Residential Water and Sewerage (CPI22311259NS@099). The estimation of a forecasting model for this index involves the specification of the appropriate operating costs which influence water and sewerage rates. Information gathered from the Bureau of Labor Statistics, the American Water Works Association, and the Input-Output Structure of the U.S. Economy indicated the major inputs used and their weights as a percent of total cost. The resulting estimating equations include a labor cost variable based on a forecasting model for average hourly earnings in Water and Sanitary Systems (AHE498NS) (see the Appendix for more details on the equation); a materials cost variable (COST2331) composed of proxies chosen from among series forecasted by the DRI Macro Model

and the Cost Forecasting Model; and two sets of dummy variables to account for price controls in the 1971:4-1972:4 and 1973:3-1973:4 periods.

The estimated index picks up the turning points with reasonable accuracy and estimates yearly percentage changes in CPI22311259NS very closely. A detailed specification of this model including regression results is presented in the Technical Appendix.

CEI2332 - Natural Gas

Escalation in this subcomponent is proxied by the movement of the Marginal Industrial Price of Natural Gas as forecast by the DRI Energy Service. The mathematical details of the underlying Energy Service models are too extensive to examine in detail in this report. However, in general, the natural gas forecasts incorporate the most timely estimates of known and future reserves, demands by major users, and the likely impact of past and impending energy policy. For more details on the models that generate this forecast, see the most current DRI Energy Service Review.

CEI2333 - Electricity

Escalation in this category is proxied by the movement of the Marginal Industrial Price of Electricity as forecast by the DRI Energy Service. Similar factors as those influencing natural gas prices are embodied in the models. For more details on the models that generate this forecast, see the most current DRI Energy Service Review.

Forecasts for CEI23 and its Components

Trend forecasts for CEI23 and its components are presented in Table 3.9 below. In this forecast we find CEI23 increasing at a 7.7% CAR over the forecast period. The pattern of annual change is similar to that discussed for CEI21 with the greatest rate of escalation occuring in 1980 and 1981 and dampening significantly after that time. The behavior of this two-digit index tends to reflect the escalation behavior of its several components. A particularly strong upward influence is being exerted by escalation in the three-digit component CEI233 – Purchased Utilities; which, in turn, reflects very strong forecasted escalation in CEI2331 – Water and Sewerage Rates, and CEI2332 – Natural Gas. The behavior of the former is largely explained by the large and increasing burden of debt service costs associated with new Federally-required water treatment facilities. The increases in the latter reflect the strong upward pressure on natural gas prices exerted by an ever-dwindling supply, exacerbated by current government energy policy, relative to an ever-increasing demand. Figure 3.5 presents comparison plots of the components of CEI23 with forecasts for more aggregative escalation measures.

Table 3.9

FORECAST: CE123
RENTS, COMMUNICATIONS, AND UTILITIES
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
CE123-RENTS, COMMUN., & UTILITIES								
TREND	1.000	1.118	1.189	1.294	1.407	1.508	1.624	1.739
%CH	12.2	11.8	6.4	8.9	8.7	7.1	7.7	7.1
CYCLE	1.000	1.120	1.195	1.304	1.454	1.621	1.760	1.890
%CH	12.2	12.0	6.7	9.1	11.5	11.4	8.6	7.4
CE1231-RENTS (0.315)								
TREND	1.000	1.126	1.139	1.209	1.311	1.370	1.436	1.508
%CH	8.7	12.6	1.1	6.2	8.4	4.5	4.8	5.0
CYCLE	1.000	1.126	1.139	1.215	1.369	1.517	1.573	1.636
%CH	8.7	12.6	1.1	6.7	12.7	10.8	3.7	4.0
CE12311-STRUCTURES (0.500)								
TREND	1.000	1.137	1.137	1.227	1.353	1.420	1.494	1.576
%CH	10.0	13.7	0.1	7.9	10.2	5.0	5.2	5.5
CYCLE	1.000	1.137	1.138	1.235	1.434	1.617	1.659	1.721
%CH	10.0	13.7	0.1	8.5	16.1	12.7	2.6	3.7
CE12312-EQUIPMENT (0.500)								
TREND	1.000	1.115	1.140	1.192	1.270	1.321	1.379	1.440
%CH	7.5	11.5	2.2	4.6	6.5	4.0	4.4	4.5
CYCLE	1.000	1.115	1.140	1.195	1.304	1.417	1.487	1.552
%CH	7.5	11.5	2.2	4.8	9.1	8.7	4.9	4.4
CE1232-COMMUNICATIONS (0.295)								
TREND	1.000	1.071	1.145	1.224	1.304	1.389	1.475	1.563
%CH	7.7	7.1	6.9	6.9	6.5	6.5	6.2	6.0
CYCLE	1.000	1.071	1.145	1.225	1.310	1.411	1.515	1.614
%CH	7.7	7.1	6.9	7.0	6.9	7.8	7.4	6.5
CE12321-TELEPHONE (0.950)								
TREND	1.000	1.071	1.143	1.219	1.300	1.380	1.462	1.547
%CH	7.7	7.1	6.7	6.6	6.6	6.1	6.0	5.8
CYCLE	1.000	1.071	1.143	1.219	1.305	1.402	1.503	1.598
%CH	7.7	7.1	6.7	6.7	7.1	7.4	7.2	6.3
CE12322-MAIL (0.050)								
TREND	1.000	1.072	1.175	1.325	1.387	1.571	1.716	1.862
%CH	7.6	7.2	9.6	12.8	4.6	13.3	9.2	8.5
CYCLE	1.000	1.073	1.177	1.326	1.391	1.584	1.750	1.916
%CH	7.6	7.3	9.7	12.6	4.9	13.9	10.5	9.5
CE1233-PURCHASED UTILITIES (0.390)								
TREND	1.000	1.147	1.263	1.416	1.563	1.709	1.888	2.059
%CH	19.0	14.7	10.2	12.1	10.4	9.3	10.5	9.0
CYCLE	1.000	1.153	1.279	1.436	1.633	1.864	2.095	2.304
%CH	19.0	15.3	11.0	12.3	13.7	14.1	12.4	10.0
CE12331-WATER & SEWERAGE (0.100)								
TREND	1.000	1.115	1.223	1.331	1.453	1.588	1.719	1.833
%CH	10.8	11.5	9.6	8.9	9.2	9.3	8.2	6.7
CYCLE	1.000	1.123	1.279	1.393	1.522	1.670	1.823	1.954
%CH	10.8	12.3	13.9	8.9	9.2	9.7	9.1	7.2

Table 3.9 (cont'd.)

CEI2332-GAS (0.450)

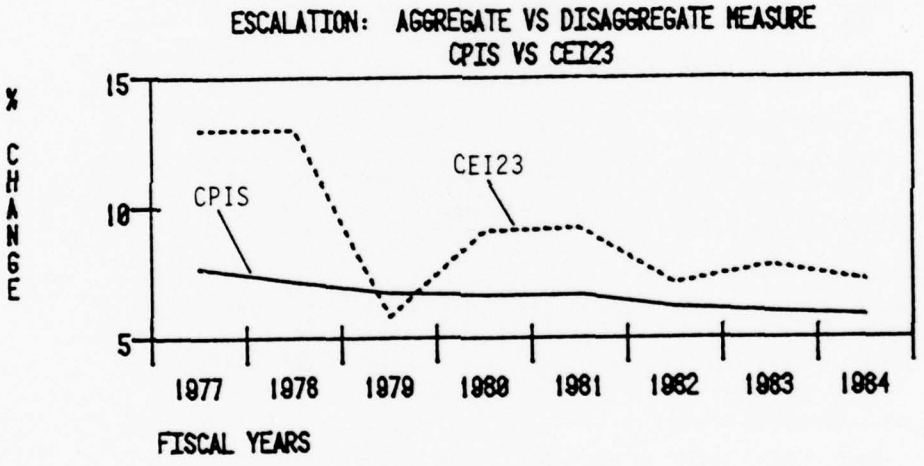
TREND	1.000	1.175	1.345	1.569	1.768	1.965	2.188	2.419
%CH	32.9	17.5	14.4	16.7	12.7	11.1	11.4	10.6
CYCLE	1.000	1.181	1.357	1.587	1.846	2.150	2.438	2.720
%CH	32.9	18.1	14.9	16.9	16.4	16.4	13.4	11.6

CEI2333-ELECTRICITY (0.450)

TREND	1.000	1.125	1.191	1.281	1.383	1.481	1.626	1.748
%CH	9.4	12.5	5.8	7.6	8.0	7.0	9.8	7.5
CYCLE	1.000	1.131	1.201	1.295	1.444	1.620	1.812	1.965
%CH	9.4	13.1	6.2	7.8	11.5	12.2	11.8	8.5

NOTE: WEIGHTS GIVEN IN BRACKETS FOR 3-DIGIT CEI'S SUM TO ONE.
WEIGHTS GIVEN IN PARENTHESES FOR EACH GROUP OF 4-DIGIT CEI'S SUM TO ONE.

Figure 3.5



The results of the Cycle alternative are also presented in Table 3.9. As shown, this alternative produces escalation above Trend values in each year in the interval but the most pronounced acceleration over the Trend solution occurs in fiscal 1981 and 1982. Of the several component CEI's that make up CEI23, those whose escalation is most sensitive to more Cycle-like macroeconomic conditions are CEI231 – Rents (and its components), CEI2332 – Gas, and CEI2333 – Electricity.

CEI24 Printing and Reproduction

The method employed in constructing this CEI was to build a series which would reflect the costs of the printing and publishing sector where these costs will ultimately be manifest as a change in price. The CPI and the AHE had to be modeled specifically for this CEI and parts of those, in turn, had to be newly modeled. The details of all of the new models along with the relevant statistics are given in the Technical Appendix. The sectors of the printing and publishing industry which are included in this CEI are: newspapers, periodicals, book publishing, book printing, and miscellaneous publishing. Information regarding the proper weights to assign to each of the variables was gathered from two sources: 1972 Census of Manufactures Industry Series, Newspapers, Books and Miscellaneous Publishing; and U.S. Industrial Outlook - 1976.

The specification of CEI24 is presented in Table 3.10.

Table 3.10

INPUT SPECIFICATION OF
PRINTING AND REPRODUCTION (CEI24)

Item	Weight	Proxy	Code
Paper	0.49	Wholesale Price Index, Paper	WPI09130131NS
Machinery	0.16	Wholesale Price Index, Special Industrial Machinery	WPI116NS
Inks and Chemicals	0.10	Wholesale Price Index, Industrial Chemicals	WPI061NS
Labor	0.25	Average Hourly Earnings, Printing and Publishing	AHE27NS

Forecast for CEI24

Table 3.11 presents both the Trend and the Cycle forecasts for this CEI. Under Trend assumptions, see this CEI escalating at a moderate 5.2% to 5.3% pace in fiscal 1977 and 1978, but beginning in 1979 there is a marked acceleration that increases escalation in this CEI by over 2.5 percentage points by 1981, when the forecast escalation is 7.8% per annum. Though there is some moderation, annual escalation remains above 7% for the remaining years in the interval. All included cost elements contribute to this pattern of escalation behavior; however, the strongest impact is generated by the 8%-plus annual pace posted over the interval by the paper price index WPI09130131NS.

CYCLELONG assumptions amplify the trend pattern moderately with the largest annual increase of 10.2% occurring in fiscal 1982.

Table 3.11

FORECAST: CE124
PRINTING AND REPRODUCTION
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
CE124-PRINTING & REPRODUCTION								
TREND	1.000	1.053	1.118	1.200	1.293	1.388	1.486	1.593
%CH	5.2	5.3	6.1	7.4	7.8	7.3	7.1	7.2
CYCLE	1.000	1.055	1.124	1.206	1.305	1.438	1.548	1.654
%CH	5.2	5.5	6.5	7.3	8.2	10.2	7.7	6.9

CEI25 - Other Services

CEI25 is an aggregation of several detailed indexes. There are 3 three-digit components; these include: CEI251 – Purchased Equipment Maintenance, CEI252 – Purchased ADP Maintenance, and CEI257 – Other Purchased Services. Of these, CEI251 and CEI257 are broken down further to several four-digit commodity-specific CEI's. The formal structure is as follows:

CEI25 - Other Services

- CEI251 - Purchased Equipment Maintenance (0.282)
  - CEI2511 - Aircraft Maintenance (0.367)
  - CEI2512 - Missile Maintenance (0.150)
  - CEI2513 - Combat Vehicle Maintenance (0.324)
  - CEI2514 - Ship Maintenance (0.010)
  - CEI2515 - Electronic/Communications (0.149)
- CEI252 - ADP Maintenance (0.017)
- CEI257 - Other Purchased Services (0.701)
  - CEI2571 - Base and Facility Maintenance (0.15)
  - CEI2572 - Management and Operation Research Studies (0.05)
  - CEI2573 - Other Contractual Services (0.80)

The aggregation weights used are based on Army budget data. Consider now the character of each of these component indexes.

CEI251 - Purchased Equipment Maintenance

Each equipment category included here has been broken down into three maintenance cost categories: direct material costs, direct labor costs, and overhead costs. The weights for each cost category in each equipment category are obtained from Army financial records. Detail within the overhead cost term is also taken from Army financial records. As was pointed out in Chapter 2, material and labor detail is developed from data found in the DRI-Army Procurement Study. The specifications in this study as to types and weights of material and labor are for construction of the equipment, not its maintenance. Yet, this presents few problems since the general types of materials and labor used in various maintenance acts will be very similar. Our investigation determined that the weights of different materials varied considerably from task to task and also from year to year. Due to this likely variability, a flexible forecast procedure is used which, in effect, picks as extremes the highest and the lowest escalation of material cost likely out of all possible weighting schemes for the included materials in order to determine the sensitivity of the forecast to variable weighting factors.

CEI2511 - Aircraft Maintenance

The specifications for the material and labor cost elements of this model are based on composition data for two rotary wing aircraft (the NTTAS and the AAH) and a general aircraft category. The specification for the overhead cost term uses proxies for common overhead categories found in Army (DARCOM) resource management reports for each equipment type. Weights for each cost element in CEI2511 were obtained from the same Army report. The specification is presented in Table 3.12 below.

Table 3.12

MAINTENANCE COST SPECIFICATION:
AIRCRAFT MAINTENANCE (CEI2511)

Material Cost (0.371)

Item	Code
Steel Mill Products	WPI1013NS
Titanium Mill Shapes	WPI102505NS
Foundry Shop Products	WPI1015NS
Internal Combustion Engines	WPI1194NS
Aluminum Sheet, Heat-Treatable	WPI10250102NS
Electronic Components	WPI1178NS
Ammunition	WPI151302NS
Rubber	WPI07
Industrial Material Handling Equipment	WPI1144NS
Bolts, Nuts, Screws, Rivets	WPI1081NS
Plastic Products	WPI072NS
Nonferrous Mill Shapes	WPI1025NS
Iron and Steel	WPI101NS

Labor Cost (0.249)

Item	Code
Average Hourly Earnings, Aircraft Production	AHE3721NS
Average Hourly Earnings, Aircraft Parts Production	AHE372NS
Average Hourly Earnings, Electrical Machinery Production	AHE36NS

Table 3.12 (cont'd.)

Overhead (0.358)

Category	Subcategory	Proxy
Indirect Mission (0.631)	Production-Related (0.40)	WPI113NS (0.5) WPISOP2620NS (0.5)
	Facilities (0.20)	CEI231
	Indirect Labor (0.40)	JRWSSNF
Indirect Base Operation (0.243)	Facilities (0.25)	CEI231
	Indirect Labor (0.50)	JRWSSNF
	Utilities (0.25)	CEI233
Administration (0.126)	Indirect Labor (0.80)	JRWSSNF
	Communication and Travel (0.10)	CEI21 (0.2) CEI232 (0.8)
	Supplies (0.10)	WPISOP2610NS

CEI2512 - Missile Maintenance

The specifications for the material and labor cost for this index are derived from Army data sources. The specification of the overhead vector includes the same items found in the other equipment categories, but the weights of the three basic overhead categories are different. Model details are as presented in Table 3.13.

Table 3.13

MAINTENANCE COST SPECIFICATION:
MISSILE MAINTENANCE (CEI2512)

Material Cost (0.231)

Item	Code
Electronic Components	WPI1178NS
Aluminum Sheet, Heat-Treatable	WPI10250102NS
Mill Shapes	WPI1025NS
Steel Mill Products	WPI1013NS
Special Industrial Machinery	WPI116NS
Industrial Chemicals	WPI061NS

Labor Cost (0.375)

Item	Code
Average Hourly Earnings, Completed Guided Missiles	AHE1925NS
Average Hourly Earnings, Electrical Machinery Production	AHE36NS

Table 3.13 (cont'd.)

Overhead (0.394)

Item	Subcategory	Proxy
Indirect Mission (0.594)	(specification identical to 2511)	
Indirect Base Operation (0.231)	(specification identical to 2511)	
Administration (0.175)	(specification identical to 2511)	

CEI2513 - Combat Vehicles

The specifications for the material and labor cost elements of this model are based on composition data for three tracked combat vehicles: the M60 and XM1 tanks, and the Armored Personnel Carrier. The specifications of the subcategories of the overhead cost element is the same as in the aircraft model. The complete specification is as presented in Table 3.14.

Table 3.14

MAINTENANCE COST SPECIFICATION:
COMBAT VEHICLES (CEI2513)

Material Cost (0.388)

Item	Code
Internal Combustion Engines	WPI1194NS
Industrial Material Handling Equipment	WPI1144NS
Foundry Shop Products	WPI1015NS
Aluminum Extrusions	WPI10250117NS
Hardware	WPI104NS
Integrating and Measuring Instruments	WPI117202NS
Rubber and Plastic Products	WPI07
Carbon Plates	WPI10130246NS
Pumps and Compressors	WPI1141NS
Mill Shapes	WPI1025NS
Machinery and Equipment	WPI11

Labor Cost (0.291)

Average Hourly Earnings, Transportation Equipment Production	AHE37NS

Table 3.14 (con't)

Overhead Cost (0.321)

Item	Subcategory	Proxy
Indirect Mission (0.595)	(specification identical to 2511)	
Indirect Base Operation (0.209)	(specification identical to 2511)	
Administration (0.196)	(specification identical to 2511)	

CEI2514 - Ship Repair and Maintenance

The specification of this model is developed from precise information on ship composition gained from both military and nonmilitary sources. The precise specification is presented in Table 3.15.

Table 3.15

MAINTENANCE COST SPECIFICATION:
SHIP REPAIR (CEI2514)

Material Cost (0.333)

Item	Proxy Code
Carbon Plates	WPI10130246NS
Wire and Cable	WPI1026NS
Switchgear, Switchboards, and Equipment	WPI1175NS
Plumbing Fixtures	WPI105NS
Pumps	WPI114102NS
Paint	WPI0621NS
Industrial Material Handling Equipment	WPI1144NS
Fuels and Lubricants	WPI05
Miscellaneous Manufacturing Supplies	WPISOP2610NS

Labor Cost (0.334)

Item	Proxy Code
Average Hourly Earnings in Shipbuilding and Repairing	AHE3731NS

Overhead (0.333)

Category	Subcategory	Proxy
Indirect Mission (0.631)	(Specification identical to 2511)	
Indirect Base Operation (0.243)	(Specification identical to 2511)	
Administration (0.126)	(Specification identical to 2511)	

CEI2515 - Communications and Electronic Equipment Maintenance

The specification of this model is developed from general knowledge gained from Army sources. What is included in the specification are several items judged to be of importance in repair of this type of equipment. The specification is presented below in Table 3.16.

Table 3.16

MAINTENANCE COST SPECIFICATION:
COMMUNICATIONS AND ELECTRONICS (CEI2515)

Material Cost (0.218)

Item	Code
Wiring Devices	WPI1171NS
Electronic Components	WPI1170NS
Integrating and Measuring Equipment	WPI1172NS
Transformers and Power Regulators	WPI1174NS
Switchgear, Switchboards, and Equipment	WPI1175NS

Labor Cost (0.42)

Item	Code
Average Hourly Earnings, Electrical Machinery	AHE36NS

Overhead (0.362)

Category	Subcategory	Proxy
Indirect Mission (0.583)	(Specification identical to 2511)	
Indirect Base Operations (0.226)	(Specification identical to 2511)	
Administration (0.191)	(Specification identical to 2511)	

CEI252 - Purchased ADP Maintenance

This cost escalation index is proxied by a cost buildup model which reflects the ADP industry's costs of providing maintenance and repair services. By identifying the relevant costs involved and knowing that future price increases mirror cost increases, an accurate forecast of price activity can be generated.

A phone survey of ADP maintenance vendors yielded the information that labor cost typically accounts for 80% of total costs and the majority of material costs are for various electronic components. Rather than rely on an aggregate wage index, labor costs are proxied by an earnings series found in a BLS publication: National Survey of Professional, Administrative, Technical, and Clerical Pay. This annual bulletin contains, among other series, salary data for five levels of engineering technicians. Based on the work descriptions given for engineering technicians at each level, the series for Engineering Technicians, Level Four was selected for use in CEI252. Its specification can be found in the Technical Appendix. Table 3.17 presents the detailed cost information for CEI252.

Table 3.17

MAINTENANCE COST SPECIFICATION:
ADP (CEI252)

Variable Labor Costs (0.80)

Item	Weight	Proxy	Proxy Code
Field Engineers	1.000	Annual Salary Index, Engineering Technician, Level Four	ASETIV

Variable Material Costs (0.20)

Item	Weight	Proxy	Proxy Code
Electronic Replacement Parts	0.500	Wholesale Price Index, Electronic Components	WPI1178NS
Electric Motors	0.200	Wholesale Price Index, Electric Motors	WPI11730INS
Replacement Belts	0.100	Wholesale Price Index, Rubber Belts	WPI071303NS
Replacement Bearings	0.200	Wholesale Price Index, Ball and Roller Bearings	WPI114905NS

CEI257 - Other Purchased Services

This CEI is made up of three component indexes: CEI2571 (Base and Facility Maintenance), CEI2572 (Management and Operation Research Studies), and CEI2573 (Other Contractual Services). Good proxies for escalation in each of these categories were developed using several detailed cost buildup models. These models are described in more detail in the following paragraphs.

CEI2571 - Base and Facility Maintenance

Activities included under this component are: routine maintenance, periodic repair, and minor construction of all buildings and other structures. In dollar terms, repair and construction made up approximately 80% of this CEI. To develop a cost buildup model for such a disparate collection of activities, information is gleaned from several DRCFS plant and facility cost indexes under the assumption that materials and labor used in facility construction are also relevant in recurring repair and maintenance jobs. The resulting model contains variable labor and material cost elements: a modified version of the equipment R&M overhead element is also included. Table 3.18 details the costs, their weights, and selected proxies which comprise CEI2571.

Table 3.18

MAINTENANCE COST SPECIFICATION:
BASE AND FACILITY MAINTENANCE (CEI2571)

Variable Labor Costs (0.34)

Item	Weight	Proxy	Proxy Code
Construction Labor	0.800	Average Hourly Earnings, Construction	AHECNS
General Labor	0.200	Index of Hourly Earnings of Production Workers, Total Private Nonfarm	JAHEADJEA

Variable Material Costs (0.33)

Item	Weight	Proxy	Proxy Code
R&M Materials	1.000	Cost Escalation Index, Supplies, GSD	CEI261

Table 3.18 (cont'd)

Overhead Costs (0.33)

Item	Weight	Proxy	Proxy Code
Administration and Superintendence	0.660	Index of Compensation per Man-hour, Nonfarm Business Sector	JRWSSNF
Paper	0.165	Wholesale Price Index, Paper, Wood Bond	WPI09130131NS
Cleaning Materials	0.165	Wholesale Price Index, Miscellaneous Chemical Products and Preparations	WPI0679NS
Personnel Transportation	0.010	Cost Escalation Index, Travel and Transportation of Persons	CEI21

The labor element includes AHECNS and JAHEADJEA with the weights indicated based on the fact that about 80% of facility R&M expenditures is for repair and minor construction and about 20% is general maintenance work. The material element corresponds to Supplies (GSD) rather than some narrower specification due to the wide range of projects included in this expenditure category. The overhead element is designed chiefly to explain administrative costs associated with base and facility R&M, but it also accounts for personnel transfers.

CEI2572 - Management and Operation Research Studies

The cost buildup approach to price escalation is used to model CEI2572. The costs specified in the model represent expenses of conducting research studies. Research and development studies are labor-intensive processes in which computers and business machines add an auxilliary expense. Therefore, labor costs are proxied by JAHEADJEA (Index of Hourly Earnings of Production Workers, Total Private Nonfarm) and given a weight of 0.80 while equipment costs are proxied by IPDENRCOSTNET (Rental Price of Capital Equipment) and given a weight of 0.20. Accordingly, cost escalation is strongly influenced by wage inflation.

CEI2573 - Other Contractual Services

The CEI for this budget component is proxied by a cost buildup model which combines an aggregate wage measure (JRWSSNF) with an aggregate material measure (CEI261). These general coverage variables are required because of the variety of services included under this category: educational services, data processing services, engineering services, logistic support, and miscellaneous services. These services are very labor-intense activities. Estimates of labor cost range from 65% to 75% of total cost. Also, since the labor required here is generally professional in nature, JRWSSNF (Index of Compensation per Man-hour, Nonfarm Business Sector) is the preferred proxy of labor costs and is given a weight of 0.70. Material costs are proxied by CEI261 (Cost Escalation Index, Supplies, GSD), an Army-specific measure of typical items used, and are given a weight of 0.30.

Forecasts for CEI25 and its Components

Table 3.19 presents escalation forecasts by fiscal year under Trend and Cycle assumptions for CEI25 and its component categories. Over the interval (1978 to 1984) CEI25 is forecasted to escalate at a 6.8% pace, somewhat below the rate for the total O&M budget. The annual pattern of change exhibits modest variation from year to year but what variation does occur is consistent with the general pattern of economic activity in the current Trend solution and the DRCFS price forecasts. CEI25 is an aggregation that reflects the escalation behavior of its component parts. For this reason, an examination of the forecasts for the three-digit categories CEI251, CEI252, and CEI257 and their four-digit components reveals the sources of its behavior. We can see immediately that a strong dampening influence on CEI251 is being exerted by the behavior of CEI251, particularly in the last three years of the forecast interval, over which CEI251 never exceeds a 5% to 6% rate of annual increase — well below forecasts for other budget categories. If we go down to the four-digit components of CEI251 we see that three equipment categories — CEI2511 – Aircraft, CEI2512 – Missiles, and CEI2515 – Electronics/Communication — are the sources of this very dampened pattern. Though not explicit here, the reasons for this very atypical behavior are largely explained by the presence in the material specification for maintenance activities on these equipment types of WPI's for several types of electronic components which, in the current CFS forecast, exhibit a very dampened price escalation pattern, consistent with the historical pattern of price escalation for electronic components. The forecasts for the four-digit equipment categories presented in Table 3.19 are generated with material cost specification that gives each included material equal weight. In the instance of the several included electronic components, the equal-weight option may overstate their true dollar importance in the maintenance activity and thus, given their relatively dampened pattern of escalation, understate the true rate of maintenance cost escalation in these four-digit equipment categories. Because of this, the reader should examine the "best and worst" possible escalation forecast alternatives that have been generated for CEI251 and presented at the end of this section.

Table 3.19

FORECAST: CE125
OTHER SERVICES
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
CE125-OTHER SERVICES								
TREND	1.000	1.068	1.141	1.217	1.304	1.392	1.484	1.587
%CH	6.8	6.8	6.9	6.6	7.2	6.8	6.6	6.9
CYCLE	1.000	1.068	1.142	1.221	1.330	1.458	1.560	1.664
%CH	6.8	6.8	7.0	6.9	9.0	9.6	7.0	6.7
CE1251-PURCHASED EQUIP. MAINTENANCE (0.282)								
TREND	1.000	1.071	1.144	1.208	1.285	1.357	1.429	1.511
%CH	6.6	7.1	6.8	5.5	6.4	5.7	5.3	5.7
CYCLE	1.000	1.071	1.144	1.210	1.309	1.432	1.509	1.586
%CH	6.6	7.1	6.9	5.8	8.1	9.4	5.4	5.1
CE12511-AIRCRAFT MAINTENANCE (0.367)								
TREND	1.000	1.062	1.138	1.202	1.278	1.350	1.421	1.504
%CH	5.5	6.2	7.2	5.6	6.3	5.6	5.3	5.8
CYCLE	1.000	1.062	1.139	1.207	1.308	1.432	1.502	1.584
%CH	5.5	6.2	7.3	6.0	8.3	9.5	4.9	5.4
CE12512-MISSILE MAINTENANCE (0.150)								
TREND	1.000	1.077	1.144	1.191	1.260	1.325	1.373	1.440
%CH	7.0	7.7	6.2	4.1	5.8	5.2	3.6	4.9
CYCLE	1.000	1.073	1.135	1.180	1.263	1.384	1.449	1.502
%CH	7.0	7.3	5.9	4.0	7.0	9.5	4.7	3.7
CE12513-COMBAT VEHICLE MAINTENANCE (0.324)								
TREND	1.000	1.077	1.152	1.222	1.304	1.380	1.466	1.553
%CH	7.6	7.7	6.9	6.0	6.7	5.9	6.2	6.0
CYCLE	1.000	1.079	1.155	1.229	1.336	1.457	1.542	1.632
%CH	7.6	7.9	7.1	6.4	8.7	9.1	5.9	5.8
CE12514-SHIP MAINTENANCE (0.010)								
TREND	1.000	1.067	1.139	1.213	1.297	1.376	1.460	1.550
%CH	7.1	6.7	6.7	6.5	7.0	6.1	6.1	6.1
CYCLE	1.000	1.068	1.142	1.218	1.321	1.452	1.547	1.631
%CH	7.1	6.8	6.9	6.6	8.5	9.9	6.5	5.4
CE12515-ELECTRONICS AND COMMUNICATION (0.149)								
TREND	1.000	1.074	1.143	1.208	1.283	1.356	1.426	1.504
%CH	6.6	7.4	6.4	5.7	6.2	5.7	5.2	5.4
CYCLE	1.000	1.074	1.142	1.207	1.299	1.424	1.511	1.573
%CH	6.6	7.4	6.4	5.7	7.6	9.6	6.1	4.1
CE1252-PURCHASED ADP MAINTENANCE (0.017)								
TREND	1.000	1.068	1.137	1.207	1.283	1.362	1.444	1.530
%CH	7.2	6.8	6.4	6.2	6.3	6.2	6.0	6.0
CYCLE	1.000	1.068	1.137	1.208	1.295	1.403	1.498	1.588
%CH	7.2	6.8	6.4	6.3	7.2	8.4	6.8	6.0
CE1257-OTHER PURCHASED SERVICES (0.701)								
TREND	1.000	1.067	1.140	1.221	1.313	1.407	1.508	1.619
%CH	6.9	6.7	6.9	7.0	7.5	7.2	7.1	7.4
CYCLE	1.000	1.067	1.141	1.225	1.340	1.469	1.581	1.697
%CH	6.9	6.6	7.0	7.4	9.3	9.7	7.6	7.3

Table 3.19 (cont'd)

	1977	1978	1979	1980	1981	1982	1983	1984
CEI2571-BASE & FACILITY MAINTENANCE (0.150)								
TREND	1.000	1.054	1.118	1.194	1.280	1.368	1.461	1.566
%CH	5.0	5.4	6.1	6.7	7.2	6.9	6.8	7.1
CYCLE	1.000	1.056	1.126	1.205	1.315	1.439	1.544	1.653
%CH	5.0	5.6	6.6	7.1	9.1	9.4	7.3	7.1
CEI2572-MNGMT. & OPER. RES. STUDIES (0.050)								
TREND	1.000	1.085	1.151	1.226	1.314	1.402	1.494	1.591
%CH	7.2	8.5	6.1	6.6	7.2	6.6	6.6	6.5
CYCLE	1.000	1.085	1.151	1.228	1.329	1.447	1.553	1.654
%CH	7.2	8.5	6.1	6.7	8.2	8.9	7.3	6.5
CEI2573-OTHER CONTRACTUAL SERVICES (0.800)								
TREND	1.000	1.068	1.144	1.225	1.319	1.415	1.517	1.631
%CH	7.3	6.8	7.1	7.1	7.6	7.3	7.2	7.5
CYCLE	1.000	1.067	1.144	1.229	1.345	1.476	1.590	1.708
%CH	7.3	6.7	7.1	7.5	9.4	9.8	7.7	7.4

NOTE: WEIGHTS GIVEN IN BRACKETS FOR 3-DIGIT CEI'S SUM TO ONE.
WEIGHTS GIVEN IN PARENTHESES FOR EACH GROUP OF 4-DIGIT CEI'S SUM TO ONE.

The component tending to accelerate the escalation in CEI25 is the relatively strong rate of escalation forecasted for CEI257 – Other Purchased Services. Over the forecast interval, CEI257 moves at a brisk 7.2% rate. The annual pattern of price change is one of steadily accelerating budget escalation through fiscal 1981 — a year in which prices for goods and services bought in this category are forecasted to increase at a 7.5% per annum rate. Subsequent years see a modest deceleration of this pace. This general pattern of annual change reflects a similar pattern across the 3 four-digit CEI's that drive the forecast for CEI257. However, of dominant influence, particularly as it affects the magnitude of price change, is the forecast behavior of CEI2573 – Other Contractual Services which represents 70% of the expenditures in CEI257. The steady 7%+ increases in all years except for 1978 are largely explained by equally steady and large increases in compensation to employees in a relatively labor-intense category.

A far more pessimistic escalation outlook is indicated for CEI25 under the more volatile Cycle conditions. As Table 3.19 reveals, Cycle assumptions lead to a pattern of price change not unlike that under the Trend solution but the magnitude of annual escalation is greater particularly in the expansion years of 1981 and 1982 which finds CEI25 increasing at very brisk 9% and 9.6% rates, respectively. The forces underlying the behavior of this aggregate CEI under Cycle are the same as those discussed under the Trend solution. Looking at the three-digit level of detail we see the general pattern and magnitude of escalation is broad-based but of singular importance is the rapid escalation in the large budget category CEI2573 – Other Contractual Services. (As we indicated above, the escalation behavior of the four-digit equipment maintenance categories should be examined in conjunction with the "sensitivity analysis" results presented below.)

Results of Sensitivity Analysis on Equipment Maintenance Components of CEI251

As the above discussion has indicated, the variability of the weight of different materials in the several maintenance activities leads us to test the sensitivity of escalation forecasts for these categories to alternative weighting schemes. Again, as was described above, the sensitivity test used in effect picks, in the first case, the most rapid escalation rate possible for the "material cost" term out of all possible weighting schemes of the included materials and, in the second case, the least rapid escalation rate possible. These results are presented below for Trend and Cycle macro alternatives in Tables 3.20 and 3.21, respectively. Each table presents best, worst, and control alternatives for each equipment category, as well as the budget categories that they feed into via aggregation.

As Table 3.20 reveals, Total O&M is affected modestly by changes in the escalation rates of the four-digit equipment categories. The magnitude of change (either + or –) is small but significant, typically 0.1% in most years after 1978 and with differences of as much as + or – 0.2% in certain years. Moving down to CEI25, we see that the "best" and "worst" alternatives have a slightly more pronounced effect, particularly in the latter years of the forecast interval, e.g., 1983, where differences range between –0.3% to +0.5%. As we would expect, the "best and worst" alternatives have the most pronounced effect on CEI251 and its four-digit equipment-specific elements. As we have observed before, the largest differences occur in the latter years of the forecast interval where the dampening effect of the electronic component becomes either completely modulated in the "best" alternative or completely amplified as in the "worst" alternative.

Table 3.21 presents the same analysis for escalation rates, in the affected categories, under Cycle assumptions. As we saw before, the "best/worst" options lead to the greatest forecast variance in the four-digit equipment maintenance CEI's with this variance being significantly reduced as we aggregate up to Total O&M. We can also see that, in comparison to the Trend results, the magnitude of variation between forecasts is much larger in the Cycle solution (for example, for CEI2511 – Aircraft Maintenance in fiscal 1982 the difference between "best" and "worst" is 4.8%), with the largest differences forecasted to occur in 1982 and 1983.

To assist the reader in better evaluating these extremes, Figure 3.6 presents a comparison between the two most extreme alternatives — the "best" under Trend assumptions (BESTTREND) and the "worst" under Cycle assumptions (WRSTCYCL) for CEIOM.

Table 3.20

TREND FORECAST:
SENSITIVITY ANALYSIS

	1977	1978	1979	1980	1981	1982	1983	1984
CE1OM-TOTAL O & M								
CE1OM	6.8	6.8	6.7	7.2	7.3	6.5	6.6	6.9
WRSTCNTL	6.8	6.8	6.8	7.2	7.4	6.5	6.9	7.0
DIFF	0.0	0.0	0.1	0.1	0.1	0.0	0.2	0.1
BESTCNTL	6.8	6.8	6.7	7.1	7.1	6.3	6.5	6.7
DIFF	0.0	0.0	-0.1	-0.1	-0.2	-0.1	-0.2	-0.2
CE125-OTHER SERVICES								
CE125	6.8	6.8	6.9	6.6	7.2	6.8	6.6	6.9
WRSTCNTL	6.8	6.8	7.1	6.7	7.4	6.9	7.1	7.2
DIFF	0.0	0.0	0.2	0.1	0.2	0.1	0.5	0.3
BESTCNTL	6.8	6.8	6.7	6.4	6.8	6.5	6.3	6.6
DIFF	0.0	0.0	-0.1	-0.2	-0.3	-0.3	-0.3	-0.3
CE1251-PURCHASED EQUIPMENT MAINTENANCE								
CE1251	6.6	7.1	6.8	5.5	6.4	5.7	5.3	5.7
WRSTCNTL	6.6	7.1	7.7	6.0	7.2	6.0	7.2	6.8
DIFF	0.0	0.0	0.9	0.5	0.9	0.3	1.8	1.1
BESTCNTL	6.6	7.1	6.4	4.9	5.1	4.7	4.1	4.3
DIFF	0.0	0.0	-0.4	-0.6	-1.3	-1.0	-1.3	-1.3
CE12511-AIRCRAFT MAINTENANCE								
CE12511	5.5	6.2	7.2	5.6	6.3	5.6	5.3	5.8
WRSTCNTL	5.5	6.2	8.0	6.4	7.4	6.5	6.6	7.2
DIFF	0.0	0.0	0.8	0.8	1.1	0.8	1.3	1.4
BESTCNTL	5.5	6.2	6.4	4.9	4.7	4.2	3.7	4.1
DIFF	0.0	0.0	-0.8	-0.7	-1.7	-1.4	-1.5	-1.7
CE12512-MISSILE MAINTENANCE								
CE12512	7.0	7.7	6.2	4.1	5.8	5.2	3.6	4.9
WRSTCNTL	7.0	7.7	7.0	4.3	6.7	5.6	4.2	6.0
DIFF	0.0	0.0	0.8	0.2	0.9	0.5	0.6	1.1
BESTCNTL	7.0	7.8	6.1	3.7	4.9	4.3	2.7	4.2
DIFF	0.0	0.0	-0.1	-0.5	-0.9	-0.8	-0.9	-0.8
CE12513-COMBAT VEHICLE MAINTENANCE								
CE12513	7.6	7.7	6.9	6.0	6.7	5.9	6.2	6.0
WRSTCNTL	7.6	7.8	8.2	6.3	7.5	5.6	9.9	7.1
DIFF	0.0	0.0	1.3	0.3	0.8	-0.3	3.7	1.2
BESTCNTL	7.6	7.8	6.6	5.2	5.4	5.0	4.6	4.3
DIFF	0.0	0.0	-0.3	-0.9	-1.3	-0.8	-1.6	-1.6
CE12514-SHIP MAINTENANCE								
CE12514	7.1	6.7	6.7	6.5	7.0	6.1	6.1	6.1
WRSTCNTL	7.1	6.8	8.1	8.6	8.6	6.8	6.6	6.5
DIFF	0.0	0.1	1.4	2.1	1.6	0.7	0.5	0.4
BESTCNTL	7.1	6.6	5.9	5.9	6.4	5.8	5.6	6.0
DIFF	0.0	-0.1	-0.8	-0.6	-0.6	-0.3	-0.5	-0.1
CE12515-ELECTRONICS AND COMMUNICATION								
CE12515	6.6	7.4	6.4	5.7	6.2	5.7	5.2	5.4
WRSTCNTL	6.6	7.4	6.5	6.0	6.5	6.0	5.5	5.7
DIFF	0.0	0.0	0.1	0.3	0.3	0.3	0.3	0.3
BESTCNTL	6.6	7.4	6.2	5.6	5.7	5.4	4.9	5.1
DIFF	0.0	0.0	-0.2	-0.1	-0.4	-0.3	-0.3	-0.3

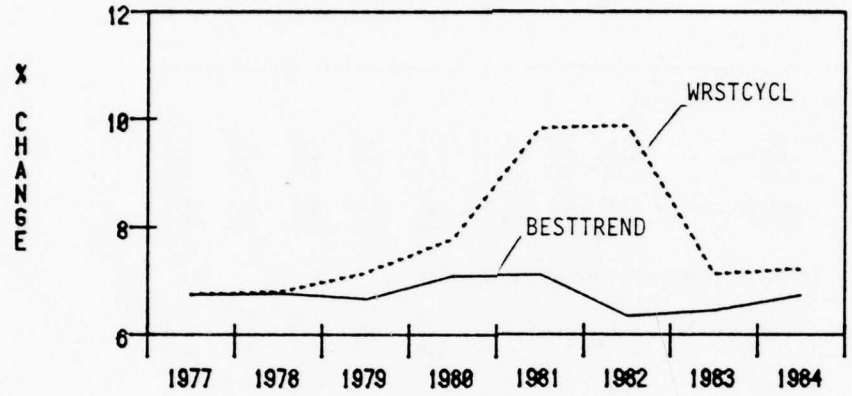
Table 3.21

CYCLE FORECAST:
SENSITIVITY ANALYSIS

	1977	1978	1979	1980	1981	1982	1983	1984
CE10M-TOTAL O & M								
CE10M	6.8	6.8	7.0	7.6	9.7	9.7	7.0	6.9
WRSTCYCL	6.8	6.8	7.1	7.8	9.8	9.9	7.1	7.2
DIFF	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.3
BESTCYCL	6.8	6.8	6.9	7.5	9.4	9.5	7.0	6.7
DIFF	0.0	0.0	-0.1	-0.1	-0.3	-0.2	0.0	-0.2
CE125-OTHER SERVICES								
CE125	6.8	6.8	7.0	6.9	9.0	9.6	7.0	6.7
WRSTCYCL	6.8	6.8	7.3	7.2	9.2	9.9	7.2	7.3
DIFF	0.0	0.0	0.3	0.3	0.3	0.3	0.2	0.6
BESTCYCL	6.8	6.8	6.8	6.6	8.4	9.1	7.0	6.2
DIFF	0.0	0.0	-0.1	-0.3	-0.6	-0.4	0.0	-0.5
CE1251-PURCHASED EQUIPMENT MAINTENANCE								
CE1251	6.6	7.1	6.9	5.8	8.1	9.4	5.4	5.1
WRSTCYCL	6.6	7.1	8.0	6.7	9.1	10.5	6.1	7.4
DIFF	0.0	0.1	1.1	1.0	1.0	1.1	0.7	2.3
BESTCYCL	6.6	7.1	6.4	4.8	6.0	7.8	5.3	3.2
DIFF	0.0	0.0	-0.5	-1.0	-2.2	-1.6	-0.1	-1.9
CE12511-AIRCRAFT MAINTENANCE								
CE12511	5.5	6.2	7.3	6.0	8.3	9.5	4.9	5.4
WRSTCYCL	5.5	6.2	8.3	7.7	10.4	11.6	6.2	8.1
DIFF	0.0	0.0	1.0	1.7	2.1	2.1	1.3	2.7
BESTCYCL	5.5	6.2	6.4	4.6	6.1	6.8	5.2	3.7
DIFF	0.0	0.0	-0.9	-1.4	-3.2	-2.7	0.3	-1.7
CE12512-MISSILE MAINTENANCE								
CE12512	7.0	7.3	5.9	4.0	7.0	9.5	4.7	3.7
WRSTCYCL	7.0	7.3	6.6	4.3	7.8	10.3	4.0	4.3
DIFF	0.0	0.0	0.8	0.3	0.8	0.7	-0.7	0.6
BESTCYCL	7.0	7.3	5.7	3.4	5.2	7.7	4.3	2.9
DIFF	0.0	0.0	-0.1	-0.6	-1.8	-1.9	-0.4	-0.8
CE12513-COMBAT VEHICLE MAINTENANCE								
CE12513	7.6	7.9	7.1	6.4	8.7	9.1	5.9	5.8
WRSTCYCL	7.6	8.0	9.0	7.1	8.6	9.6	7.0	9.5
DIFF	0.0	0.1	1.9	0.7	0.0	0.5	1.2	3.7
BESTCYCL	7.6	7.9	6.7	5.3	6.7	8.2	5.4	2.6
DIFF	0.0	0.1	-0.4	-1.1	-2.0	-0.9	-0.4	-3.2
CE12514-SHIP MAINTENANCE								
CE12514	7.1	6.8	6.9	6.6	8.5	9.9	6.5	5.4
WRSTCYCL	7.1	6.9	8.2	8.6	10.7	11.1	8.3	6.6
DIFF	0.0	0.1	1.3	1.9	2.2	1.2	1.8	1.1
BESTCYCL	7.1	6.8	7.1	7.0	8.3	9.7	3.4	4.2
DIFF	0.0	0.0	0.2	0.4	-0.2	-0.3	-3.1	-1.3
CE12515-ELECTRONICS AND COMMUNICATION								
CE12515	6.6	7.4	6.4	5.7	7.6	9.6	6.1	4.1
WRSTCYCL	6.6	7.4	6.4	5.8	8.4	10.0	5.9	4.2
DIFF	0.0	0.0	0.1	0.1	0.8	0.4	-0.2	0.1
BESTCYCL	6.6	7.4	6.3	5.4	7.1	9.4	6.1	3.3
DIFF	0.0	0.0	-0.1	-0.3	-0.5	-0.3	0.0	-0.8

Figure 3.6

CEIOM
Comparison Plot: BESTTREND vs. WRSTCYCL



CEI26 - Supplies

The CEI for this EOE category is composed of seven subindexes: CEI261 (Supplies, General Support Division); CEI262 (POL, Aircraft); CEI263 (POL, Other); CEI264 (Coal, Nonpetroleum-based Fuels); CEI265 (Medical Supplies); CEI266 (Aviation Repair Parts); and CEI267 (ADP Supplies). The formal specification including assigned weights is:

CEI26 - Supplies

CEI261 - General Supplies (0.69)
CEI262 - POL, Aircraft (0.05)
CEI263 - POL, Ship (0.05)
CEI264 - POL, Other (0.05)
CEI265 - Coal, Nonpetroleum-based Fuels (0.01)
CEI266 - Medical Supplies (0.10)
CEI267 - Aviation Repair Parts (0.04)
CEI268 - ADP Supplies (0.01)

Each subindex is described in sequence.

CEI261 - Supplies, GSD

The BLS stages-of-processing indexes are constructed by combining segments of the regular comprehensive WPI. The procedure employed in building CEI261 was to look at the component wholesale price indexes and the BLS weights for each of these components in WPISOP2610NS (Wholesale Price Index by Stages of Processing, Supplies for Manufacturing Industries). The component WPI's are then divided into homogeneous

blocks, and these blocks are proxied by variables already forecast by the DRI Cost Forecasting Service. However, rather than assume that the BLS specification of WPISOP2610NS adequately explains DOD supply requirements, information provided by the Department of Defense was incorporated to focus on those supplies which are of particular interest and dollar importance. The resulting specification is given in Table 3.22.

Table 3.22

COST SPECIFICATION:
GENERAL SUPPLIES (CEI261)

Variable Name	Code	Weight
Wholesale Price Index, Industries, Other	WPIINDO	0.011
Wholesale Price Index, Textile Products and Apparel	WPI03	0.006
Wholesale Price Index, Chemicals and Allied Products	WPI06	0.007
Wholesale Price Index, Miscellaneous Chemical Products and Preparations	WPI0679NS	0.002
Wholesale Price Index, Rubber and Plastic Products	WPI07	0.210
Wholesale Price Index, Rubber Belts and Belting	WPI071303NS	0.015
Wholesale Price Index, Lumber and Wood Products	WPI08	0.018
Wholesale Price Index, Paper, Wood Bond	WPI09130131NS	0.010
Wholesale Price Index, Corrugated Shipping Containers	WPI09150323NS	0.374
Wholesale Price Index, Paper, Pulp, and Allied Products	WPI09	0.082
Wholesale Price Index, Special Industrial Machinery and Equipment	WPI116NS	0.030
Wholesale Price Index, Switchgear, Switchboards, and Equipment	WPI1175NS	0.002
Wholesale Price Index, Electrical Machinery and Equipment	WPI117NS	0.030

Table 3.22 (cont'd.)

Variable Name	Code	Weight
Wholesale Price Index, Graphite Electrode	WPI11790324NS	0.002
Wholesale Price Index, Transportation Equipment	WPI14	0.001
Wholesale Price Index, Capacitors*	WPI117811NS	0.036
Wholesale Price Index, Resistors*	WPI117812NS	0.032
Wholesale Price Index, Relays*	WPI117821NS	0.024
Wholesale Price Index, Connectors	WPI117824NS	0.040
Wholesale Price Index, Magnetic Tape	WPI117825NS	0.022
Wholesale Price Index, Transistors*	WPI117835NS	0.018
Wholesale Price Index, Digital Bi-Polar Integrated Circuits*	WPI117841NS	0.012
Wholesale Price Index, Digital MOS Integrated Circuits*	WPI117842NS	0.010
Wholesale Price Index, Linear Integrated Circuits*	WPI117845NS	0.006

CEI262 - POL, Aircraft

Although aircraft use a variety of fuels, military aircraft primarily use AVGAS 100 and JP-4. The number of aircraft with reciprocating engines using AVGAS 100 has been substantially reduced during the last decade and, thus, JP-4 constitutes the major fuel used in military aircraft. JP-4 fuel prices are highly correlated with kerosine prices. Therefore, PKBBL (Wholesale Price of Kerosine, Dollars per Barrel), a price series forecasted by the DRI Energy Service, proxies CEI262.

*Econometric models for these price series are developed specifically for use in CEI261. The regression results and model specifications can be found in the Technical Appendix.

CEI263 - POL, Ship

In most cases, ships use petroleum bunker fuel #2. Unfortunately, there exists no accurate proxy for the price behavior of this fuel. This being the case, the advice of knowledgeable personnel in the DRI Energy Service was solicited to identify the best available proxy. In their opinion, PDFBBL (Wholesale Price of Distillate Fuel, Dollars per Barrel) most closely mirrors price activity for petroleum bunker fuel #2 and is, therefore, used to proxy CEI263.

CEI264 - POL, Other

To best represent the variety of fuels purchased in this category, CEI264 is proxied by an equally-weighted combination of PGN (Pump Price of Gasoline, Cents per Gallon) and PRFBBL (Wholesale Price of Residual Fuel Oil, Dollars per Barrel). The forecasts for these price series are developed by the DRI Energy Service.

CEI265 - Coal, Nonpetroleum-based Fuels

CEI265 is proxied by a combination of two DRI Energy Service variables: PCONTRACT (Contract Price of Coal, Delivered, Dollars per Ton) and PSPOT (Spot Market Price of Coal, F.O.B., Dollars Per Ton). Since most of the coal purchased by the Department of Defense is under a contract, the weights assigned to the proxies are 0.80 and 0.20, respectively.

CEI266 - Medical Supplies

The CEI for medical supplies is proxied by a cost buildup model which combines WPI0635NS (Wholesale Price Index, Ethical Pharmaceutical Preparations) and WPI117NS (Wholesale Price Index, Electrical Machinery and Equipment). The latter is included to represent the high technology and electronic nature of various types of medical diagnostic equipment likely to be purchased. The two categories carry weights of 0.90 and 0.10, respectively. To construct this index, an econometric forecasting model for WPI0635NS was developed using regression analysis. The newly developed model for WPI0635NS contains, as do other DRCFS price models, two major components — a cost element and a market element — which combine to explain price movements over time. The detailed specification and regression results can be found in the Technical Appendix.

CEI267 - Aviation Repair Parts

This subindex of CEI26 is proxied by a cost buildup model which incorporates the basic labor and material costs involved in the assembly and manufacture of aviation repair parts. Since a wide variety of metal (ferrous and nonferrous), nonmetal, electrical, and mechanical parts are used in aircraft and missile, engine, and exchangeable repair and maintenance activities, the model is segmented into five cost elements. These are detailed in Table 3.23 below.

Table 3.23

COST SPECIFICATION:
AVIATION REPAIR PARTS (CEI267)

Variable Labor Cost (0.500)

Item	Weight	Proxy	Proxy Code
Production Labor, Aircraft	0.190	Average Hourly Earnings, Aircraft	AHE3721NS
Production Labor, Aircraft Parts	0.120	Average Hourly Earnings, Aircraft and Parts	AHE372NS
Production Labor, Missile Parts	0.010	Average Hourly Earnings, Completed Guided Missiles	AHE1925NS
Production Labor, Mechanical Parts	0.436	Average Hourly Earnings, Nonelectrical Machinery	AHE35NS
Production Labor, Electrical Parts	0.244	Average Hourly Earnings, Electrical Machinery	AHE36NS

Aircraft and Missile Repair Parts
Variable Material Costs (0.100)

Item	Weight	Proxy	Proxy Code
Structural Aluminum	0.142	Wholesale Price Index, Mill Shapes	WPI1025NS
Sheet Aluminum	0.143	Wholesale Price Index, Aluminum Sheet, Heat-Treatable	WPI10250102NS
Titanium	0.143	Wholesale Price Index, Titanium Mill Shapes	WPI102505NS
Iron and Steel	0.143	Wholesale Price Index, Iron and Steel	WPI101NS
Wire and Cable	0.143	Wholesale Price Index, Wire and Cable	WPI1026NS
Electronics	0.143	Wholesale Price Index, Electronic Components	WPI1178NS
Rubber and Plastic	0.143	Wholesale Price Index, Rubber and Plastic Products	WPI07

Table 3.23 (cont'd.)

Engine Repair Parts
Variable Material Costs (0.060)

Item	Weight	Proxy	Proxy Code
Aluminum Shapes	0.167	Wholesale Price Index, Aluminum Shapes	WPI102501NS
Titanium	0.167	Wholesale Price Index, Titanium Mill Shapes	WPI102505NS
Nickel	0.167	Wholesale Price Index, Nickel, Cathode Sheets	WPI10220116NS
Other Nonferrous	0.166	Wholesale Price Index, Primary Nonferrous Shapes	WPI1022NS
Alloys	0.167	Wholesale Price Index, Secondary Metal and Alloy Basic Shapes	WPI1024NS
General Equipment	0.166	Wholesale Price Index, General-Purpose Machinery and Equipment	WPI114NS

Mechanical Parts
Variable Material Costs (0.217)

Item	Weight	Proxy	Proxy Code
Aluminum	0.125	Wholesale Price Index, Mill Shapes	WPI1025NS
Other Nonferrous	0.125	Wholesale Price Index, Primary Nonferrous Shapes	WPI1022NS
Hardware	0.125	Wholesale Price Index, Hardware	WPI104NS
Miscellaneous Metal Parts	0.125	Wholesale Price Index, Miscellaneous Metal Products	WPI108NS
Pumps and Compressors	0.125	Wholesale Price Index, Pumps and Compressors	WPI1141NS
Fluid Power Equipment	0.125	Wholesale Price Index, Fluid Power Equipment	WPI1143NS

Table 3.23 (cont'd.)

Item	Weight	Proxy	Proxy Code
Valves	0.125	Wholesale Price Index, Valves and Fittings	WPI114901NS
Bearings	0.125	Wholesale Price Index, Ball and Roller Bearings	WPI114905NS

Electrical Parts
Variable Material Costs (0.123)

Item	Weight	Proxy	Proxy Code
Wiring Devices	0.200	Wholesale Price Index, Wiring Devices	WPI1171NS
Instruments	0.200	Wholesale Price Index, Integrating and Measuring Instruments	WPI1172NS
Switchgear	0.200	Wholesale Price Index, Switchgear, Switchboards, and Equipment	WPI1175NS
Components	0.200	Wholesale Price Index, Electronic Components	WPI1178NS
Wire	0.200	Wholesale Price Index, Wire and Cable	WPI1026NS

CEI268 - ADP Supplies

CEI268 is proxied by a cost buildup model. Information gained from vendors of ADP supplies indicated that the costs of paper and magnetic tapes are the two most important supply materials, with each of approximately equal importance in total cost. Proxies for these two supply elements are WPI09130131NS (Wholesale Price Index, Paper, Wood Bond) and WPI117825NS (Wholesale Price Index, Magnetic Tape), each given an equal weight in the model.

Forecasts for CEI26 and its Components

Forecasts for CEI26 and its subindexes are presented in Table 3.24. The dominating influences in this EOE category come from general supplies and energy. Rapidly escalating fuel prices in CEI262, CEI263, CEI264, and CEI265 pull CEI26 up quickly through FY 1980. Only the moderate escalation of CEI261 keeps CEI26 from inflating more rapidly.

Table 3.24

FORECAST: CEI26
SUPPLIES
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
CEI26-SUPPLIES								
TREND	1.000	1.043	1.101	1.175	1.248	1.312	1.388	1.479
%CH	4.4	4.3	5.5	6.8	6.2	5.1	5.8	6.6
CYCLE	1.000	1.045	1.112	1.198	1.320	1.444	1.550	1.651
%CH	4.4	4.5	6.5	7.7	10.2	9.4	7.3	6.6
CEI261-SUPPLIES, GSO [0.273]								
TREND	1.000	1.028	1.071	1.122	1.182	1.237	1.298	1.377
%CH	3.5	2.7	4.2	4.8	5.4	4.6	5.0	6.0
CYCLE	1.000	1.029	1.084	1.149	1.265	1.382	1.450	1.535
%CH	3.5	2.9	5.3	6.0	10.0	9.3	4.9	5.8
CEI262-POL, AIRCRAFT [0.050]								
TREND	1.000	1.093	1.215	1.417	1.546	1.645	1.785	1.941
%CH	3.0	9.3	11.2	16.6	9.1	6.4	8.5	8.7
CYCLE	1.000	1.098	1.226	1.433	1.615	1.800	1.989	2.182
%CH	3.0	9.8	11.6	16.9	12.7	11.5	10.5	9.7
CEI263-POL, SHIP [0.050]								
TREND	1.000	1.110	1.223	1.415	1.538	1.632	1.764	1.912
%CH	11.2	11.0	10.2	15.7	8.7	6.1	8.1	8.4
CYCLE	1.000	1.115	1.234	1.431	1.605	1.785	1.966	2.150
%CH	11.2	11.5	10.7	15.9	12.2	11.2	10.1	9.4
CEI264-POL, OTHER [0.050]								
TREND	1.000	1.104	1.202	1.371	1.475	1.551	1.663	1.788
%CH	7.5	10.4	8.9	14.1	7.5	5.2	7.2	7.6
CYCLE	1.000	1.109	1.213	1.387	1.540	1.697	1.853	2.011
%CH	7.6	10.9	9.3	14.3	11.1	10.2	9.2	8.5
CEI265-COAL, NONPET.-BASED FUELS [0.010]								
TREND	1.000	1.091	1.190	1.319	1.402	1.488	1.649	1.743
%CH	15.1	9.1	9.0	10.9	6.3	6.2	10.8	5.7
CYCLE	1.000	1.097	1.200	1.333	1.464	1.629	1.838	1.960
%CH	15.1	9.7	9.4	11.1	9.8	11.3	12.8	6.6
CEI266-MEDICAL SUPPLIES [0.100]								
TREND	1.000	1.048	1.109	1.175	1.253	1.327	1.408	1.504
%CH	4.5	4.9	5.8	5.9	6.6	5.9	6.1	6.8
CYCLE	1.000	1.048	1.110	1.181	1.285	1.376	1.438	1.533
%CH	4.5	4.8	6.0	6.4	8.8	7.1	4.5	6.5
CEI267-AVIATION REPAIR PARTS [0.040]								
TREND	1.000	1.067	1.150	1.230	1.320	1.407	1.499	1.600
%CH	6.8	6.7	7.8	6.9	7.3	6.6	6.5	6.8
CYCLE	1.000	1.067	1.151	1.237	1.351	1.478	1.569	1.676
%CH	6.8	6.7	7.8	7.4	9.3	9.4	6.1	6.8
CEI268-ADP SUPPLIES [0.010]								
TREND	1.000	1.056	1.100	1.156	1.236	1.317	1.403	1.512
%CH	5.4	5.6	4.2	5.1	7.0	6.5	6.5	7.8
CYCLE	1.000	1.036	1.064	1.122	1.214	1.340	1.409	1.474
%CH	3.4	3.6	2.7	5.5	8.2	10.3	5.2	4.6

NOTE: WEIGHTS GIVEN IN BRACKETS FOR 5-DIGIT CEI'S SUM TO ONE.

As we have seen before, the pace of economic activity in the Cycle solution boosts annual rates of escalation for CEI26 significantly above the Trend values. Also, as we have seen before, the largest increases are forecasted for the fiscal years 1980 through 1983. The most rapid annual escalation is a rate of 0.2% in 1981 (4 percentage points above the Trend value). The dominant influence on the escalation behavior of CEI26 is CEI261 — General Supplies, but large annual increases in the several POL categories is an important contributing factor.

CEI31 - Equipment

The cost escalation index for this EOE category contains two major subindexes: CEI311 (Transportation Equipment) and CEI312 (Machinery and Equipment). The formal specification is as follows:

CEI31 - Equipment

CEI311 - Transportation Equipment (0.10)
CEI312 - Machinery and Equipment (0.90)

Each subindex is explained more fully below.

CEI311 - Transportation Equipment

The CEI for this subindex is proxied by WPI14 (Wholesale Price Index, Transportation Equipment), an existing price model maintained and updated by the DRI Macro Model. As defined by the Department of Labor, Bureau of Labor Statistics, WPI14 includes motor vehicles and equipment, aircraft (fixed wing and rotary wing), and railroad equipment.

CEI312 - Machinery and Equipment

The CEI for this subindex is proxied by the Wholesale Price Index for General-Purpose Machinery and Equipment (WPI114NS), an existing price model maintained and updated by the DRI Cost Forecasting Service. Included in this index, the BLS lists pumps, compressors, and equipment, elevators and escalators, fluid power equipment, material handling equipment, mechanical power transmission equipment, scales and balances, fans and blowers, and miscellaneous general-purpose equipment. Accordingly, the DRCFS model for WPI114NS is an identity composed of seven subordinate wholesale price indexes, each of which is forecasted by DRCFS. The model specification is presented in Table 3.25.

Table 3.25

COST SPECIFICATION:
MACHINERY AND EQUIPMENT (WPI114NS)

Variable Name	Code	Weight
Wholesale Price Index, Pumps and Compressors	WPI1141NS	0.138
Wholesale Price Index, Fluid Power Equipment	WPI1143NS	0.099
Wholesale Price Index, Industrial Material Handling Equipment	WPI1144NS	0.206
Wholesale Price Index, Mechanical Power Transmission Equipment	WPI1145NS	0.136
Wholesale Price Index, Fans and Blowers	WPI1147NS	0.071
Wholesale Price Index, Valves and Fittings	WPI114901NS	0.245
Wholesale Price Index, Ball and Roller Bearings	WPI114905NS	0.105

Forecasts for CEI31 and its Components

Forecasts for CEI31, CEI311, and CEI312 are presented in Table 3.26. Since CEI312 is the dominating influence in this case, escalation in CEI31 approaches that in CEI312 through the forecast period. CEI311 has a slight dampening effect as its annual inflation is expected to be below average through 1984. Cycle assumptions amplify the magnitude of annual escalation rates, particularly in fiscal 1981 and 1982 where forecast escalation exceeds Trend rates by 1.7 and 3.8 percentage points, respectively.

Table 3.26

FORECAST: CEI31
EQUIPMENT
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
CEI31-EQUIPMENT								
TREND	1.000	1.068	1.146	1.218	1.301	1.381	1.463	1.549
%CH	6.2	6.8	7.3	6.3	6.9	6.1	5.9	5.8
CYCLE	1.000	1.067	1.143	1.220	1.324	1.454	1.537	1.632
%CH	6.2	6.7	7.2	6.7	8.6	9.8	5.7	6.2
CEI311-TRANSPORTATION EQUIPMENT [0.100]								
TREND	1.000	1.074	1.129	1.181	1.237	1.304	1.373	1.445
%CH	6.5	7.4	5.2	4.6	4.7	5.4	5.3	5.2
CYCLE	1.000	1.071	1.122	1.173	1.240	1.346	1.442	1.513
%CH	6.5	7.1	4.8	4.6	5.7	8.5	7.2	4.9
CEI312-MACHINERY & EQUIPMENT [0.900]								
TREND	1.000	1.067	1.148	1.222	1.309	1.390	1.475	1.572
%CH	6.2	6.7	7.6	6.5	7.1	6.2	6.0	6.7
CYCLE	1.000	1.067	1.146	1.225	1.334	1.466	1.547	1.646
%CH	6.2	6.7	7.4	6.9	8.9	9.9	5.5	6.4

NOTE: WEIGHTS GIVEN IN BRACKETS FOR 3-DIGIT CEI'S SUM TO ONE.

TECHNICAL APPENDIX

I. INTRODUCTION

This appendix contains two types of information: 1) the statistical results and/or technical specifications of all new DRCFS price and earnings models developed specifically for use in the O&M Cost Escalation Index Model discussed in the body of this report; and 2) the detailed forecast tables for all base models referred to in the body of the report. Regarding the former, there are a total of twenty (20) new models. Fifteen (15) are used as proxies for CEI's or for components of CEI's; five (5) are used as regressors for modeling CEI proxies. In particular, the following price and earnings series were modeled:

Price Models

Code	Description	Included In
CIAC	Cost Index, Air Cargo	CEI224
CIIT	Cost Index, Interstate Trucking	CEI221
CPIHOTEL	Consumer Price Index, Hotel/Motel Room Rates	CEI2121
CPI12000000NS@099	Consumer Price Index, Meals Away From Home	CEI2122
CPI22311259NS@099	Consumer Price Index, Residential Water and Sewerage	CEI2331
CPI23212399NS@099	Consumer Price Index, Postal Charges	CEI223
WPI0635NS	Wholesale Price Index, Ethical Pharmaceutical Preparations	CEI265
WPI117811NS	Wholesale Price Index, Capacitors	CEI261
WPI117812NS	Wholesale Price Index, Resistors	CEI261
WPI117821NS	Wholesale Price Index, Relays	CEI261
WPI117825NS	Wholesale Price Index, Magnetic Tape	CEI267
WPI117835NS	Wholesale Price Index, Transistors	CEI261
WPI117841NS	Wholesale Price Index, Digital Bi-Polar Integrated Circuits	CEI261
WPI117842NS	Wholesale Price Index, Digital MOS Integrated Circuits	CEI261
WPI117845NS	Wholesale Price Index, Linear Integrated Circuits	CEI261

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Earnings Models

Code	Description	Included In
AHEPOST	Average Hourly Earnings, Postal Workers	CPI23212399NS@099
AHE27NS	Average Hourly Earnings, Printing and Publishing	CEI24
AHE498NS	Average Hourly Earnings, Water and Sanitary Services	CPI22311259NS@099
AHE701NS	Average Hourly Earnings, Hotels, Motels, and Tourist Courts	CPIHOTEL
ASETIV	Annual Salary Index, Engineering Technician, Level Four	CEI252

Eighteen (18) of these new models were developed using regression analysis on the percent change form of the data at a quarterly frequency. For these, the *R-bar squared*, *Durbin-Watson*, and *Standard Error* statistics are presented with each model. The first two are listed immediately following each equation; the Standard Errors of the regression coefficients are listed in parentheses below the coefficients themselves. The other two (2) models were constructed using the cost buildup approach — i.e., appropriate cost variables were selected from the DRI Cost Forecasting, Energy, and Macro Models and combined using a priori weighting information from the Input-Output Table of the U.S. Economy or from industry sources.

The model discussions and detailed forecast tables are presented below in sequential order according to CEI number.

II. KEY TO NOTATION

(1) +, -, *, / = addition, subtraction, multiplication, division operators

(2) %(X) = percent change form of the time series variable X

(3) X\t = the variable X lagged t periods

(4) MOVAVG(t to 1, X) = simple moving average of variable X from one period lagged through t periods lagged

III. MODEL DISCUSSIONS AND FORECAST TABLES

CEI21 - Travel and Transportation of Persons

Three new models were developed for use in this major EOE category: 1) a regression model for CPIHOTEL (Consumer Price Index, Hotel/Motel Room Rates) which is used to proxy CEI2121; 2) a regression model for

CPI12000000NS@099 (Consumer Price Index, Meals Away From Home) which is used to proxy CEI2122; and 3) a regression model for AHE701NS (Average Hourly Earnings, Hotels, Motels, and Tourist Courts) which is used as an argument in the CPIHOTEL regression model. These are discussed below.

Detailed forecast tables are presented for three base models: 1) CPI42111792NS@099 which proxies CEI211; 2) CPIHOTEL which proxies CEI2121; and 3) CPI12000000NS@099 which proxies CEI2122.

CEI211 - Air Fares

Table A.1 presents the detailed forecast for CPI42111792NS@099 (Consumer Price Index, Air Fares, Chiefly Coach).

TABLE A.1

CEI211-AIR FARES,CHIEFLY COACH
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
CPI42111792NS@099	1.000	1.067	1.136	1.206	1.281	1.359	1.440	1.524
%CH		6.7	6.5	6.2	6.2	6.1	5.9	5.8
JAHEADJEA(1.457251	1.000	1.077	1.154	1.235	1.326	1.422	1.523	1.629
%CH		7.7	7.1	7.1	7.3	7.3	7.1	7.0
(1/RC)(4.65291	1.000	1.132	1.157	1.185	1.279	1.289	1.348	1.450
%CH		13.2	2.2	2.4	7.9	0.8	4.5	7.6

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.

CEI2121 - Hotel/Motel Room Rates

The model specification and relevant statistics for CPIHOTEL are:

```
%(CPIHOTEL) = 1.16172 + 0.137588*%(COST2121) +
              (0.1991)  (0.5862)

               0.649603*SEASONQ2 + 1.05341*SEASONQ3 -
               (0.2456)            (0.2584)

               0.729614*SEASONQ4 - 1.10811*PCDUM
               (0.2476)            (0.2719)

R-bar squared = 0.6997
Durbin-Watson = 0.9912

CPIHOTEL = (1 + %(CPIHOTEL)/100)*CPIHOTEL\1
```

BESTCYCL 6.6 7.4 6.3 5.4 7.1 9.4 6.1 5.8
DIFF 0.0 0.0 -0.1 -0.5 -0.5 -0.5 0.0 -0.5

where:

CPIHOTEL = Consumer Price Index, Hotel/Motel Room Rates

COST2121 = 0.60*(0.5*(AHE701NS\3)/1.553 + 0.5*JAHEADJEA + 0.30*WPISOP2400NS\1 + 0.10*(ICNRCOST/0.0885)

AHE701NS = Average Hourly Earnings, Hotels, Motels, and Tourist Courts

JAHEADJEA = Index of Hourly Earnings of Production Workers, Total Private Nonfarm

WPISOP2400NS = Wholesale Price Index of Stages of Processing, Processed Fuels and Lubricants

ICNRCOST = Rental Price of Capital, Nonresidential Structures

SEASONQ2, SEASONQ3, SEASONQ4 = Seasonal Dummy Variables for the 2nd, 3rd, and 4th Quarters

PCDUM = Price Control Dummy Variable for 5 Quarters from 1971:4 to 1972:4

As can be seen, this specification includes an explanatory cost measure (COST2121), three seasonal dummy variables (SEASONQ2, SEASONQ3, SEASONQ4), and a price control dummy (PCDUM). COST2121 includes the variables and corresponding weights suggested by a priori information. These dummy variables account for strong seasonal fluctuations in room rates and the effects of price controls. The resulting estimated equation yields the statistics listed above. While the R-bar squared is wholly acceptable when working with data in percent change form, the Durbin-Watson statistic indicates the likely presence of positive autocorrelation. Correcting for first-order autocorrelation yields the following equation:

```
%(CPIHOTEL) = 1.06202 + 0.169225*%(COST2121) +
              (0.2305)  (0.06400)

               0.665927*SEASONQ2 + 1.00778*SEASONQ3 -
               (0.1606)           (0.2017)

               0.803505*SEASONQ4 - 0.589133*PCDUM +
               (0.1650)            (0.3811)

               0.592566*RHO
               (0.1464)

R-bar squared = 0.7809
Durbin-Watson = 2.0962
```

Price Index by Stages of Processing, Supplies for Manufacturing Industries). The component WPI's are then divided into homogeneous

In this equation RHO accounts for the portion of the error transmitted from error term to successive error term. Note, however, that these estimated regression coefficients have not changed significantly from those in the first equation. This being the case, either model could be used with confidence. The original is used in the CEI model.

Table A.2 presents the detailed forecast of CPIHOTEL.

TABLE A.2

CEI2121-HOTEL/MOTEL ROOM RATES
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
CPIHOTEL	1.000	1.111	1.200	1.284	1.375	1.468	1.566	1.671
%CH		8.4	11.1	8.0	7.0	7.1	6.7	6.7	6.7
COST MEASURE								
AHE701NS(.300)	1.000	1.101	1.175	1.242	1.311	1.388	1.467	1.550
%CH		7.5	10.1	6.8	5.7	5.6	5.9	5.7	5.6
JAHEADJEA(.300)	1.000	1.077	1.154	1.235	1.326	1.422	1.523	1.629
%CH		7.1	7.7	7.1	7.1	7.3	7.3	7.1	7.0
APISOP2400NS(.300)	1.000	1.091	1.229	1.395	1.572	1.701	1.846	1.993
%CH		11.5	9.1	12.6	13.5	12.7	8.2	8.5	7.9
ICNRCOST(.100)	1.000	1.141	1.128	1.214	1.338	1.406	1.480	1.563
%CH		10.6	14.1	-1.2	7.6	10.3	5.1	5.2	5.6

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.

The industry-specific average hourly earnings series (AHE701NS) included above was also estimated for use in this subcategory. The equation and statistics are:

$$\%(AHE701NS) = \underset{(0.4041)}{0.726653} + \underset{(0.2260)}{0.417172}*\%(JRWSSNF\backslash 3) +$$

$$\underset{(0.8300)}{2.95823}*(0.33*SEASONQ3) + \underset{(0.5013)}{4.96149}*(0.67*SEASONQ4)$$

R-bar squared = 0.82
Durbin-Watson = 1.89

$$AHE701NS = (1 + \%(AHE701NS)/100)*AHE701NS\backslash 1$$

where:

JRWSSNF = Index of Compensation Per Man-hour, Nonfarm Business Sector

SEASONQ3, SEASONQ4 = Seasonal Dummy Variables for the 3rd and 4th Quarters

JRWSSNF is an indicator of general wage patterns in the economy. Since hotel, motel and tourist court workers are generally not highly unionized, one would expect them to follow the general pattern with a lag. Also, the coefficient (0.417172) indicates the reality of these workers' wages deteriorating relative to other occupations. The variation on seasonal dummies would account for wage increases occurring some time in the middle of the fourth quarter of each year and the impact being felt predominantly in the fourth quarter and slightly in the first quarter.

CEI2122 - Meals Away From Home

The model specification and relevant statistics for CPI12000000NS@099 are:

```
%(CPI12000000NS@099) = 0.270823 + 0.545369*%(JAHEADJEA) +
                       (0.1882)   (0.1457)

                       0.169042*%(COST2122) +
                      (0.02919)

                       0.0988634*(CNFOOD - CNFOOD\1) -
                       (0.03642)

                       0.336755*SEASONQ1 - 0.549690*PCDUM
                       (0.1285)            (0.2004)

R-bar squared = 0.7369
Durbin-Watson = 1.5939

CPI12000000NS@099 = (1 + %(CPI12000000NS@099)/100)*
                    CPI12000000NS@099\1
```

where:

CPI12000000NS@099 = Consumer Price Index, Meals Away From Home

JAHEADJEA = Index of Hourly Earnings of Production Workers, Total Private Nonfarm

COST2122 = 0.07*WPI01\1 + 0.63*WPI02\1 + 0.29*((WPI05 + WPI05\1 + WPI05\2)/3) + 0.01*(ICNRCOST\1)/0.0885

WPI01 = Wholesale Price Index, Farm Products

WPI02 = Wholesale Price Index, Processed Foods and Feeds

WPI05 = Wholesale Price Index, Fuels and Related Products, and Power

ICNRCOST = Rental Price of Capital, Nonresidential Structures

be found in the Technical Appendix.

CNFOOD = Personal Consumption Expenditures, Food

SEASONQ1 = Seasonal Dummy Variable for the 1st Quarter

PCDUM = Price Control Dummy Variable for 5 Quarters from 1971:4 to 1972:4

The estimation of this index required the appropriate specification of the relevant operating costs (labor, material, and capital), an indication of demand for meals away from home, and an accounting of seasonal price variation as well as price control influences from 1971:4 to 1972:4. The resulting equation includes a labor cost variable (JAHEADJEA), a materials cost variable (COST2122), a demand measure (CNFOOD), and two dummy variables — a seasonal dummy (SEASONQ1) and a price control dummy (PCDUM). The standard errors of each estimated regression parameter indicate their significance: the R-bar squared and Durbin-Watson statistics are acceptable.

Table A.3 presents the detailed forecast of CPI12000000NS@099.

TABLE A.3

CE12122-MEALS AWAY FROM HOME
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
CPI12000000NS@099	1.000	1.075	1.166	1.266	1.373	1.492	1.614	1.747
%CH		7.1	7.4	8.5	8.6	8.9	8.2	8.2	8.2
LABOR(.545)								
JAHEADJEA(1.00)	1.000	1.077	1.154	1.235	1.326	1.422	1.523	1.629
%CH		7.1	7.7	7.1	7.1	7.5	7.1	7.0
MATERIAL(.169)								
WPI02(.630)	1.000	1.055	1.116	1.173	1.230	1.282	1.334	1.392
%CH		2.0	5.5	5.8	5.1	4.8	4.2	4.0	4.5
WPI01(.070)	1.000	1.008	1.058	1.098	1.134	1.168	1.200	1.241
%CH		0.0	0.8	5.0	3.8	3.3	3.0	2.7	3.4
WPI05(.290)	1.000	1.091	1.227	1.392	1.561	1.687	1.828	1.972
%CH		13.1	9.1	12.5	13.4	12.1	8.1	8.4	7.8
ICNRCOST(.010)	1.000	1.141	1.128	1.214	1.338	1.406	1.480	1.565
%CH		10.6	14.1	-1.2	7.6	10.3	5.1	5.2	5.6
MARKET MEASURE(.099)								
CNFOOD(1.00)	1.000	1.083	1.179	1.280	1.387	1.486	1.590	1.697
%CH		8.8	8.5	8.9	8.6	8.4	7.1	7.1	6.7

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.

These are detailed in Table 3.23 below.

CEI22 - Transportation of Things

Four new models were developed for use in this major EOE category: 1) a cost buildup model for Interstate Trucking (CIIT) which is used to proxy CEI221; 2) a regression model for CPI23212399NS@099 (Consumer Price Index, Postal Charges) which is used to proxy CEI223; 3) a cost buildup model for Air Cargo (CIAC) which is used to proxy CEI224; and 4) a regression model for AHEPOST (Index of Average Hourly Earnings, Postal Workers) which is used as an argument in the postage regression model.

Detailed forecast tables are presented for four base models: 1) CIIT which proxies CEI221; 2) LRTTL which proxies CEI222; 3) CPI23212399NS@099 which proxies CEI223; and 4) CIAC which proxies CEI224.

CEI221 - Truck Freight

The new cost buildup model for interstate trucking used to proxy CEI221 differs from the original DRCFS trucking cost index in two respects: 1) the new index has a more comprehensive coverage of costs; and 2) the weights of common-cost items have been altered to reflect the current characteristics of the trucking industry. The equation specification of CIIT (Interstate Trucking Cost Index) in level form includes DRCFS and DRI Macro Model variables as follows:

```
CIIT = 0.400*(0.700*WPI05 + 0.040*WPI071201NS +
       0.160*WPI141102NS + 0.100*WPIIND) + 0.330*(0.500*
       (AHE421NS/3.289) + 0.500*(AHE422NS/2.512)) +
       (0.270*(0.3033*(TXGF/16.275) + 0.3033*(TXGSL/54.00) +
       0.1183*PICNR + 0.2751*JAHEADJEA)
```

where:

AHE421NS = Average Hourly Earnings, Trucking

AHE422NS = Average Hourly Earnings, Public Warehousing

JAHEADJEA = Index of Hourly Earnings of Production Workers, Total Private Nonfarm

PICNR = Implicit Price Deflator, Investment, Private Non-residential Structures

TXGF = Federal Government Indirect Business Tax and Nontax Accruals

TXGSL = State and Local Government Indirect Business Tax and Nontax Accruals

WPIIND = Wholesale Price Index, Industrial Commodities

WPI05 = Wholesale Price Index, Fuels and Related Products, and Power

WPI071201NS = Wholesale Price Index, Tires

WPI141102NS = Wholesale Price Index, Trucks

Table A.4 presents the detailed forecast of CIIT.

TABLE A.4

CEI221-INTERSTATE TRUCKING COST
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
CIIT	1.000	1.088	1.199	1.328	1.462	1.572	1.690	1.812
%CH	9.5	8.8	10.3	10.7	10.1	7.5	7.5	7.2
COMPONENTS								
FIXED COST(.270)								
OAHEADOEA(.2717)	1.000	1.077	1.154	1.235	1.326	1.422	1.523	1.629
%CH	7.1	7.7	7.1	7.1	7.3	7.3	7.1	7.0
TXGSL(.3033)	1.000	1.098	1.209	1.322	1.443	1.563	1.699	1.864
%CH	10.5	9.8	10.1	9.4	9.1	8.3	8.6	9.7
TXGF(.3033)	1.000	1.100	1.355	1.748	2.123	2.293	2.458	2.584
%CH	2.9	10.0	23.2	29.1	21.4	8.0	7.2	5.2
PICNR(.1150)	1.000	1.067	1.136	1.212	1.309	1.405	1.498	1.599
%CH	5.4	6.7	6.5	6.7	8.0	7.4	6.6	6.7
MATERIAL COST(.400)								
WPI05(.700)	1.000	1.091	1.227	1.392	1.561	1.687	1.828	1.972
%CH	13.1	9.1	12.5	13.4	12.1	8.1	8.4	7.8
WPI071201NS(.100)	1.000	1.022	1.068	1.113	1.175	1.239	1.299	1.379
%CH	8.4	2.2	4.5	4.1	5.6	5.5	4.8	6.2
WPI141102NS(.100)	1.000	1.091	1.184	1.268	1.366	1.464	1.564	1.674
%CH	7.7	9.1	8.6	7.1	7.7	7.2	6.9	7.0
WPIINDO(.100)	1.000	1.062	1.116	1.172	1.236	1.298	1.359	1.425
%CH	6.0	6.2	5.0	5.0	5.5	5.0	4.7	4.9
LABOR COST(.330)								
AHE241NS(.500)	1.000	1.094	1.176	1.257	1.348	1.444	1.548	1.657
%CH	6.8	9.4	7.5	6.9	7.3	7.1	7.2	7.1
AHE422NS(.500)	1.000	1.075	1.141	1.206	1.277	1.353	1.429	1.510
%CH	8.5	7.5	6.2	5.6	5.9	6.0	5.6	5.6

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.

CEI222 - Rail Freight

Table A.5 presents the detailed forecast for LRTTL (Price Index, Railroad Freight Rates, Total).

TABLE A.5

CEI222-RAILROAD FREIGHT RATES, TOTAL
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
LRTTL	1.000	1.064	1.157	1.262	1.392	1.539	1.708	1.892
%CH	6.8	6.4	8.8	9.1	10.3	10.5	11.0	10.8
COST MEASURE								
JAHEADJEA(.500)	1.000	1.077	1.154	1.235	1.326	1.422	1.523	1.629
%CH	7.1	7.7	7.1	7.1	7.3	7.3	7.1	7.0
WPI05(.202)	1.000	1.091	1.227	1.392	1.561	1.687	1.828	1.972
%CH	13.1	9.1	12.5	13.4	12.1	8.1	8.4	7.8
WPI061NS(.010)	1.000	1.002	1.006	1.066	1.142	1.209	1.288	1.374
%CH	3.2	0.1	0.4	6.0	7.1	5.9	6.5	6.7
WPI071201NS(.005)	1.000	1.022	1.068	1.113	1.175	1.239	1.299	1.379
%CH	8.4	2.2	4.5	4.1	5.6	5.5	4.8	6.2
WPI071303NS(.010)	1.000	1.043	1.089	1.160	1.241	1.323	1.413	1.510
%CH	9.6	4.3	4.4	6.6	7.0	6.6	6.8	6.9
WPI08(.050)	1.000	1.150	1.183	1.258	1.360	1.404	1.503	1.617
%CH	16.3	15.0	2.9	6.4	8.1	3.2	7.0	7.6
WPI09130131NS(.010)	1.000	1.027	1.070	1.143	1.240	1.329	1.426	1.534
%CH	3.0	2.7	4.2	6.8	8.5	7.2	7.3	7.6
WPI1013NS(.135)	1.000	1.097	1.206	1.294	1.413	1.516	1.631	1.770
%CH	9.3	9.7	9.9	7.4	9.2	7.3	7.6	8.5
WPI1015NS(.037)	1.000	1.072	1.196	1.292	1.386	1.485	1.594	1.722
%CH	6.0	7.2	11.5	8.0	7.3	7.2	7.3	8.0
WPI114905NS(.005)	1.000	1.068	1.156	1.218	1.289	1.359	1.429	1.512
%CH	8.6	6.8	8.3	5.4	5.8	5.4	5.1	5.8
WPI117NS(.036)	1.000	1.063	1.131	1.187	1.253	1.313	1.370	1.439
%CH	4.9	6.3	6.4	5.0	5.5	4.8	4.3	5.0
MARKET MEASURE								
GNP72(1.000)	1.000	1.047	1.088	1.137	1.186	1.224	1.274	1.323
%CH	4.7	4.7	3.9	4.5	4.3	3.2	4.1	3.9

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.

CEI223 - Parcel Post

The model specification and relevant statistics for CPI23212399NS@099 are:

```
%(CPI23212399NS@099) = 1.22485*%(XCOSTPOST)
                       (0.06997)

R-bar squared = 0.8974
Durbin-Watson = 1.7276

CPI23212399NS@099 = (1 + %(CPI23212399NS@099)/100)*
                    CPI23212399NS@099\1
```

where:

XCOSTPOST = a variation of COSTPOST

```
COSTPOST = 0.3*(0.92*(0.78*CEI221\1 + 0.22*CEI222\1) +
           0.08*CEI221) + 0.7*AHEPOST\2
```

AHEPOST = Index of Average Hourly Earnings, Postal Workers

CEI211 = Cost Escalation Index, Air Fares

CEI221 = Cost Escalation Index, Truck Freight

CEI222 = Cost Escalation Index, Rail Freight

In this model, COSTPOST is a composite of the relevant operating costs facing the U.S. Postal Service. As can be seen, it includes CEI's for three modes of transportation and an earnings index. However, due to the regulatory process involved, these costs are not passed through continuously. This being the case, an EPS ROUTINE was designed to allow costs to build up to some critical level before permitting an increase in the postage rate CPI. Thus, XCOSTPOST can be viewed as a special type of dummy variable.

Table A.6 presents the detailed forecast for CPI23212399NS@099.

TABLE A.6

CEI223-POSTAL CHARGES
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
CPI23212399NS@099	1.000	1.072	1.175	1.325	1.387	1.571	1.716	1.862
%CH		7.6	7.2	9.6	12.8	4.6	13.3	9.2	8.5
COST MEASURE								
AHEPOST(.700)	1.000	1.083	1.163	1.251	1.346	1.443	1.549	1.662
%CH		8.3	7.4	7.5	7.6	7.2	7.3	7.3

Table A.6 (cont'd.)

	1977	1978	1979	1980	1981	1982	1983	1984
CE1211(.024)	1.000	1.067	1.136	1.206	1.281	1.359	1.440	1.524
%CH		6.7	6.5	6.2	6.2	6.1	5.9	5.8
CE1221(.215)	1.000	1.088	1.199	1.328	1.462	1.572	1.690	1.812
%CH		8.8	10.3	10.7	10.1	7.5	7.5	7.2
CE1222(.061)	1.000	1.064	1.157	1.262	1.392	1.539	1.708	1.892
%CH		6.4	8.8	9.1	10.3	10.5	11.0	10.8

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.

The industry-specific average hourly earnings index (AHEPOST) included above was also estimated for use in this subcategory. The equation and statistics are:

$$\%(AHEPOST) = \underset{(0.4215)}{1.38} + \underset{(0.7596)}{3.26}*SETLMNT + \underset{(0.0993)}{0.237}*\%(AHE481NS) - \underset{(0.5631)}{1.95}*SEASONQ1 + \underset{(0.0747)}{0.337}*CEDUM4$$

R-bar squared = 0.7616
Durbin-Watson = 2.46

AHEPOST = (1 + %(AHEPOST)/100)*AHEPOST\1

where:

AHEPOST = Index of Average Hourly Earnings, Postal Workers

AHE481NS = Average Hourly Earnings, Telephone Communication

SETLMNT = Strike Settlement Dummy Variable for 2 Quarters from 1970:2 to 1970:3

SEASONQ1 = Seasonal Dummy Variable for the 1st Quarter

CEDUM = Cost-of-Living Variable

The index used is from Employment and Earnings, which is published by the Bureau of Labor Statistics. Unlike other AHE series, this is an index and is not reported in that publication on a monthly basis, although it is calculated monthly. It is available historically since 1967.

The model includes a strike settlement dummy, a seasonal dummy, a cost-of-living variable, and a wage series which moves similarly to the postal workers wage series. The strike settlement dummy is used to account for the aftereffects of the postal walkout of March 18–25, 1970 and is entered in 1970:2-1970:3. The seasonal dummy is present in the first quarter of each year and it captures the effect of the post-Christmas lull when both overtime hours and number of workers employed are reduced. The cost-of-living variables take account of the fact that postal workers get biannual wage adjustments based on increases in the CPI. Finally, the average hourly earnings variable which is used in explaining wages of postal workers is AHE481NS. The overall wage model for postal workers does very well in capturing the turning points in the series and also has a relatively high R–bar squared (0.76).

CEI224 - Air Cargo

The specification of this cost buildup model combines DRCFS and DRI Macro Model variables as follows:

```
CIAC = 0.74*(0.36*JRWSSNF + 0.57*WPI05 + 0.06*
       IPDENRCOSTNET/0.162 + 0.01*PICNR/0.718) + 0.26*(0.55*
       (0.66*(0.5*AHE372NS/3.446 + 0.5*AHE36NS/2.773) +
       0.34*(0.20*WPI10250102NS + 0.20*WPI101NS + 0.20*
       WPI1178NS + 0.20*WPI1025NS + 0.20*WPI07)) + 0.45*
       (0.6*JAHEADJEA + 0.4*(0.3*IPDENRCOSTNET/0.162 + 0.3*
       ICNRCOSTNET/0.082 + 0.4*WPISOP2610NS)))
```

where:

AHE36NS = Average Hourly Earnings, Electrical Machinery

AHE372NS = Average Hourly Earnings, Aircraft and Parts

ICNRCOSTNET = Rental Price of Capital, Structures

IPDENRCOSTNET = Rental Price of Capital, Equipment

JAHEADJEA = Index of Hourly Earnings of Production Workers, Total Private Nonfarm

JRWSSNF = Index of Compensation Per Man-hour, Nonfarm Business Sector

PICNR = Implicit Price Deflator, Investment, Private Non-residential Structures

WPI05 = Wholesale Price Index, Fuels and Related Products, and Power

WPI07 = Wholesale Price Index, Rubber and Plastic Products

WPI101NS = Wholesale Price Index, Iron and Steel

WPI1025NS = Wholesale Price Index, Mill Shapes

WPI10250102NS = Wholesale Price Index, Aluminum Sheet, Heat-treatable

WPI1178NS = Wholesale Price Index, Electronic Components

WPISOP2610NS = Wholesale Price Index by Stages of Processing, Supplies for Manufacturing Industries

This specification accounts for aircraft flying operations and maintenance expenses. Expenses for flying operations include flight deck crew expenses (JRWSSNF), fuel and oil costs (WPI05), equipment rental costs (IPDENRCOSTNET), and insurance expenses (PICNR). Maintenance expenses include labor, materials, and equipment used for repair and maintenance activities.

Table A.7 presents the detailed forecast for CIAC.

TABLE A.7

CEI224-AIR FREIGHT
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
CIAC	1.000	1.089	1.191	1.309	1.436	1.546	1.664	1.788
%CH	10.1	8.9	9.4	9.9	9.7	7.6	7.7	7.4
COSTS								
JRWSSNF(.266)	1.000	1.086	1.175	1.270	1.377	1.491	1.611	1.739
%CH	9.0	8.6	8.2	8.0	8.5	8.3	8.0	8.0
WPI05(.422)	1.000	1.091	1.227	1.392	1.561	1.687	1.828	1.972
%CH	13.1	9.1	12.5	13.4	12.1	8.1	8.4	7.8
IPDENRCOSTNET(.059)	1.000	1.115	1.140	1.192	1.270	1.321	1.379	1.440
%CH	7.5	11.5	2.2	4.6	6.5	4.0	4.4	4.5
PICNR(.007)	1.000	1.067	1.136	1.212	1.309	1.405	1.498	1.599
%CH	5.4	6.7	6.5	6.7	8.0	7.4	6.6	6.7
AHE372NS(.047)	1.000	1.077	1.161	1.245	1.351	1.451	1.555	1.677
%CH	7.0	7.7	7.8	7.2	8.6	7.4	7.2	7.8
AHE36NS(.047)	1.000	1.091	1.178	1.258	1.346	1.438	1.533	1.634
%CH	8.5	9.1	8.0	6.8	7.0	6.9	6.6	6.6
WPI10250102NS(.010)	1.000	1.152	1.228	1.322	1.385	1.462	1.555	1.597
%CH	7.2	15.2	6.6	7.7	4.7	5.6	6.4	2.7
WPI101NS(.010)	1.000	1.090	1.211	1.310	1.425	1.533	1.662	1.809
%CH	7.0	9.0	11.1	8.2	8.8	7.5	8.4	8.8

Table A.7 (cont'd.)

	1977	1978	1979	1980	1981	1982	1983	1984
WPI1178NS(.010)	1.000	1.059	1.128	1.192	1.242	1.288	1.337	1.388
%CH	2.8	5.9	6.5	5.7	4.2	3.7	3.8	3.8
WPI1025NS(.010)	1.000	1.072	1.174	1.265	1.368	1.460	1.552	1.650
%CH	11.0	7.2	9.5	7.7	8.1	6.8	6.3	6.3
WPI07(.010)	1.000	1.038	1.094	1.157	1.231	1.296	1.365	1.432
%CH	6.6	3.8	5.4	5.8	6.4	5.2	5.3	4.9
UAHEADUEA(.070)	1.000	1.077	1.154	1.235	1.326	1.422	1.523	1.629
%CH	7.1	7.7	7.1	7.1	7.3	7.3	7.1	7.0
ICNRCOSTNET(.014)	1.000	1.137	1.138	1.227	1.353	1.420	1.494	1.576
%CH	10.0	13.7	0.1	7.9	10.2	5.0	5.2	5.5
WPISOP2610NS(.019)	1.000	1.041	1.098	1.162	1.233	1.300	1.375	1.463
%CH	5.1	4.1	5.5	5.8	6.1	5.4	5.8	6.8

NOTE: ALL SERIES ARE INDEXES TO 1977=1.000.

CEI23 - Rents, Communications, and Utilities

Two new models were developed for use in this major EOE category: 1) a regression model for CPI22311259NS@099 (Consumer Price Index, Residential Water and Sewerage) which is used to proxy CEI2331; and 2) a regression model for AHE498NS (Average Hourly Earnings, Water and Sanitary Services) which is used as an argument in the water and sewerage regression model. (NOTE: The postage regression model which is used to proxy CEI2322 is discussed above under CEI223.) A detailed forecast table is presented for CPI22311259NS@099.

CEI2331 - Water and Sewerage

The model specification and relevant statistics for CPI22311259NS@099 are:

```
%(CPI22311259NS@099) = 1.30912 + 0.372105*%(AHE498NS\3) +
                      (0.4224)   (0.1982)

                       0.0788721*%(COST2331) - 1.22580*PCDUM1 -
                       (0.04131)              (0.4380)

                       1.21403*PCDUM2
                      (0.6700)
```

R-bar squared = 0.3718
Durbin-Watson = 1.6544

```
CPI22311259NS@099 = (1 + %(CPI22311259NS@099)/100)*
                    CPI22311259NS@099\1
```

where:

AHE498NS = Average Hourly Earnings, Water and Sanitary Services

COST2331 = 0.6382*WPISOP2400NS\7 + 0.0938*WPI061NS\7 + 0.0290*WPI0622NS\7 + 0.0442*WPI09\5 + 0.0491*WPI101NS\7 + 0.0190*WPI107NS\6 + 0.0198*WPI105NS\7 + 0.0064*WPI117NS\3 + 0.0140*WPI1083NS\2 + 0.0309*WPI102NS\7 + 0.0082* WPI071201NS\4 + 0.0040*WPI1072NS\7 + 0.0394*WPI114\7 + 0.0040*WPI1081\6

WPISOP2400NS = Wholesale Price Index by Stages of Processing, Processed Fuels and Lubricants

WPI061NS = Wholesale Price Index, Industrial Chemicals

WPI0622NS = Wholesale Price Index, Paint Materials

WPI09 = Wholesale Price Index, Pulp, Paper, and Allied Products

WPI101NS = Wholesale Price Index, Iron and Steel

WPI107NS = Wholesale Price Index, Fabricated Structural Metal Products

WPI105NS = Wholesale Price Index, Plumbing Fixtures

WPI1072NS = Wholesale Price Index, Metal Tanks

WPI1081NS = Wholesale Price Index, Bolts, Nuts, Screws, and Rivets

WPI102NS = Wholesale Price Index, Nonferrous Metals

WPI117NS = Wholesale Price Index, Electrical Machinery and Equipment

WPI1083NS = Wholesale Price Index, Lighting Fixtures

WPI114NS = Wholesale Price Index, General-Purpose Machinery and Equipment

WPI071201NS = Wholesale Price Index, Tires

PCDUM1 = Price Control Dummy Variable for 5 Quarters from 1971:4 to 1972:4

PCDUM2 = Price Control Dummy Variable for 2 Quarters from 1973:3 to 1973:4

The statistical results presented above should not be regarded as an indication of poor performance. Rather, given the data limitations encountered in estimating this CPI, more attention ought to be given to the model's ability to estimate turning points well. Also, it is comforting to note from a budgetary view that the model accurately estimates annual percentage changes despite data constraints and institutional peculiarities. The Durbin-Watson statistic is above the upper limit, indicating that first-order autocorrelation is not a potential problem.

Table A.8 presents the detailed forecast for CPI22311259NS@099.

TABLE A.8

CEI2331-RESIDENTIAL WATER AND SEWERAGE
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
CPI22311259NS@099	1.000	1.115	1.223	1.331	1.453	1.588	1.719	1.833
%CH	10.6	11.5	9.6	8.9	9.2	9.3	8.2	6.7
LABOR								
AHE498NS(.372105)	1.000	1.086	1.171	1.260	1.359	1.464	1.573	1.683
%CH	7.4	8.6	7.9	7.6	7.9	7.7	7.5	7.3
MATERIAL								
WPISOP2400NS(.6382)	1.000	1.091	1.229	1.395	1.572	1.701	1.846	1.993
%CH	11.6	9.1	12.6	13.5	12.7	8.2	8.5	7.9
WPI061NS(.0938)	1.000	1.002	1.006	1.066	1.142	1.209	1.288	1.374
%CH	3.2	0.1	0.4	6.0	7.1	5.9	6.5	6.7
WPI0622NS(.029)	1.000	1.006	1.048	1.106	1.163	1.235	1.327	1.415
%CH	11.4	0.6	4.1	5.5	5.2	6.2	7.5	6.6
WPI09(.0442)	1.000	1.042	1.094	1.145	1.211	1.278	1.347	1.417
%CH	4.4	4.2	5.0	4.7	5.8	5.5	5.5	5.2
WPI101NS(.0491)	1.000	1.090	1.211	1.310	1.425	1.533	1.662	1.809
%CH	7.0	9.0	11.1	8.2	8.8	7.5	8.4	8.8
WPI102NS(.0300)	1.000	1.056	1.173	1.272	1.372	1.463	1.573	1.685
%CH	9.0	5.6	11.0	8.5	7.9	6.7	7.5	7.2
WPI1081NS(.004)	1.000	1.042	1.109	1.162	1.237	1.299	1.368	1.459
%CH	0.6	4.2	6.5	4.8	6.5	4.9	5.3	6.7
WPI1072NS(.004)	1.000	1.107	1.194	1.276	1.372	1.458	1.552	1.661
%CH	6.5	10.7	7.9	6.8	7.6	6.3	6.5	7.0
WPI107NS(.019)	1.000	1.085	1.178	1.257	1.347	1.435	1.527	1.639
%CH	5.9	8.6	8.6	6.6	7.2	6.5	6.4	7.3
WPI105NS(.0198)	1.000	1.067	1.144	1.232	1.323	1.407	1.498	1.592
%CH	7.8	6.7	7.2	7.7	7.3	6.4	6.5	6.2
WPI117NS(.0064)	1.000	1.063	1.131	1.187	1.253	1.313	1.370	1.439
%CH	4.9	6.3	6.4	5.0	5.5	4.8	4.3	5.0
WPI1083NS(.014)	1.000	1.057	1.129	1.202	1.286	1.359	1.438	1.527
%CH	4.5	5.7	6.8	6.5	7.0	5.7	5.8	6.2
WPI114NS(.0394)	1.000	1.067	1.148	1.222	1.309	1.390	1.473	1.572
%CH	6.2	6.7	7.6	6.5	7.1	6.2	6.0	6.7
WPI071201NS(.0082)	1.000	1.022	1.068	1.113	1.175	1.239	1.299	1.379
%CH	8.4	2.2	4.5	4.1	5.6	5.5	4.8	6.2

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.

The industry-specific average hourly earnings series (AHE498NS) included above was also estimated for use in this subcategory. The equation and statistics are:

```
%(AHE498NS) = 0.0821737 + 1.07094*%(JAHEADJEA) +
              (0.2601)   (0.1504)

              0.0698745*%(JQIND49&G) - 0.710115*SEASONQ2 -
              (0.05634)                (0.1677)

              0.531762*PCDUM
              (0.2816)

R-bar squared = 0.555
Durbin-Watson = 1.9382

AHE498NS = (1 + %(AHE498NS)/100)*AHE498NS\1
```

where:

AHE498NS = Average Hourly Earnings, Water and Sanitary Services

JAHEADJEA = Index of Hourly Earnings of Production Workers, Total Private Nonfarm

JQIND49&G = Industrial Production Index, Utilities

SEASONQ2 = Seasonal Dummy Variable for the 2nd Quarter

PCDUM = Price Control Dummy Variable for 4 Quarters from 1972:2 to 1973:1

In this equation, JAHEADJEA explains the variation in AHE498NS resulting from changes in hourly earnings for the nation as a whole. JQIND49&G accounts for industry-specific production levels and corresponding overtime payments. SEASONQ2 and PCDUM explain seasonal and settlement variation and the effects of price controls, respectively. The R-bar squared was lowered significantly due to an outlying data observation in 1969:4, and the Durbin-Watson indicates that autocorrelation is not a problem.

CEI24 - Printing and Reproduction

One new model was developed for this major EOE category which itself consists of only one cost escalation index. The addition is a regression model for AHE27NS (Average Hourly Earnings, Printing and Publishing) which is used as a cost component in CEI24. The model specification and relevant statistics for AHE27NS are shown below, and the detailed forecast for CEI24 is presented in Table A.9.

TABLE A.9

CEI24-PRINTING AND REPRODUCTION
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
CEI24	1.000	1.053	1.118	1.200	1.293	1.388	1.486	1.593
%CH	5.2	5.3	6.1	7.4	7.8	7.3	7.1	7.2
AHE27NS(.250)	1.000	1.070	1.138	1.210	1.290	1.375	1.462	1.554
%CH	6.7	7.0	6.3	6.4	6.6	6.6	6.4	6.3
WPI061NS(.020)	1.000	1.002	1.006	1.066	1.142	1.209	1.288	1.374
%CH	3.2	0.1	0.4	6.0	7.1	5.9	6.5	6.7
WPI09130131NS(.470)	1.000	1.027	1.070	1.143	1.240	1.329	1.426	1.534
%CH	3.0	2.7	4.2	6.8	8.5	7.2	7.3	7.6
WPI116NS(.160)	1.000	1.095	1.188	1.270	1.359	1.447	1.541	1.647
%CH	7.1	9.5	8.4	6.9	7.0	6.5	6.5	6.9
CEI2322(.050)	1.000	1.072	1.175	1.325	1.387	1.571	1.716	1.862
%CH	7.6	7.2	9.6	12.8	4.6	13.3	9.2	8.5

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.

$$\%(AHE27NS) = \underset{(1.158)}{0.159} + \underset{(0.092)}{0.8535}*JAHEADJEAAVG - \underset{(0.099)}{0.343}*SEASONQ1 + \underset{(0.3447)}{1.088}*WBG753 - \underset{(0.244)}{0.566}*PCDUM1 - \underset{(0.3424)}{0.707}*PCDUM2$$

R-bar squared = 0.70
Durbin-Watson = 2.04

AHE27NS = (1 + %(AHE27NS)/100)*AHE27NS\1

where:

AHE27NS = Average Hourly Earnings, Printing and Publishing

JAHEADJEAVG = (%(JAHEADJEA) + %(JAHEADJEA\1))/2

JAHEADJEA = Index of Hourly Earnings of Production Workers, Total Private Nonfarm

SEASONQ1 = Seasonal Dummy Variable for the 1st Quarter

PCDUM1 = Price Control Dummy Variable for 2 Quarters from 1972:4 to 1973:1

PCDUM2 = Price Control Dummy Variable for 1973:4

WBG753 = Bulge Dummy Variable for 1975:3

CEI25 - Other Services

One new regression model was developed for use in this major EOE category: it is for ASETIV (Annual Salary Index, Engineering Technical, Level Four) which is used as the labor cost element in CEI252. Nine tables detail the price forecasts and underlying assumptions for CEI2511, CEI2512, CEI2513, CEI2514, CEI2515, CEI252, CEI2571, CEI2572, and CEI2573.

CEI251 - Purchased Equipment Maintenance

Tables A.10 through A.14 present the detailed forecasts for the components of this subcategory.

TABLE A-10

CE12511-AIRCRAFT MAINTENANCE
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
CE12511	1.000	1.062	1.138	1.202	1.276	1.350	1.421	1.504
%CH	5.5	6.2	7.2	5.6	6.3	5.6	5.3	5.8
LABOR								
AME36NS(.340)	1.000	1.091	1.178	1.258	1.346	1.438	1.533	1.634
%CH	8.5	9.1	8.0	6.8	7.0	6.9	6.6	6.6
AME372NS(.330)	1.000	1.077	1.161	1.245	1.351	1.451	1.555	1.677
%CH	7.0	7.7	7.8	7.2	8.6	7.4	7.2	7.8
AME3721NS(.330)	1.000	1.058	1.139	1.216	1.322	1.417	1.516	1.636
%CH	6.5	5.8	7.6	6.8	8.7	7.2	7.0	7.9
MATERIAL								
WP107(.077)	1.000	1.038	1.094	1.157	1.231	1.296	1.365	1.432
%CH	6.6	3.8	5.4	5.8	6.4	5.2	5.3	4.9
WP10721NS(.077)	1.000	1.033	1.087	1.153	1.226	1.286	1.360	1.455
%CH	5.1	3.3	5.2	6.1	6.3	4.9	5.8	7.0
WP1101NS(.077)	1.000	1.090	1.211	1.310	1.425	1.533	1.662	1.809
%CH	7.0	9.0	11.1	8.2	8.8	7.5	8.4	8.8
WP11013NS(.077)	1.000	1.097	1.206	1.294	1.413	1.516	1.631	1.770
%CH	9.3	9.7	9.9	7.4	9.2	7.3	7.6	8.5
WP11015NS(.077)	1.000	1.072	1.196	1.292	1.386	1.485	1.594	1.722
%CH	6.0	7.2	11.5	8.0	7.3	7.2	7.3	8.0
WP11025NS(.077)	1.000	1.072	1.174	1.265	1.368	1.460	1.552	1.650
%CH	11.0	7.2	9.5	7.7	8.1	6.8	6.3	6.3
WP110250102NS(.077)	1.000	1.152	1.228	1.322	1.385	1.462	1.555	1.597
%CH	7.2	15.2	6.6	7.7	4.7	5.6	6.4	2.7
WP1102505NS(.077)	1.000	1.009	1.093	1.148	1.232	1.334	1.424	1.552
%CH	-0.5	0.9	8.2	5.1	7.3	8.2	6.8	9.0
WP11081NS(.077)	1.000	1.042	1.109	1.162	1.237	1.299	1.368	1.459
%CH	0.6	4.2	6.5	4.8	6.5	4.9	5.3	6.7
WP11144NS(.077)	1.000	1.071	1.151	1.232	1.326	1.415	1.507	1.605
%CH	7.5	7.1	7.5	7.0	7.6	6.7	6.4	6.5
WP11178NS(.077)	1.000	1.059	1.128	1.192	1.242	1.288	1.337	1.388
%CH	2.8	5.9	6.5	5.7	4.2	3.7	3.8	3.8
WP11194NS(.077)	1.000	1.090	1.178	1.256	1.346	1.433	1.520	1.629
%CH	8.3	9.0	8.2	6.6	7.2	6.4	6.1	7.1
WP1151302NS(.077)	1.000	1.093	1.207	1.307	1.399	1.473	1.560	1.671
%CH	7.5	9.3	10.4	8.3	7.1	5.3	5.9	7.1
OVERHEAD								
IDMN2511(.631)	1.000	1.086	1.153	1.234	1.329	1.417	1.512	1.617
%CH	8.0	8.6	6.2	7.0	7.7	6.7	6.7	7.0
IDBO2511(.243)	1.000	1.112	1.188	1.293	1.411	1.520	1.641	1.767
%CH	11.4	11.2	6.8	8.8	9.1	7.7	8.0	7.7
ADM2511(.126)	1.000	1.080	1.165	1.255	1.356	1.463	1.574	1.696
%CH	8.4	8.0	7.8	7.7	8.1	7.9	7.6	7.7

NOTE: ALL SERIES ARE INDEXED TO 1977 = 1.000.

TABLE A.11

CEI2512-MISSILE MAINTENANCE
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
CEI2512	1.000	1.077	1.144	1.191	1.260	1.325	1.373	1.440
%CH	7.0	7.7	6.2	4.1	5.8	5.2	3.6	4.9
LABOR (.623)								
AHE1925NS(.500)	1.000	1.111	1.196	1.246	1.355	1.447	1.499	1.617
%CH	11.0	11.1	7.7	4.2	8.7	6.8	3.5	7.9
AHE36NS(.500)	1.000	1.091	1.178	1.258	1.346	1.438	1.533	1.634
%CH	8.5	9.1	8.0	6.8	7.0	6.9	6.6	6.6
MATERIAL (.351)								
WPI061NS(.166)	1.000	1.002	1.006	1.066	1.142	1.209	1.288	1.374
%CH	3.2	0.1	0.4	6.0	7.1	5.9	6.5	6.7
WPI1013NS(.167)	1.000	1.097	1.206	1.294	1.413	1.516	1.631	1.770
%CH	9.3	9.7	9.9	7.4	9.2	7.3	7.6	8.5
WPI1025NS(.167)	1.000	1.072	1.174	1.265	1.368	1.460	1.552	1.650
%CH	11.0	7.2	9.5	7.7	8.1	6.8	6.3	6.3
WPI10250102NS(.167)	1.000	1.152	1.228	1.322	1.385	1.462	1.555	1.597
%CH	7.2	15.2	6.6	7.7	4.7	5.6	6.4	2.7
WPI116NS(.166)	1.000	1.095	1.188	1.270	1.359	1.447	1.541	1.647
%CH	7.1	9.5	8.4	6.9	7.0	6.5	6.5	6.9
WPI1178NS(.167)	1.000	1.059	1.128	1.192	1.242	1.288	1.337	1.388
%CH	2.8	5.9	6.5	5.7	4.2	3.7	3.8	3.8
OVERHEAD (.026)								
IDMN2512(.594)	1.000	1.086	1.153	1.234	1.329	1.417	1.512	1.617
%CH	8.0	8.6	6.2	7.0	7.7	6.7	6.7	7.0
IDBO2512(.231)	1.000	1.112	1.188	1.293	1.411	1.520	1.641	1.767
%CH	11.4	11.2	6.8	8.8	9.1	7.7	8.0	7.7
ADM2512(.175)	1.000	1.080	1.165	1.255	1.356	1.463	1.574	1.696
%CH	8.4	8.0	7.8	7.7	8.1	7.9	7.6	7.7

NOTE: ALL SERIES ARE INDEXED TO 1977 = 1.000.

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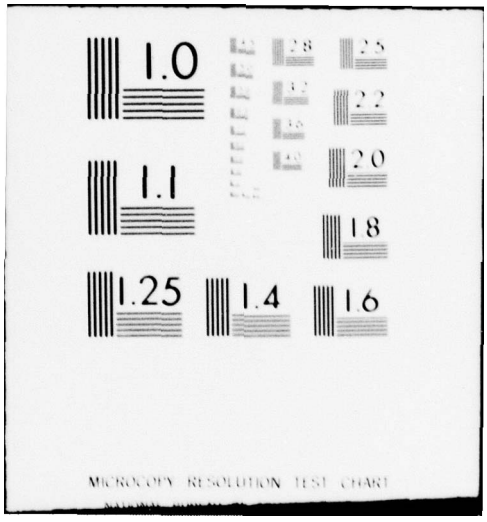

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TABLE A.12

CE12513-COMBAT VEHICLE MAINTENANCE
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
CE12513	1.000	1.077	1.152	1.222	1.304	1.380	1.466	1.553
%CH	7.6	7.7	6.9	6.0	6.7	5.9	6.2	6.0
LABOR (.429)								
AHE37NS(1.000)	1.000	1.090	1.174	1.270	1.379	1.491	1.617	1.747
%CH	8.8	9.0	7.7	8.1	8.6	8.1	8.5	8.0
MATERIAL (.514)								
WPI08(.091)	1.000	1.150	1.183	1.258	1.360	1.404	1.503	1.617
%CH	16.3	15.0	2.9	6.4	8.1	3.2	7.0	7.6
WPI10130246NS(.091)	1.000	1.111	1.243	1.333	1.449	1.525	1.736	1.885
%CH	9.6	11.1	11.9	7.2	8.7	5.3	13.8	8.6
WPI1015NS(.091)	1.000	1.072	1.196	1.292	1.386	1.485	1.594	1.722
%CH	6.0	7.2	11.5	8.0	7.3	7.2	7.3	8.0
WPI1025NS(.091)	1.000	1.072	1.174	1.265	1.368	1.460	1.552	1.650
%CH	11.0	7.2	9.5	7.7	8.1	6.8	6.3	6.3
WPI10250117NS(.090)	1.000	1.117	1.219	1.318	1.430	1.527	1.635	1.729
%CH	16.9	11.7	9.1	8.1	8.5	6.8	7.1	5.7
WPI104NS(.091)	1.000	1.063	1.134	1.193	1.264	1.328	1.396	1.473
%CH	7.2	6.3	6.7	5.3	5.9	5.1	5.2	5.5
WPI1141NS(.091)	1.000	1.077	1.169	1.252	1.345	1.423	1.504	1.611
%CH	6.5	7.7	8.6	7.1	7.4	5.8	5.7	7.1
WPI1144NS(.091)	1.000	1.071	1.151	1.232	1.326	1.415	1.507	1.605
%CH	7.5	7.1	7.5	7.0	7.6	6.7	6.4	6.5
WPI117202NS(.091)	1.000	1.056	1.130	1.187	1.243	1.295	1.345	1.391
%CH	1.8	5.6	7.0	5.1	4.7	4.2	3.9	3.4
WPI1194NS(.091)	1.000	1.090	1.178	1.256	1.346	1.433	1.520	1.629
%CH	8.3	9.0	8.2	6.6	7.2	6.4	6.1	7.1
WPI11(.091)	1.000	1.070	1.135	1.196	1.266	1.340	1.418	1.497
%CH	6.0	7.0	6.1	5.4	5.8	5.9	5.8	5.6
OVERHEAD (.057)								
IDMN2513(.595)	1.000	1.086	1.153	1.234	1.329	1.417	1.512	1.617
%CH	8.0	8.6	6.2	7.0	7.7	6.7	6.7	7.0
IDBO2513(.209)	1.000	1.112	1.188	1.293	1.411	1.520	1.641	1.767
%CH	11.4	11.2	6.8	8.8	9.1	7.7	8.0	7.7
ADM2513(.196)	1.000	1.080	1.165	1.255	1.356	1.463	1.574	1.696
%CH	8.4	8.0	7.8	7.7	8.1	7.9	7.6	7.7

NOTE: ALL SERIES ARE INDEXED TO 1977 = 1.000.

TABLE A.13

CEI2514-SHIP MAINTENANCE
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
CEI2514	1.000	1.067	1.139	1.213	1.297	1.375	1.460	1.550
%CH	7.1	6.7	6.7	6.5	7.0	6.1	6.1	6.1
LABOR (.333)								
AME3731NS(1.000)	1.000	1.068	1.145	1.230	1.323	1.418	1.517	1.622
%CH	7.7	6.8	7.3	7.4	7.5	7.1	7.0	6.9
MATERIAL (.333)								
WPI05(.091)	1.000	1.091	1.227	1.392	1.561	1.687	1.828	1.972
%CH	13.1	9.1	12.5	13.4	12.1	8.1	8.4	7.8
WPI0621NS(.091)	1.000	1.053	1.112	1.182	1.254	1.330	1.414	1.502
%CH	4.4	5.3	5.6	6.3	6.1	6.1	6.3	6.2
WPI1013NS(.091)	1.000	1.097	1.206	1.294	1.413	1.516	1.631	1.770
%CH	9.3	9.7	9.9	7.4	9.2	7.3	7.6	8.5
WPI10130246NS(.091)	1.000	1.111	1.243	1.333	1.449	1.525	1.736	1.885
%CH	9.6	11.1	11.9	7.2	8.7	5.3	13.8	8.6
WPI1026NS(.091)	1.000	0.998	1.099	1.182	1.247	1.300	1.367	1.430
%CH	4.7	-0.2	10.1	7.6	5.4	4.3	5.2	4.6
WPI105NS(.091)	1.000	1.067	1.144	1.232	1.323	1.407	1.498	1.592
%CH	7.8	6.7	7.2	7.7	7.3	6.4	6.5	6.2
WPI114NS(.091)	1.000	1.067	1.148	1.222	1.309	1.390	1.473	1.572
%CH	6.2	6.7	7.6	6.5	7.1	6.2	6.0	6.7
WPI114102NS(.091)	1.000	1.077	1.171	1.252	1.351	1.435	1.515	1.626
%CH	6.3	7.7	8.8	6.9	7.9	6.2	5.6	7.4
WPI1144NS(.091)	1.000	1.071	1.151	1.232	1.326	1.415	1.507	1.605
%CH	7.5	7.1	7.5	7.0	7.6	6.7	6.4	6.5
WPI1175NS(.091)	1.000	1.049	1.122	1.196	1.279	1.355	1.434	1.519
%CH	5.5	4.9	6.9	6.6	6.9	6.0	5.8	5.9
WPISOP2510NS(.090)	1.000	1.041	1.098	1.162	1.233	1.300	1.375	1.468
%CH	5.1	4.1	5.5	5.8	6.1	5.4	5.8	6.8
OVERHEAD								
IDMN2514(.631)	1.000	1.086	1.153	1.234	1.329	1.417	1.512	1.617
%CH	8.0	8.6	6.2	7.0	7.7	6.7	6.7	7.0
IDBO2514(.243)	1.000	1.112	1.188	1.293	1.411	1.520	1.641	1.767
%CH	11.4	11.2	6.8	8.8	9.1	7.7	8.0	7.7
ADM2514(.126)	1.000	1.080	1.165	1.255	1.356	1.463	1.574	1.696
%CH	8.4	8.0	7.8	7.7	8.1	7.9	7.6	7.7

NOTE: ALL SERIES ARE INDEXED TO 1977 = 1.000.

TABLE A.14

CEI2515-ELECTRONIC AND COMMUNICATION EQUIPMENT MAINTENANCE FORECAST AND ASSUMPTIONS (FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
CEI2515	1.000	1.074	1.143	1.208	1.283	1.356	1.426	1.504
%CH	6.6	7.4	6.4	5.7	6.2	5.7	5.2	5.4
LABOR (.420)								
AHE36NS(1.000)	1.000	1.091	1.178	1.258	1.346	1.458	1.553	1.654
%CH	8.5	9.1	8.0	6.8	7.0	8.9	6.6	6.6
MATERIAL (.218)								
WPI1171NS(.200)	1.000	1.075	1.165	1.253	1.350	1.440	1.531	1.633
%CH	5.1	7.5	8.4	7.6	7.7	6.7	6.4	6.6
WPI1172O2NS(.200)	1.000	1.056	1.130	1.187	1.243	1.295	1.345	1.391
%CH	1.8	5.6	7.0	5.1	4.7	4.2	3.9	3.4
WPI1174NS(.200)	1.000	1.065	1.142	1.210	1.302	1.382	1.462	1.564
%CH	4.7	6.5	7.3	6.0	7.5	6.2	5.8	7.0
WPI1175NS(.200)	1.000	1.049	1.122	1.196	1.279	1.355	1.434	1.519
%CH	6.5	4.9	6.9	6.6	6.9	6.0	5.8	5.9
WPI1178NS(.200)	1.000	1.059	1.128	1.192	1.242	1.288	1.337	1.388
%CH	2.8	5.9	6.5	5.7	4.2	3.7	3.8	3.8
OVERHEAD (.362)								
IDMN2515(.583)	1.000	1.086	1.153	1.234	1.329	1.417	1.512	1.617
%CH	8.0	8.6	6.2	7.0	7.7	6.7	6.7	7.0
IDBO2515(.226)	1.000	1.121	1.193	1.301	1.423	1.531	1.654	1.779
%CH	12.2	12.1	6.4	9.1	9.4	7.6	8.0	7.6
ADM2515(.191)	1.000	1.080	1.165	1.255	1.356	1.463	1.574	1.696
%CH	8.4	8.0	7.8	7.7	8.1	7.9	7.6	7.7

NOTE: ALL SERIES ARE INDEXED TO 1977 = 1.000.

CEI252 - Purchased ADP Maintenance

The specification of CEI252 required the identification and estimation of a labor earnings series that would account for labor costs in ADP maintenance and repair. With no average hourly earnings series available, a substitute was found in National Survey of Professional, Administrative, Technical, and Clerical Pay. The data in this bulletin is collected annually, making the quarterly estimation of the series impractical. The model is, therefore, constructed at an annual frequency and, once the forecast is attained, the series is distributed to a quarterly frequency and used in CEI252. The equation and statistics for ASETIV follow immediately, and the detailed forecast table for CEI252 (see Table A.15) ends this part.

```
%(ASETIV) = -1.72600 + 1.12548**%(JAHEADJEA)
            (1.435)    (0.2193)

R-bar squared = 0.6973
Durbin-Watson = 0.9687

ASETIV = (1 + %(ASETIV/100)*ASETIV\1
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where:

ASETIV = Annual Salary Index, Engineering Technician, Level Four

JAHEADJEA = Index of Average Hourly Earnings of Production Workers, Total Private Nonfarm

TABLE A.15

CE1252-ADP MAINTENANCE
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
CE1252	1.000	1.068	1.137	1.207	1.283	1.362	1.444	1.530
%CH	7.2	6.8	6.4	6.2	6.3	6.2	6.0	6.0
LABOR(.800)								
ASETIV	1.000	1.071	1.138	1.209	1.287	1.370	1.456	1.545
%CH	7.6	7.1	6.3	6.2	6.5	6.5	6.2	6.1
MATERIAL(.200)								
*PI1178NS(.500)	1.000	1.059	1.128	1.192	1.242	1.288	1.337	1.388
%CH	2.8	5.9	6.5	5.7	4.2	3.7	3.8	3.8
*PI117501NS(.200)	1.000	1.064	1.152	1.235	1.318	1.411	1.505	1.620
%CH	7.5	6.4	8.3	7.2	6.7	7.1	6.6	7.6
*PI114905NS(.200)	1.000	1.066	1.156	1.218	1.289	1.359	1.429	1.512
%CH	6.6	6.8	8.3	5.4	5.8	5.4	5.1	5.8
*PI071503NS(.100)	1.000	1.045	1.089	1.160	1.241	1.323	1.415	1.510
%CH	9.6	4.5	4.4	6.6	7.0	6.6	6.5	6.9

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.

CEI257 - Other Purchased Services

Tables A.16 to A.18 detail the forecasts for CEI2571, CEI2572, and CEI2573.

TABLE A.16

CEI2571-BASE AND FACILITY MAINTENANCE
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
CEI2571	1.000	1.054	1.116	1.194	1.280	1.368	1.461	1.566
%CH	5.0	5.4	6.1	6.7	7.2	6.9	6.8	7.1
LABOR								
LABOR(.340)	1.000	1.068	1.146	1.238	1.338	1.445	1.556	1.673
%CH	5.4	6.8	7.4	8.0	8.1	8.0	7.7	7.6
AHECNS(.800)	1.000	1.065	1.144	1.238	1.341	1.451	1.564	1.685
%CH	5.0	6.5	7.4	8.2	8.3	8.2	7.8	7.7
JAHEADJEA(.200)	1.000	1.077	1.154	1.235	1.326	1.422	1.523	1.629
%CH	7.1	7.7	7.1	7.1	7.3	7.3	7.1	7.0
MATERIAL								
CEI261(.330)	1.000	1.028	1.071	1.122	1.182	1.237	1.298	1.377
%CH	3.5	2.7	4.2	4.8	5.4	4.6	5.0	6.0
OVERHEAD								
OVERHEAD(.330)	1.000	1.066	1.137	1.221	1.319	1.420	1.527	1.643
%CH	6.0	6.6	6.7	7.3	8.1	7.7	7.5	7.6
JRWSSNF(.660)	1.000	1.086	1.175	1.270	1.377	1.491	1.611	1.739
%CH	9.0	8.6	8.2	8.0	8.5	8.3	8.0	8.0
WP109130131NS(.165)	1.000	1.027	1.070	1.143	1.240	1.329	1.426	1.534
%CH	3.0	2.7	4.2	6.8	8.5	7.2	7.3	7.6
WP10679NS(.165)	1.000	1.023	1.050	1.100	1.164	1.225	1.293	1.370
%CH	-1.9	2.3	2.6	4.8	5.8	5.3	5.5	6.0
CEI261(.010)	1.000	1.028	1.071	1.122	1.182	1.237	1.298	1.377
%CH	3.5	2.7	4.2	4.8	5.4	4.6	5.0	6.0

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.

TABLE A.17

CE12572-MANAGEMENT AND OPERATIONS
RESEARCH STUDIES
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
CE12572	1.000	1.085	1.151	1.226	1.314	1.402	1.494	1.591
%CH	7.2	8.5	6.1	6.6	7.2	6.6	6.6	6.5
JAHEADUEA(.800)	1.000	1.077	1.154	1.235	1.326	1.422	1.523	1.629
%CH	7.1	7.7	7.1	7.1	7.3	7.3	7.1	7.0
IPDENRCOSTNET(.200)	1.000	1.115	1.140	1.192	1.270	1.321	1.379	1.440
%CH	7.5	11.5	2.2	4.6	6.5	4.0	4.4	4.5

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.

TABLE A.18

CE12573-OTHER CONTRACTUAL SERVICES
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
CE12573	1.000	1.068	1.144	1.225	1.319	1.415	1.517	1.631
%CH	7.3	6.8	7.1	7.1	7.6	7.3	7.2	7.5
JRWSSNF(.700)	1.000	1.086	1.175	1.270	1.377	1.491	1.611	1.739
%CH	9.0	8.6	8.2	8.0	8.5	8.3	8.0	8.0
CE1261(.300)	1.000	1.028	1.071	1.122	1.182	1.237	1.298	1.377
%CH	3.5	2.7	4.2	4.8	5.4	4.6	5.0	6.0

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.

CEI26 - Supplies

Nine new models were developed for use in this major EOE category: 1) regression models for seven six-digit electronics WPI's which are used as elements of CEI261 (see specifications below for definitions); 2) a regression model WPI0635NS (Wholesale Price Index, Ethical Pharmaceutical Preparations) which is used as an element of CEI266; and 3) a regression model for WPI117825NS (Wholesale Price Index, Magnetic Tape) which is used as an element of CEI268.

Four tables detail the price forecasts and underlying assumptions for CEI261, CEI266, CEI267, and CEI268.

CEI261 - Supplies, GSD

Seven new six-digit electronics WPI's were modeled for the development of CEI261. They are: WPI117811NS (Wholesale Price Index, Capacitors), WPI117812NS (Wholesale Price Index, Resistors), WPI117821NS (Wholesale Price Index, Relays), WPI117835NS (Wholesale Price Index, Transistors), WPI117841NS (Wholesale Price Index, Digital Bi-Polar Integrated Circuits), WPI117842NS (Wholesale Price Index, Digital MOS Integrated Circuits), and WPI117845NS (Wholesale Price Index, Linear Integrated Circuits). Of these, data for WPI117835NS, WPI117841NS, WPI117842NS, and WPI117845NS is only available from 1974:4. Therefore, due to degrees of freedom problems, the price models for these equations differ somewhat from the other three. In addition, the interval over which the estimations were run is characterized by steadily declining prices. Therefore, although we feel quite confident about our near-term forecasts, the forecasts for the later periods are somewhat less reliable. The basic information on the cost variables comes from 1972 Census of Manufactures (Industry Series) and information on individual markets (demand) from various electronics journals. The seven model specifications are presented below, and a single list of variable definitions completes the specification of these models.

```
%(WPI117811NS) = -1.000 + 0.730176*%(COST117811) +
                 (0.6003)  (0.1188)

                  56.1126*(IF D117811M8 LEQ -0.037 THEN
                  (21.57)

                  D117811M8 + 0.037 ELSE 0) + -38.8795*(IF
                                              (12.39)

                  D117811M8 LEQ 0.031 THEN D117811M8 - 0.031 ELSE

                  0) + 33.8691*(IF D117811M8 GTR 0.031 THEN
                       (10.84)

                  D117811M8 - 0.031 ELSE 0) + -53.8458*(IF
                                              (41.89)

                  D117811M8 GTR 0.099 THEN D117811M8 - 0.099

                  ELSE 0) + 0.807349*SEASONQ2
                            (0.4493)

R-bar squared = 0.6226
Durbin-Watson = 1.6877

WPI117811NS = (1 + %(WPI117811NS)/100)*WPI117811NS\1

where:

     COST117811 = .591*(.24*WPI07 + .14*WPI1081NS +
                  .03*WPI1089NS + .05*WPI1013NS + .06*
                  WPI1022NS\1 + .04*WPI1074NS + .1*
                  ((WPISOP2400NS\1 + WPISOP2400NS\2)/2) + .05*
                  WPI1171NS + .04*WPI1026NS + .225*WPI102501NS +
                  .025*WPI134NS) + .409*(AHE36NS/2.773)

     D117811M8 = OUT117811 - ((8*OUT117811\1 + 7*OUT117811\2 +
                 6*OUT117811\3 + 5*OUT117811\4 + 4*OUT117811\5 +
                 3(PIT118911\7 + 2(PIT118911\8 + PIT118911\8/36)

     OUT117811 = .2*CD72 5/259.5 + .236*JQIND366 + .235*JQIND38 +
                 .14*JQIND357@9 + .037*JQIND371\2 + JQIND39\3*
                 .009 + .1*JQIND363\2
```

```
%(WPI117812NS) = -0.765636 + 0.511275*%(COST117812) +
                 (0.5093)    (0.1183)

                 28.1407*(IF D117812M6 LEQ -0.047 THEN
                 (13.60)

                 D117812M6 + 0.047 ELSE 0) + -21.9272*(IF
                                             (8.822)

                 D117812M6 LEQ 0.039 THEN D117812M6 - 0.039

                 ELSE 0) + 14.7939*(IF D117812M6 GTR 0.039 THEN
                           (8.600)

                 D117812M6 - 0.039 ELSE 0) + -48.5129*(IF
                                             (28.80)

                 D117812M6 GTR 0.125 THEN D117812M6 - 0.125

                 ELSE 0) + -3.16613*TECDUM
                           (0.7763)

R-bar squared = 0.5279
Durbin-Watson = 1.9162

WPI117812NS = (1 + %(WPI117812NS/100)*WPI117842NS\1

where:

     COST117812 = .591*(.23*WPI07\1 + .106*WPI1089NS\1 +
                  .04*WPI134NS\1 + .178*WPI101NS + .148*
                  WPI1022NS\7 + .128*((WPI102501NS\1 +
                  WPI102501NS\2)/2) + .12*WPISOP2400NS\2 +
                  .05*WPI06\1) + .409*(AHE36NS\1/2.773)

     D117812M6 = OUT117812 - (MOVAVG(6 TO 1, OUT117812))

     OUT117812 = .18*MOVAVG(2 TO 1, JQIND366) + .15*
                 MOVAVG(3 TO 2, JQIND357@9) + .1*
                 MOVAVG(2 TO 1, JQIND371) + .15*
                 MOVAVG(3 TO 2, JQIND39) + .05*
                 MOVAVG(2 TO 1, JQIND367) + .13*
                 MOVAVG(3 TO 2, JQIND363) + .19*
                 MOVAVG(2 TO 1, JQIND38) + .05*
                 MOVAVG(2 TO 1, JQIND361&2)
```

```
%(WPI117821NS) = 0.7319 + 0.433758*%(COST117821) +
                (0.3359) (0.05108)

                 -34.5979*(IF D117821M8 LEQ -0.033 THEN
                  (10.93)

                 D117821M8 + 0.033 ELSE 0) + 16.9539*(IF
                                             (6.059)

                 D117821M8 LEQ 0.050 THEN D117821M8 - 0.050

                 ELSE 0) + -8.47906*(IF D117821M8 GTR 0.050
                           (3.768)

                 THEN D117821M8 - 0.050 ELSE 0) + -2.93192*

                 DUM712

R-bar squared = 0.8415
Durbin-Watson = 1.4238

WPI117821NS = (1 + %(WPI117821NS)/100)*WPI117821NS\1

where:

     COST117821 = .2*WPI0721NS + .05*((WPI1081NS +
                  WPI1081NS\1)/2) + .15*WPI1089NS\1 +
                  .05*WPI0921NS\1 + .05*WPI134NS + .05*
                  WPI1013NS\1 + .05*WPI1022NS\3 + .05*WPI1074NS +
                  .05*((WPISOP2400NS\1 + WPISOP2400NS\2)/2) +
                  .15*((WPI061NS + WPI061NS\1)/2) + .15*
                  (AHE36NS/2.773)

     D117821M8 = OUT117821 - (MOVAVG(8 TO 1, OUT117821))

     OUT117821 = .30*JQIND366\1 + .05*JQIND22\2 + .3*
                 ((JQIND357@9\1 + JQIND357@9\2)/2) +
                 .025*JQIND371\2 + .025*JQIND39\2 +.3*
                 ((CD72/259.5 + CD72\1/259.5)/2)
```

```
%(WPI117835NS) = -1.4184 + 0.429044*%(COST117835) +
                 (0.1026) (0.07304)

                 -3.04472*D117835M6
                  (1.156)

R-bar squared = 0.7831
Durbin-Watson = 2.3168

WPI117835NS = (1 + %(WPI117835NS)/100)*WPI117835NS\1

where:

     COST117835 = .591 + (.234*WPI0721NS + .071*
                  WPI10220106NS\1 + .042*WPI1081NS + .145*
                  WPI0921NS\1 + .043*WPI134NS\6 + .092*
                  WPI1013NS + .074*WPI1022NS\1 + .007*WPI1074NS +
                  .1*WPI10240151NS + .071*WPI1026NS + .071*
                  WPI102501NS + .05*WPI05) + .409*(AHE36NS/2.773)

     D117835M6 = OUT117835 - (MOVAVG(6 TO 1, OUT117835))

     OUT117835 = .05*CD72/259.5 + .15*JQIND366 + .12*
                 JQIND357@9 + .25*JQIND365\2
```

```
%(WPI117841NS) = -3.008 + 0.843*%(COST117842) + 9.7587*D117841M4
                 (0.8567) (0.3102)

R-bar squared = 0.3883
Durbin-Watson = 2.6452

WPI117841NS = (1 + %(WPI117841NS)/100)*WPI117841NS\1

where:

     COST117841 = .591*(.234*WPI07 + .142*WPI1081NS\3 + .071*
                  WPI1392NS\1 + .043*WPI134NS\2 + .092*
                  WPI1013NS\2 + .074*WPI1022NS\4 + .007*
                  WPI1074NS\3 + .071*WPI1171NS + .071*
                  WPI102501NS\3 + .074*WPI061NS\1 + .05*
                  WPISOP2400NS\3 + .071*WPI10220106NS\4) +
                  .409*(AHE36NS\2/2.773)

     D117841M4 = OUT117841 - (MOVAVG(4 TO 1, OUT117841))

     OUT117841 = .13*JQIND366 + .12*JQIND357@9 + .23*
                 JQIND371\2 + .12*JQIND363 + .12*JQIND361&2 +
                 .11*JQIND38 + .05*CD72\1/259.5 + .12*JQIND365
```

```
%(WPI117842NS) = -3.268 + 0.712755*%(COST117842) + 33.627*
                (0.8726)  (0.5102)                 (18.35)

                 D117842M4

R-bar squared = 0.7763
Durbin-Watson = 2.6244

WPI117842NS = (1 + %(WPI117842NS)/100)*WPI117842NS\1

where:

     COST117842 = .591*(.184*WPI0721NS + .042*WPI1081NS\8 +
                  .021*WPI1392NS + .043*WPI134NS\9 + .142*
                  WPI1013NS\8 + .074*WPI1022NS + .057*
                  WPI1074NS\8 + .071*MOVAVG(2 TO 0, WPI1026NS) +
                  .121*WPI102501NS + .05*WPI10240151NS\3 + .05*
                  WPISOP2400NS\9 + .074*WPI061NS\8 + .071*
                  WPI10220106NS\2) + .409*(AHE36NS\8/2.773)

     D117842M4 = OUT117842 - (MOVAVG(4 TO 1, OUT117842))

     OUT117842 = .15*JQIND366 + .12*JQIND357@9 + .11*JQIND363 +
                 .08*JQIND361&2\2 + .11*JQIND38\2 + .3*JQIND365 +
                 .13*JQIND371A
```

```
%(WPI117845NS) = -2.921 + 0.675*%(COST117845) + 9.163*D117845M4
                 (1.387) (0.2944)

R-bar squared = 0.3610
Durbin-Watson = 2.7282

WPI117845NS = (1 + %(WPI117845NS)/100)*WPI117845NS\1

where:

     COST117845 = .591*(.234*WPI0721NS\4 + .142*WPI1081NS\4 +
                  .043*WPI134NS\2 + .092*WPI1013NS\2 + .055*
                  WPI1392NS\1 + .078*WPI1074NS\3 + .071*
                  WPI1171NS\2 + .071*WPI102501NS\5 + .05*
                  WPISOP2400NS\5 + .092*WPI1026NS\4 + .074*
                  WPI061NS\4) + .409*(AHE36NS\4/2.773)

     D117845M4 = OUT117845 - (MOVAVG(4 TO 1, OUT117845))

     OUT117845 = .1*JQIND366 + .05*JQIND357@9 + .15*JQIND371 +
                 .1*JQIND363 + .05*JQIND361&2 + .4*JQIND365 +
                 .15*CD72/259.5
```

VARIABLE DEFINITIONS FOR NEW ELECTRONICS

AHE36NS = Average Hourly Earnings, Electrical Machinery Production

ICD72 = Index of Personal Consumption Expenditures, Durable Goods, 1972 Dollars

JQIND22 = Industrial Production Index, Textile Mill Products

JQIND357@9 = Industrial Production Index, Office, Service, and Miscellaneous Equipment

JQIND361&2 = Industrial Production Index, Major Electrical Equipment and Parts

JQIND363 = Industrial Production Index, Household Appliances

JQIND365 = Industrial Production Index, Television and Radio Sets

JQIND366 = Industrial Production Index, Communication Equipment

JQIND367 = Industrial Production Index, Electronic Components

JQIND371 = Industrial Production Index, Motor Vehicles and Parts

JQIND371A = Industrial Production Index, Autos

JQIND38 = Industrial Production Index, Instruments

JQIND39 = Industrial Production Index, Miscellaneous Manufacturers

WPI05 = Wholesale Price Index, Fuels and Related Products, and Power

WPI06 = Wholesale Price Index, Chemicals and Allied Products

WPI061NS = Wholesale Price Index, Industrial Chemicals

WPI07 = Wholesale Price Index, Rubber and Plastic Products

WPI0721NS = Wholesale Price Index, Plastic Construction Products

WPI0921NS = Wholesale Price Index, Insulation Board

WPI101NS = Wholesale Price Index, Iron and Steel

WPI1013NS = Wholesale Price Index, Steel Mill Products

WPI1022NS = Wholesale Price Index, Primary Nonferrous Shapes

WPI10220106NS = Wholesale Price Index, Copper Wirebar, Domestic Origin

WPI10250151NS = Wholesale Price Index, Zinc, Die Casting Alloy, #3

WPI10250INS = Wholesale Price Index, Aluminum Shapes

WPI1026NS = Wholesale Price Index, Wire and Cable

WPI1074NS = Wholesale Price Index, Structural Metal Products

WPI1081NS = Wholesale Price Index, Fasteners

WPI1089NS = Wholesale Price Index, Other Miscellaneous Metal Products

WPI1171NS = Wholesale Price Index, Wiring Devices

WPI134NS = Wholesale Price Index, Structural Clay Products

WPI1392NS = Wholesale Price Index, Insulation Materials

WPISOP2400NS = Wholesale Price Index, Processed Fuels and Lubricants

Table A.19 presents the detailed forecast for CEI261.

TABLE A.19

CEI261-SUPPLIES(USD)
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
CEI261	1.000	1.028	1.071	1.122	1.182	1.237	1.298	1.377
%CH	3.5	2.7	4.2	4.8	5.4	4.6	5.0	6.0
COSTS								
WPIIND(.011)	1.000	1.065	1.134	1.209	1.293	1.368	1.450	1.533
%CH	7.0	6.5	6.5	6.6	6.9	5.8	6.0	5.8
WPI03(.006)	1.000	1.035	1.077	1.116	1.162	1.204	1.253	1.304
%CH	4.1	3.5	4.0	3.6	4.2	3.6	4.1	4.1
WPI06(.007)	1.000	1.028	1.071	1.122	1.183	1.239	1.298	1.350
%CH	3.0	2.7	4.3	4.7	5.4	4.8	4.8	4.0
WPI067GNS(.002)	1.000	1.023	1.050	1.100	1.164	1.225	1.293	1.370
%CH	-1.9	2.3	2.6	4.8	5.8	5.3	5.5	6.0
WPI07(.210)	1.000	1.038	1.094	1.157	1.231	1.296	1.365	1.432
%CH	6.6	3.8	5.4	5.8	6.4	5.2	5.3	4.9
WPI071303NS(.015)	1.000	1.043	1.089	1.160	1.241	1.323	1.413	1.510
%CH	9.6	4.3	4.4	6.6	7.0	6.6	6.8	6.9
WPI08(.018)	1.000	1.150	1.183	1.258	1.360	1.404	1.503	1.617
%CH	16.3	15.0	2.9	6.4	8.1	3.2	7.0	7.6
WPI09(.082)	1.000	1.042	1.094	1.145	1.211	1.278	1.347	1.417
%CH	4.4	4.2	5.0	4.7	5.8	5.5	5.5	5.2
WPI09130131NS(.010)	1.000	1.027	1.070	1.143	1.240	1.329	1.426	1.534
%CH	3.0	2.7	4.2	6.8	8.5	7.2	7.3	7.6
WPI09150323NS(.374)	1.000	1.005	1.044	1.098	1.158	1.215	1.283	1.393
%CH	1.2	0.4	3.9	5.2	5.5	4.9	5.6	8.6
WPI116NS(.030)	1.000	1.095	1.188	1.270	1.359	1.447	1.541	1.647
%CH	7.1	9.5	8.4	6.9	7.0	6.5	6.5	6.9
WPI117NS(.030)	1.000	1.063	1.131	1.187	1.253	1.313	1.370	1.439
%CH	4.9	6.3	6.4	5.0	5.5	4.8	4.3	5.0
WPI1175NS(.002)	1.000	1.049	1.122	1.196	1.279	1.355	1.434	1.519
%CH	6.5	4.9	6.9	6.6	6.9	6.0	5.8	5.9
WPI117811NS(.036)	1.000	1.059	1.096	1.112	1.127	1.133	1.136	1.105
%CH	4.6	5.9	3.5	1.5	1.4	0.5	0.3	-2.8
WPI117812NS(.032)	1.000	1.044	1.072	1.097	1.150	1.205	1.248	1.307
%CH	7.3	4.4	2.7	2.3	4.9	4.7	3.6	4.7

Table A.19 (cont'd.)

	1977	1978	1979	1980	1981	1982	1983	1984
*PI1117821NS(.024)	1.000	1.022	1.067	1.115	1.157	1.194	1.235	1.270
%CH		6.5	2.2	4.4	4.5	3.7	3.2	3.5	2.8
*PI1117824NS(.040)	1.000	1.072	1.136	1.188	1.254	1.315	1.378	1.444
%CH		6.7	7.2	6.0	4.6	5.5	4.9	4.8	4.8
*PI1117825NS(.022)	1.000	1.085	1.130	1.188	1.232	1.304	1.380	1.490
%CH		5.9	8.5	4.1	5.4	5.5	5.8	5.8	8.0
*PI1117835NS(.018)	1.000	0.976	0.946	0.915	0.883	0.850	0.818	0.788
%CH		-4.0	-2.4	-3.1	-3.3	-3.5	-3.8	-3.7	-3.7
*PI1117841NS(.012)	1.000	0.846	0.785	0.755	0.734	0.707	0.678	0.658
%CH		-14.2	-15.4	-7.2	-3.8	-2.8	-3.7	-4.1	-2.9
*PI1117842NS(.010)	1.000	0.917	0.867	0.854	0.861	0.851	0.845	0.854
%CH		-8.2	-8.3	-5.4	-1.5	0.8	-1.1	-0.8	1.1
*PI1117845NS(.006)	1.000	0.882	0.825	0.783	0.747	0.711	0.674	0.642
%CH		-19.1	-11.9	-9.4	-5.1	-4.8	-4.8	-5.2	-4.8
*PI1179032 4NS(.002)	1.000	1.085	1.170	1.254	1.318	1.357	1.408	1.444
%CH		8.6	8.5	7.8	7.2	5.1	3.0	3.8	2.6
*PI14(.001)	1.000	1.074	1.129	1.181	1.237	1.304	1.373	1.445
%CH		9.5	7.4	5.2	4.6	4.7	5.4	5.3	5.2

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.
*WEIGHTS IN PARENTHESES SUM TO ONE.

CEI266 - Medical Supplies

The model specification and relevant statistics for WPI0635NS (Wholesale Price Index, Ethical Pharmaceutical Preparations) are:

```
%(WPI0635NS) = -0.756151 + 0.377166*%(COST0635) + 14.2128*(IF
               (0.2041)    (0.05595)                (3.436)

               D0635M4 GTR 0 THEN D0635M4 ELSE 0) + -14.844*(IF
                                                     (3.748)

               D0635M4 LEQ 0 THEN D0635M4 ELSE 0)
```

R-bar squared = 0.6799
Durbin-Watson = 1.8995

```
WPI0635NS = (1 + %(WPI0635NS)/100)*WPI0635NS\1
```

where:

COSTO635 = 0.223*((WPIO61NS + WPIO61NS\1)/2) + 0.119*
WPIO9150323NS + 0.024*WPI1013NS\1 + 0.085*
((WPIO7\1 + WPIO7\2)/2) + 0.024*WPI102501NS\3 +
0.025*((WPISOP2400NS\2 + WPISOP2400NS\3)/2) +
0.500*JRWSSNF

DO635M4 = OUTO635 - (MOVAVG(4 TO 1, OUTO635))

OUTO635 = 0.296*((JQIND20 + JQIND20\1)/2) + .007*((JQIND26 +
JQIND26\1)/2) + 0.467*((JQIND28 + JQIND28\1)/2) +
0.139*((JQIND281+JQIND281\1)/2) + 0.012*
((JQIND307 + JQIND307\1)/2) + 0.004*((JQIND32 +
JQIND32\1)/2) + 0.075*((JQIND38 + JQIND38\1)/2)

JQIND20 = Industrial Production Index, Foods

JQIND26 = Industrial Production Index, Paper and Products

JQIND28 = Industrial Production Index, Chemicals and Products

JQIND281 = Industrial Production Index, Basic Chemicals

JQIND307 = Industrial Production Index, Plastics Products

JQIND32 = Industrial Production Index, Clay, Glass, and Stone Products

JQIND38 = Industrial Production Index, Instruments

JRWSSNF = Index of Compensation Per Man-hour, Nonfarm Business Sector

WPIO61NS = Wholesale Price Index, Industrial Chemicals

WPIO7 = Wholesale Price Index, Rubber and Plastic Products

WPIO9150323NS = Wholesale Price Index, Corrugated Shipping Containers

WPI1013NS = Wholesale Price Index, Steel Mill Products

WPI102501NS = Wholesale Price Index, Aluminum Shapes

WPISOP2400NS = Wholesale Price Index by Stages of Processing, Processed Fuels and Lubricants

The price model of WPIO635NS is composed of a cost (supply) component and a demand measure. Information on the proper specification was obtained from the Census of Manufacturers and from U.S. Industrial Outlook 1976. The lag structure which is used is based on correlation analysis.

Table A.20 presents the detailed forecast for CEI266.

TABLE A.20

CEI266-MEDICAL SUPPLIES
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
CEI266	1.000	1.048	1.109	1.175	1.253	1.327	1.408	1.504
%CM	4.5	4.9	5.8	5.9	6.6	5.9	6.1	6.8
*PI0835NS(.500)	1.000	1.047	1.106	1.173	1.253	1.328	1.412	1.511
%CM	4.4	4.7	5.7	6.1	6.8	6.0	6.3	7.0
*PI117NS(.500)	1.000	1.063	1.131	1.187	1.253	1.313	1.370	1.439
%CM	4.9	6.3	6.4	5.0	5.5	4.8	4.3	5.0

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.

CEI267 - Aviation Repair Parts

Table A.21 presents the detailed forecast for CEI267.

TABLE A.21

CEI267-AVIATION REPAIR PARTS
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
CEI267	1.000	1.067	1.150	1.230	1.320	1.407	1.494	1.600
%CM	6.8	6.7	7.8	6.9	7.3	6.6	6.5	6.8
LABOR(.500)								
AME1925NS(.005)	1.000	1.111	1.196	1.246	1.355	1.447	1.499	1.617
%CM	11.0	11.1	7.7	4.2	8.7	6.8	3.5	7.9
AME35NS(.218)	1.000	1.083	1.159	1.244	1.340	1.438	1.543	1.657
%CM	7.1	8.3	7.0	7.3	7.8	7.3	7.3	7.4
AME36NS(.122)	1.000	1.091	1.178	1.258	1.346	1.438	1.533	1.634
%CM	8.5	9.1	8.0	6.8	7.0	6.9	6.6	6.6
AME372NS(.060)	1.000	1.077	1.161	1.245	1.351	1.451	1.555	1.677
%CM	7.0	7.7	7.8	7.2	8.5	7.4	7.2	7.8
AME3721NS(.095)	1.000	1.058	1.139	1.216	1.322	1.417	1.516	1.636
%CM	5.5	5.8	7.6	6.8	8.7	7.2	7.0	7.9

Table A.21 (cont'd.)

	1977	1978	1979	1980	1981	1982	1983	1984
MATERIAL(.500)								
wPI07	1.000	1.038	1.094	1.157	1.231	1.296	1.365	1.432
%CH	0.0	3.8	5.4	5.8	6.4	5.2	5.3	4.9
wPI101NS	1.000	1.090	1.211	1.510	1.425	1.533	1.662	1.809
%CH	7.0	9.0	11.1	8.2	8.8	7.5	8.4	8.8
wPI1022NS	1.000	1.036	1.148	1.260	1.373	1.479	1.610	1.731
%CH	-9.1	3.5	10.9	9.7	9.0	7.7	8.9	7.5
wPI10220116NS	1.000	0.889	0.975	1.053	1.126	1.198	1.270	1.347
%CH	8.5	-11.1	9.7	7.9	6.9	6.4	6.0	6.0
wPI1024NS	1.000	1.052	1.131	1.230	1.334	1.422	1.542	1.677
%CH	11.6	5.2	7.5	8.7	8.5	6.5	8.4	8.8
wPI1025NS	1.000	1.072	1.174	1.265	1.368	1.460	1.552	1.650
%CH	11.0	7.2	9.5	7.7	8.1	6.8	6.3	6.3
wPI1102501NS	1.000	1.125	1.230	1.333	1.461	1.570	1.664	1.765
%CH	14.5	12.5	9.4	8.4	9.6	7.5	6.0	6.0
wPI10250102NS	1.000	1.152	1.228	1.322	1.385	1.462	1.555	1.597
%CH	7.2	15.2	6.6	7.7	4.7	5.6	6.4	2.7
wPI1102505NS	1.000	1.009	1.093	1.148	1.232	1.334	1.424	1.552
%CH	-0.5	0.9	8.2	5.1	7.3	8.2	6.8	9.0
wPI1026NS	1.000	0.998	1.099	1.182	1.247	1.300	1.367	1.430
%CH	4.7	-0.2	10.1	7.6	5.4	4.3	5.2	4.6
wPI104NS	1.000	1.063	1.134	1.193	1.264	1.328	1.396	1.473
%CH	7.2	6.3	6.7	5.3	5.9	5.1	5.2	5.5
wPI108NS	1.000	1.063	1.137	1.206	1.290	1.363	1.443	1.539
%CH	4.7	6.3	7.0	6.0	7.0	5.7	5.8	6.7
wPI114NS	1.000	1.067	1.148	1.222	1.309	1.390	1.473	1.572
%CH	6.2	6.7	7.6	6.5	7.1	6.2	6.0	6.7
wPI1141NS	1.000	1.077	1.169	1.252	1.345	1.423	1.504	1.611
%CH	6.5	7.7	8.6	7.1	7.4	5.8	5.7	7.1
wPI1143NS	1.000	1.068	1.136	1.200	1.273	1.348	1.424	1.507
%CH	6.1	6.8	6.4	5.7	6.1	5.8	5.7	5.8
wPI1144901NS	1.000	1.062	1.143	1.217	1.304	1.387	1.473	1.581
%CH	4.6	6.2	7.7	6.5	7.1	6.3	6.2	7.3
wPI1144905NS	1.000	1.068	1.156	1.218	1.289	1.359	1.429	1.512
%CH	8.6	6.8	8.3	5.4	5.8	5.4	5.1	5.8
wPI1171NS	1.000	1.075	1.165	1.253	1.350	1.440	1.531	1.633
%CH	5.1	7.5	8.4	7.6	7.7	6.7	6.4	6.6
wPI1172NS	1.000	1.056	1.129	1.189	1.253	1.311	1.370	1.425
%CH	2.5	5.6	6.9	5.3	5.4	4.6	4.5	4.0
wPI1175NS	1.000	1.049	1.122	1.196	1.279	1.355	1.434	1.519
%CH	6.5	4.9	6.9	6.6	6.9	6.0	5.8	5.9
wPI1178NS	1.000	1.059	1.128	1.192	1.242	1.288	1.337	1.388
%CH	2.8	5.9	6.5	5.7	4.2	3.7	3.8	3.8

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.
ALL MATERIAL COMPONENTS WERE COMBINED USING AN EVEN WEIGHTING SCHEME AS DISCUSSED IN THE BODY OF THE REPORT.

CEI268 - ADP Supplies

The model specification and relevant statistics for WPI117825NS (Wholesale Price Index, Magnetic Tape) are:

```
%(WPI117825NS) = 0.265274 + 0.770276*%(COST117825) + -80.7727*
                 (0.6915)   (0.2027)                 (69.06)

                 (IF D117825M16 LEQ -0.024 THEN D117825M16 +

                 0.024 ELSE 0) + 40.7609*(IF D117825M16 LEQ
                                 (26.86)

                 0.028 THEN D117825M16 - 0.028 ELSE 0) +

                 -37.1068*(IF D117825M16 GTR 0.028 THEN
                 (23.44)

                 D117825M16 - 0.028 ELSE 0) + 66.6188*(IF
                                              (57.11)

                 D117825M16 GTR 0.080 ELSE 0) + -4.87025*PCDUM +
                                                 (1.141)

                 6.43786*DATADUM

R-bar squared = 0.8248
Durbin-Watson = 2.1050


WPI117825NS = (1 + %(WPI117825NS/100)*WPI117825NS\1

where:

     COST117825 = 0.591*(0.116*WPI061NS + 0.116*WPI0721NS\1 +
                  0.193*WPISOP2400NS\1 + 0.013*WPI10220116NS\1 +
                  0.038*WPI09130131NS + 0.004*WPI0150101NS +
                  0.014*WPI102501NS\3 + 0.032*WPI10250117NS\4 +
                  0.026*WPI110250103NS\4 + 0.061*
                  WPI10220106NS\5 + 0.078*WPI1026NS\4 + 0.036*
                  WPI10130247NS + 0.041*WPI10130248NS\1 + 0.054*
                  WPI10130246NS\1 + 0.178*WPI117824NS\2) +
                  0.409*AHE36NS\4/2.773

     D117825M16 = OUT117825 - (MOVAVG(16 TO 1, OUT117825))

     OUT117825 = 0.25*CN72 3/259.5 + 0.15*JQINDEQPBUS\1 +
                 0.20*JQIND198G\1 + 0.20*JQIND38\1 + 0.20*
                 JQIND366

     AHE36NS = Average Hourly Earnings, Electrical Machinery
     Production

     CN72 = Personal Consumption Expenditures, Nondurables
```

JQINDEQPBUS = Business Equipment

JQIND198G = Ordnance, Private and Government

JQIND38 = Instruments

JQIND366 = Communication Equipment

WPI061NS = Wholesale Price Index, Industrial Chemicals

WPI0721NS = Wholesale Price Index, Plastic

WPI09130131NS = Wholesale Price Index, Paper, Wood Bond

WPI10130246NS = Wholesale Price Index, Carbon Plates

WPI10130247NS = Wholesale Price Index, Stainless Steel Plates

WPI10130248NS = Wholesale Price Index, Structural Steel Shapes

WPI10150101NS = Wholesale Price Index, Gray Iron Castings

WPI10220106NS = Wholesale Price Index, Copper Wirebar, Domestic Origin

WPI10220116NS = Wholesale Price Index, Nickel, Cathode Sheets

WPI102501NS = Wholesale Price Index, Aluminum Shapes

WPI10250103NS = Wholesale Price Index, Aluminum Sheet, Siding Coil

WPI10250117NS = Wholesale Price Index, Aluminum Extrusions

WPI1026NS = Wholesale Price Index, Wire and Cable

WPI117824NS = Wholesale Price Index, Connectors

WPISOP2400NS = Wholesale Price Index by Stages of Processing, Process Fuels and Lubricants

PCDUM = Price Control Dummy Variable for 2 Quarters from 1972:1 to 1972:2

DATADUM = Dummy Variable for 1975:2 to account for Data Aberration

Table A.22 presents the detailed forecast of CEI268.

TABLE A.22

CEI268-ADP SUPPLIES
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
CEI268	1.000	1.056	1.100	1.156	1.236	1.317	1.403	1.512
%CH		5.6	4.2	5.1	7.0	6.5	6.6	7.8
WPI117825NS(.500)	1.000	1.085	1.130	1.168	1.232	1.304	1.380	1.490
%CH		8.5	4.1	3.4	5.5	5.8	5.8	8.0
WPI09130131NS(.500)	1.000	1.027	1.070	1.143	1.240	1.329	1.426	1.534
%CH		2.7	4.2	6.8	8.5	7.2	7.3	7.6

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000

CEI31 - Equipment

Table A.23 presents the detailed forecast for CEI312.

TABLE A.23

CEI312-GENERAL-PURPOSE MACHINERY AND EQUIPMENT
FORECAST AND ASSUMPTIONS
(FISCAL YEARS)

	1977	1978	1979	1980	1981	1982	1983	1984
FORECAST								
#PI114NS	1.000	1.067	1.148	1.222	1.309	1.390	1.473	1.572
%CH	6.2	6.7	7.6	6.5	7.1	6.2	6.0	6.7
COMPONENTS								
#PI1141NS(.137)	1.000	1.077	1.169	1.252	1.345	1.423	1.504	1.611
%CH	6.5	7.7	8.6	7.1	7.4	5.8	5.7	7.1
#PI1143NS(.099)	1.000	1.066	1.136	1.200	1.273	1.348	1.424	1.507
%CH	6.1	6.8	6.4	5.7	6.1	5.8	5.7	5.8
#PI1144NS(.206)	1.000	1.071	1.151	1.232	1.326	1.415	1.507	1.605
%CH	7.5	7.1	7.5	7.0	7.6	6.7	6.4	6.5
#PI1145NS(.136)	1.000	1.079	1.164	1.247	1.345	1.437	1.531	1.640
%CH	5.9	7.8	7.9	7.1	7.9	6.8	6.5	7.2
#PI1147NS(.071)	1.000	1.063	1.136	1.193	1.265	1.330	1.394	1.471
%CH	7.2	6.3	6.9	5.0	6.1	5.2	4.8	5.5
#PI11490INS(.246)	1.000	1.062	1.143	1.217	1.304	1.387	1.473	1.581
%CH	4.6	6.2	7.7	6.5	7.1	6.3	6.2	7.3
#PI11490SNS(.105)	1.000	1.068	1.156	1.218	1.289	1.359	1.429	1.512
%CH	6.6	6.8	8.3	5.4	5.8	5.4	5.1	5.8

NOTE: ALL SERIES ARE INDEXED TO 1977=1.000.

IV. LIST OF VARIABLES

CODE	VARIABLE DEFINITION
AHECNS	Average Hourly Earnings, Construction, United States
AHEPOST	Average Hourly Earnings, Postal Service Workers
AHE1925NS	Average Hourly Earnings, Completed Guided Missiles
AHE27NS	Average Hourly Earnings, Printing and Publishing
AHE36NS	Average Hourly Earnings, Electrical Machinery
AHE372NS	Average Hourly Earnings, Aircraft and Parts
AHE3721NS	Average Hourly Earnings, Aircraft
AHE3731NS	Average Hourly Earnings, Ship Building and Repairing
AHE421NS	Average Hourly Earnings, Truckings
AHE422NS	Average Hourly Earnings, Public Warehousing
AHE498NS	Average hourly Earnings, Water and Sanitary Systems
ASETIV	Index of Annual Earnings, Engineering Technician, Level 4
CIAC	Air Cargo Cost Index
CIIT	Interstate Trucking Cost Index
CNFOOD	Personal Consumption Expenditures - Food
CPIHOTEL	Consumer Price Index, Hotel/Motel Room Rates
CPI12000000NS@099	Consumer Price Index, Meals Away from Home
CPI22311259NS@099	Consumer Price Index, Residential Water and Sewerage
CPI23212399NS@099	Consumer Price Index, Postal Charges
CPI42111792NS@099	Consumer Price Index, Air Fares, Chiefly Coach
GNP72	Gross National Product - 1972 Dollars
ICNRCOST	Rental Price of Capital - Structures - Old Formulation
ICNRCOSTNET	Rental Price of Capital - Structures
IPDENRCOSTNET	Rental Price of Capital - Equipment
JAHEADJEA	Index of Hourly Earnings of Production Workers, Private Nonfarm
JRWSSNF	Index of Compensation Per Hour, Nonfarm Business Sector
LRTTL	Railroad Freight Rates, Total
PICNR	Implicit Price Deflator, Investment, Private Nonresidential Structures
TXGF	Federal Government Indirect Business Tax and Nontax Accruals
TXGSL	State and Local Government Indirect Business Tax and Nontax Accruals
WPIIND	Wholesale Price Index, Industrial Commodities (Seasonally Adjusted)
WPIINDO	Wholesale Price Index, Industries - Other
WPISOP2400NS	Wholesale Price Index, Processed Fuels and Lubricants
WPISOP2610NS	Wholesale Price Index, Supplies for Manufacturing Industries
WPI01	Wholesale Price Index, Farm Products
WPI02	Wholesale Price Index, Processed Foods and Feeds
WPI03	Wholesale Price Index, Textile Products and Apparel
WPI05	Wholesale Price Index, Fuels and Related Products and Power
WPI06	Wholesale Price Index, Chemicals and Allied Products
WPI061NS	Wholesale Price Index, Industrial Chemicals
WPI0622NS	Wholesale Price Index, Paint Materials
WPI0679NS	Wholesale Price Index, Miscellaneous Chemical Products and Preparations

CODE	VARIABLE DEFINITION
WPI07	Wholesale Price Index, Rubber and Plastic Products
WPI071201NS	Wholesale Price Index, Tires
WPI071303NS	Wholesale Price Index, Rubber Belts
WPI0721NS	Wholesale Price Index, Plastic Construction Products
WPI08	Wholesale Price Index, Lumber and Wood Products
WPI09	Wholesale Price Index, Pulp, Paper and Allied Products
WPI09130131NS	Wholesale Price Index, Paper, Wood Bond
WPI09150323NS	Wholesale Price Index, Corrugated Shipping Containers
WPI101NS	Wholesale Price Index, Iron and Steel
WPI1013NS	Wholesale Price Index, Steel Mill Products
WPI10130246NS	Wholesale Price Index, Carbon Plates
WPI1015NS	Wholesale Price Index, Foundry Shop Products
WPI102NS	Wholesale Price Index, Nonferrous Metals
WPI1022NS	Wholesale Price Index, Primary Nonferrous Shapes
WPI0220116NS	Wholesale Price Index, Nickel, Cathode Sheets
WPI1024NS	Wholesale Price Index, Secondary Metal and Alloy Basic Shapes
WPI1025NS	Wholesale Price Index, Mill Shapes
WPI102501NS	Wholesale Price Index, Aluminum Shapes
WPI10250102NS	Wholesale Price Index, Aluminum Sheet, Heat-Treatable
WPI10250117NS	Wholesale Price Index, Aluminum Extrusions
WPI102505NS	Wholesale Price Index, Titanium Mill Shapes
WPI1026NS	Wholesale Price Index, Wire and Cable
WPI104NS	Wholesale Price Index, Hardware
WPI105NS	Wholesale Price Index, Plumbing Fixtures
WPI107NS	Wholesale Price Index, Fabricated Structural Metal Products
WPI1072NS	Wholesale Price Index, Metal Tanks
WPI108NS	Wholesale Price Index, Miscellaneous Metal Products
WPI1081NS	Wholesale Price Index, Bolts, Nuts, Screws, and Rivets
WPI11	Wholesale Price Index, Machinery and Equipment
WPI114NS	Wholesale Price Index, General-Purpose Machinery and Equipment
WPI1141NS	Wholesale Price Index, Pumps and Compressors
WPI1143NS	Wholesale Price Index, Fluid Power Equipment
WPI1144NS	Wholesale Price Index, Industrial Material Handling Equipment
WPI1145NS	Wholesale Price Index, Mechanical Power Transmission Equipment
WPI1147NS	Wholesale Price Index, Fans and Blowers
WPI114901NS	Wholesale Price Index, Valves and Fittings
WPI114905NS	Wholesale Price Index, Ball and Roller Bearings
WPI116NS	Wholesale Price Index, Special Industrial Machinery and Equipment
WPI117NS	Wholesale Price Index, Electrical Machinery and Equipment
WPI1171NS	Wholesale Price Index, Wiring Devices
WPI1172NS	Wholesale Price Index, Integrating and measuring Instruments
WPI117202NS	Wholesale Price Index, Electronic Instruments
WPI1174NS	Wholesale Price Index, Transformers and Power Regulators
WPI1175NS	Wholesale Price Index, Switchgear, Switchboards and Equipment
WPI1178NS	Wholesale Price Index, Electronic Components
WPI11781NS	Wholesale Price Index, Capcitors
WPI117812NS	Wholesale Price Index, Resistors

CODE	VARIABLE DEFINITION
WPI117821NS	Wholesale Price Index, Relays
WPI117824NS	Wholesale Price Index, Connectors
WPI117825NS	Wholesale Price Index, Magnetic Tape
WPI117835NS	Wholesale Price Index, Transistors
WPI117841NS	Wholesale Price Index, Digital Bi-Polar Integrated Circuits
WPI117842NS	Wholesale Price Index, Digital M.O.S. Integrated Circuits
WPI117845NS	Wholesale Price Index, Linear Integrated Circuits
WPI11790324NS	Wholesale Price Index, Electrode, Graphite
WPI1194NS	Wholesale Price Index, Internal Combustion Engines
WPI14	Wholesale Price Index, Transportation Equipment
WPI141102NS	Wholesale Price Index, Trucks
WPI151302NS	Wholesale Price Index, Ammunition