Armed Services Pricing Manual

(ASPM)

Volume 2
Price Analysis

DEPARTMENT OF DEFENSE

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FOREWORD TO VOLUME 2

This Volume 2 of the *Armed Services Pricing Manual (ASPM)* is published for the guidance of Department of Defense personnel engaged in the analysis and negotiation of contract prices. It contains instructional material dealing with price analysis and is based on policies and procedures of the Federal Acquisition Regulation (FAR) and the DoD FAR Supplement (DFARS). It uses detailed discussions and examples to illustrate the application of pricing policy to pricing problems, but it is not directive. This volume is to be used for training, both in classrooms and on the job. It is also to be used as a handbook.

This volume, *Price Analysis*, can stand alone or be combined with Volume 1, *Contract Pricing*. The chapters in the two volumes are numbered consecutively, 1 through 19. Each volume has a topical index and, as appendices, a list of acronyms and a glossary. These are identical in both volumes. Volume 2 has three other appendices, one dealing with the catalog or market price exemption, one with quantitative tools of analysis, and one with sources of pricing information.

Copies of Volume 2 may be purchased from the Superintendent of Documents, Attention: Mail List Section, U.S. Government Printing Office, Washington, DC 20402.

ARMED SERVICES PRICING MANUAL

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CHAPTER 11

PRICES AND PRICING

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11.1 Introduction

Price analysis is one of two ways for determining whether a seller's proposed price is acceptable. Cost analysis is the other. Both are part of the contract pricing function discussed and explained in the first volume of this Manual.

Nine of that volume's 10 chapters, as well as the coverage of contract pricing in the Federal Acquisition Regulation (FAR) and the DoD FAR Supplement (*DFARS*), focus on costs and cost analysis. They do so despite the fact that cost analysis is used mostly in the relatively small number of noncompetitive procurements and contract modifications expected to exceed $100,000, while price analysis should be used in all procurements, competitive and noncompetitive, regardless of dollar value.

This emphasis on cost analysis is probably the natural consequence of the number of dollars involved in large defense contracts. How can price analysis be used to price a nuclear-powered warship, a fixed-wing aircraft, a tank, or an airborne radar? Who would dare use price analysis on such high-risk buys, and *how* could you do it? We answer these questions in this second volume of the *Armed Services Pricing Manual (ASPM)* and show how you can use price analysis effectively in buying more commonplace products and services. This kind of buying is not glamorous, but it is

essential and demanding and it usually takes something other than cost analysis to reach a fair and reasonable price.

This volume is the first major Department of Defense effort to focus on how to use price analysis, and it is the first major effort to list and describe sources of pricing information. For the most part, this volume addresses price analysis as it can and should be done, even though not all organizations are set up in such a manner that their contract specialists will be able to operate in the ways described.

FAR 15.801 defines price analysis and cost analysis in the following terms:

- "'Cost analysis' means the review and evaluation of the separate cost elements and proposed profit of (a) an offeror's or contractor's cost or pricing data and (b) the judgmental factors applied in projecting from the data to the estimated costs in order to form an opinion on the degree to which the proposed costs represent what the cost of the contract should be, assuming reasonable economy and efficiency."

- "'Price analysis' means the process of examining and evaluating a proposed price without evaluating its separate cost elements and profit."

While these definitions emphasize the differences in the two types of analysis, both types make extensive use of comparison techniques, and the real differences are in the kinds and sources of the data used in each analysis.

The company's accounting books and records are the principal sources of the data used in cost analysis, where the focus is on the cost breakdown and (1) the costs incurred in earlier, as well as current, work, (2) the ongoing costs of operating the company, and (3) the data and assumptions used to project the future contract costs.

In price analysis, proposed prices are compared with the following indicators of reasonableness:

- Competitive quotations
- Market prices
- Past prices
- Past quotations
- Estimating yardsticks such as dollars per pound
- Independent estimates.

The sources of these data, except for some past prices and past quotations, are outside the offeror's organization; past prices and quotations can be secured from both offerors and external sources.

The way cost analysis and price analysis are defined, you might conclude that cost analysis and cost breakdowns go together and that price analysis is not concerned with cost breakdowns. Although such an interpretation is possible, it is not true; price analysis can and should be used to evaluate selected cost elements in the breakdowns supporting an offer. For instance, catalog and market prices can be used to evaluate the prices of certain commercial or commercial-type parts and

components in a material cost estimate, and prices paid for commercial-type services can be used to evaluate that segment of a proposal.

You undertake both types of analysis to determine the reasonableness of the prices offered. You can perform – or, rather, you *should* perform – price analysis on every procurement, alone or together with cost analysis. With sealed bidding and competitive proposals, the analysis that leads to the conclusion that effective price competition does or does not exist is price analysis.

If a noncompetitive procurement is expected to exceed $100,000, you must get cost or pricing data, perform cost analysis and price analysis, negotiate an agreement on price, and get a certificate of current cost or pricing data, even though you think you can establish a reasonable price on the basis of price analysis alone.

11.2 Fair and Reasonable

Fair and reasonable is defined as a conclusion that a price is fair to both parties to the contract, considering the promised quality and timeliness of contract performance. More specifically, a fair and reasonable price is one that represents the value of the product or service to you, the buyer. To reach that conclusion, you must ask yourself, is it worth this price? If your answer is yes, you have a fair and reasonable price. If your answer is no, you must analyze and negotiate and after that, if you still can't answer yes, you must ask for help from someone higher in the organization.

When you say a price equates with the product's worth to you and the seller agrees to sell at that price, you can say that the price also is fair and reasonable to the seller; it may not be as high as originally asked, but it's one the seller can accept.

Worth

You are expected to be able to say that the prices of every contract you award are fair and reasonable. On the basis of experience with sole-source sellers, this is not entirely realistic. However, considering all the factors that determine worth, you usually can do it in good conscience. For example, if the requirement (the demand) that sends you into the marketplace is relatively inelastic, the price you ultimately agree to is what the product or service is worth because it is the price you must pay in order to get it. (*Inelastic* means you must have a specified product or service and you have no alternative but to buy it from the seller at the best price you can get the seller to agree to.) However, you can call that price fair and reasonable only if you have done all that needs to be done in analyzing and negotiating before you reach that conclusion.

Much of the time, the market factors of supply and demand help set the prices at which goods and services change hands. Nonmarket factors such as laws and regulations also can play a part as does, for example, the law that limits the fee on certain cost-reimbursement contracts to 10 percent of the estimated contract cost exclusive of fee.

We concentrate on market-based pricing and on situations where market factors and selling strategies determine the pricing environment. However, even in a free market, price can be influenced by such things as advertising, national and international monetary and trade policies, technological changes, and tax policies.

Market factors

The law of supply and demand works perfectly only under conditions of perfect competition – and perfect competition rarely exists. *Perfect competition* exists when there are many sellers and buyers, the product is homogeneous and perfectly interchangeable, and the market price is determined by supply and demand. A single seller may sell or refuse to sell at the existing price,

but that one seller does not control the price; other sellers may sell at that price. Similarly, the buyer may buy or refuse to buy at that price, but that buyer does not control the price either; other buyers may buy all that is offered at that price. All are free to enter or leave the particular market at will.

Modern price theory classifies markets by degrees of competition ranging from perfect competition at one end to monopoly and monopsony at the other. *Monopoly* exists when there is one seller of a product that has no close substitutes. The seller controls the entire supply of the particular product and is free to maximize profits by regulating output and forcing a favorable *supply-demand relationship. Monopoly also exists when, as it is* with many sole-source military items, there is one buyer and one seller. A seller's control over price varies according to circumstances that determine bargaining strength. *Monopsony* exists when there are several sellers and one buyer of interchangeable products. In this situation, *sellers tend to have little effective* control over price.

Between the extremes, there are many degrees of competition, ranging from industries like automobiles in which relatively few suppliers compete through many dealers to sell their cars and trucks, to those like food products in which thousands of independent companies compete to get their products on the grocers' shelves and the grocers compete to sell their wares to consumers.

11.3 Sellers' Approaches

Prices for goods and services in the market are a function of sellers' competing pricing strategies. The more you know about a company's approaches to pricing, the better off you are in analyzing and negotiating prices. These approaches are categorized as cost-based, market-based, or some combination of the two.

Cost-based pricing

Under cost-based pricing, the seller asks a price that is expected to cover all costs of contract performance and produce an acceptable profit. The theory is that price is a direct function of the cost to perform and a fair price is a combination of an accurate representation of cost and a fair profit.

Many sellers in the defense industry start from this point in pricing their wares. However, a pure cost-based price can cause you to pay too much if the seller is inefficient or its management is ineffective. For this reason, you also must test the reasonableness *of an offered price using market* data.

In situations involving high-priced, technically complex products, you may have to use cost or pricing data and make an in-depth analysis to determine what the cost should be. This *should-cost* technique is discussed in FAR 15.810. It differs from other cost analyses in its depth, in its use of specialists with a wide variety of technical skills, in the fact that it is conducted at the *seller's* plant, and in the extent to which the Government evaluates costs and identifies and challenges inefficiencies in the seller's management and operations.

Market-based pricing

Sellers in a competitive market pay close attention to prices in hopes of identifying the lowest figure that will achieve a reasonable number of sales and produce an acceptable financial outcome overall. That outcome does not necessarily depend on earning a profit on each sale.

A seller sometimes finds it expedient and in its long-term interest to price a sale on the basis of the incremental cost of performing the contract. The incremental costs are the costs incurred as a result of doing the work, costs that would not be incurred if the sale were not made. These would be direct material and labor and certain indirect costs. Such pricing, referred to as *marginal pricing*,

may mean a loss on the sale but could, as part of an overall business plan, bring higher profits at the end of the fiscal period than would otherwise be realized. In addition, a seller sometimes will adopt a pricing strategy designed to maintain or improve its market share, expecting that the increased market share would lower unit costs and improve overall profit margins.

These things may be true enough in some cases, but always remember that a seller may set a price arbitrarily, without a clear understanding of or care for the likely reaction of buyers and what the price might do profit and market share.

11.4 Government Approaches

Contract pricing is the function that answers your question, "What should I pay?" To answer this question, you must decide if proposed prices are fair and reasonable and if they are not, prepare and negotiate to reach agreement on prices that are. You also must support that determination with a written report. In doing all this, you may use cost analysis and always will use price analysis. We talk about cost or pricing data so you will understand price analysis more fully and because exemption from the statutory requirement that the offeror furnish such data depends on price analysis. How that works will become clear when we discuss exemptions for (1) adequate price competition, (2) catalog or market prices, and (3) prices set by law or regulation in Chapter 13.

Cost or pricing data

Cost or pricing data is a phrase that is used to describe the data needed for cost analysis. It was introduced into law in 1962 with the passage of P.L. 87-653, the Truth in Negotiations Act. *Cost or pricing data* are all facts as of the time of agreement on price that can be expected to affect price negotiations significantly. These facts are the basis for a seller's projections of future costs and the basis for your evaluation of those projections. The data include such things as cost breakdowns on materials, subcontracted items, standard commercial items, direct labor hours and dollars, and indirect expenses. Because they are factual, you can use them to test the offeror's judgments in estimating future costs.

Cost or pricing data may or may not be required for a particular procurement, depending both on the estimated dollar value of the procurement and the existence of competition or a competitive marketplace. Unless sealed bid procedures are used or unless a statutory exemption fits or a waiver is granted, you must require the offeror to submit cost or pricing data in support of a procurement expected to exceed $100,000. This requirement of P.L. 87-653 is implemented in FAR 15.804. The cost or pricing data submitted and identified in writing must later be certified by the offeror at the conclusion of negotiations. Certification means the offeror promises that the data are current, accurate, and complete at the time of agreement on price and agrees to reduce the agreed-to price if those data are later found to be defective, that is, noncurrent, inaccurate, or incomplete, causing the agreed-to price to be overstated.

Price analysis

Price analysis is what you do when you examine and evaluate offers using competitive offers, market data, and procurement histories. When cost or pricing data and cost analysis are required, price analysis augments cost analysis by helping establish the value of the product or service, independent of the cost of doing the work. When cost or pricing data are not required and not needed, price analysis is the exclusive means of establishing that an offered price is fair and reasonable.

Cost analysis, by itself, cannot establish a reasonable price because it concentrates exclusively on costs and internal cost or pricing data. This can lead to bad pricing because these data do not necessarily give a clue to what the costs should be, what the value of the products or services are, or

what the price likely would be in a competitive buy. Therefore, price analysis is to be performed in all cases.

Comparison

Comparison is the basis for price analysis. The three major types are described below and discussed in detail in Chapter 14.

Primary Comparisons

Primary comparisons are the most conclusive and are made whenever possible. Competitive evaluations and comparisons with published prices are primary comparisons. Competitive evaluation refers to the comparison of competing offers. This technique can produce the most reliable comparisons when the price competition is judged to be effective. The other primary technique, comparison with published prices, is effective when prices are available in the marketplace, when there are priced catalogs, or when prices are set by law or regulation.

Secondary Comparisons

Secondary comparisons include a family of techniques in which data other than competitive offers or published prices are used to make comparisons: These kinds of data include prior quotations, prices paid before for similar items, cost estimating relationships such as dollars per pound, and Government estimates. Secondary comparisons usually support one or both primary techniques, but they can stand alone as the basis for determining the reasonableness of price.

Auxiliary Analyses

Auxiliary analyses are techniques that can't be used on their own to establish the reasonableness of prices; they must be used in conjunction with primary or secondary comparisons or with cost analysis. The technique used most commonly is value analysis in which you try to isolate the reasons for differences in prices quoted for similar products.

Because price analysis relies on comparisons, it is useful only if the data being compared are accurate and reasonably comparable. For this reason, this volume covers adjustment techniques you can use to verify the accuracy of data and improve comparability.

11.5 Steps in Contract Pricing

All contract pricing involves a logical sequence of interrelated actions. Three major steps are necessary for all procurements, and two others are needed when other than sealed bidding procedures are used. If you overlook any step, you may pay more than is necessary.

Plan the acquisition – Step 1

You always must do some planning before developing the solicitation. Your purpose is to make sure the need (the requirement) is met in the most economical and timely manner. Part 7 of the FAR describes this planning process. Those elements that relate to contract pricing are:

a. *Risk.* Assess how technical, cost, and scheduling risks might be reduced.

b. *Sources.* Identify prospective sources, including required sources, based on market research and analysis.

c. *Competition.* Explore ways to seek, promote, and sustain competition throughout the course of the acquisition.

d. *Source selection procedures.* Determine the procedures to be followed and assess the effect on pricing.

e. *Cost estimate.* Prepare a cost estimate independent of any prepared by contractors.

The aim of many elements of acquisition planning is to give early, thorough consideration to ways to intensify competition because competition is the best way to make sure the price you pay is fair and reasonable.

Assemble the data – Step 2

Price analysis is a comparative process. You must have price information with which to compare an offered price and you must anticipate what information you will need from the offerors and ask for it in the solicitation. You need to decide the type of analysis you will be doing and ask for the necessary data in the format you will need for that type of analysis. In doing this, consider dollar value of the procurement, nature of the competition expected, type of requirement, procurement history, and specific requirements of regulations.

Rarely will the data used be limited to information furnished by the offeror. Useful information can be found in contract files and in the marketplace. You are responsible for obtaining relevant, accurate, and complete data from whatever sources are available.

Analyze the data – Step 3

At its simplest, price analysis is a matter of comparing competitive bids. In other cases, you must consider technical as well as price factors in order to select the best offer. In all cases, you must identify the pricing issues and use appropriate analytic techniques to make proper price decisions.

You must determine how data will be verified and analyzed. You must consider time available, personnel resources, and circumstance of the particular procurement. You don't ask for data unless you are going to use it, but there will be times when circumstances arising after you receive data make it unnecessary to review that data.

Several key issues shape data analysis. You must decide whether price analysis alone will do the job or whether it will take both price and cost analysis. You also must decide how much analysis to do and what techniques to use. Finally, you may need to adjust the data to make the comparisons meaningful.

Negotiate the price – Step 4

After completing the third step, take stock of where you are and what you know about the offered price and decide your next move. In sealed bidding, depending on your analysis, you award the contract or cancel the invitations for bids. With most competitive proposals and all noncompetitive procurements, your next move, after a review, is to negotiate, to bargain with offerors or offeror.

You use the findings and conclusions of analysis to plan the negotiation and fix your negotiation objective. In most organizations, your boss, or someone higher, will review your plans with you before negotiations start. Review lets you test your conclusions and demonstrate the quality

of your work. If it is a review of your written analysis report, the work you do to prepare the report will help you later if you should have to reconstruct the events of the procurement.

The planning you do to prepare for negotiation, using the data and findings of analysis, will help you more than any number of negotiation gimmicks.

Document the agreement – Step 5

You need to describe your discussions with offerors and the resulting changes in offers and include that information in the contract file. One record of *how* and *why* you have performed, called a price negotiation memorandum, or PNM, summarizes for future readers the issues, analyses, actions, and determinations that led to the contract ultimately awarded. On small purchases, the document may have another name but its purpose is the same, to explain and justify the contract price. If you prepared a separate record of price analysis, it, too, will be a part of the contract file.

CHAPTER 12

PLANNING THE ACQUISITION

CONTENTS

Acquisition planning is a process for coordinating and integrating the efforts of all people responsible for significant aspects of the acquisition. This is done through a comprehensive plan for fulfilling an agency need. The process can be formal or informal, depending on the complexity and value of the acquisition. Obviously, the more rigorous and detailed planning is done for major programs, but the elements described in FAR and DFARS can be adapted to other procurements.

FAR 7.102 states that agencies shall plan acquisitions and conduct market surveys to promote full and open competition or, when full and open competition is not required, to obtain competition to the maximum extent practicable.

Planning covers the key steps to be taken, anticipates problems, and considers probable responses and in so doing, provides the framework for fulfilling the department's need on time and at a fair and reasonable price. In other words, planning seeks to make sure that procurements will be effective, timely, and economical. The requiring activity (the organization that issues the purchase request) is interested primarily in effectiveness and timeliness – getting what it needs when it needs it. Your primary responsibility is with economy – reasonable prices – but the three elements are interrelated and you must give due consideration to all three in your plans.

12.1 Market Research

Market analysis and research (hereafter shortened to market research) is a prime source for much of the information needed in planning for a procurement. As shown in Table 12-1, market research may take many forms, and various techniques can be used, depending on what is being procured. Moreover, the greatest potential benefit of market research occurs when procurement offices use (1) knowledge of current technology and trends, (2) understanding of the commercial marketplace, and (3) meaningful presolicitation contact with the private sector and others to influence the development of a competitive solicitation package.

TABLE 12-1. MARKET RESEARCH TECHNIQUES, APPLICATIONS, AND IMPACTS

TECHNIQUE	APPLICATION	IMPACT
1. *Investigate the market.* Determine current status of technology, extent of commercial applications, and source availability. Evaluate if commercial items can be incorporated into system design and the extent of adaptation needed to meet requirements.	Buys where rapid technological changes influence the way the requirement is stated. Any buy where commercial items could be used.	Market indicators drive the requirements statement and the contracting approach (e.g., multiyear, options, type of contract). Substantial savings by adopting or adapting commercial items. Identify impediments to effective competition.
2. *Brief industry.* Conduct widely publicized briefings on requirements to solicit early comments about the planned approach.	Major buys involving technological advances, new contracting approaches, or the chance to use commercial items. Seek out companies who might not be aware of or interested.	Acquire information that will affect the requirements statement, specification development, and contracting approach.
3. *Contact potential contractors* to discuss requirements and get recommendations about a planned acquisition.	All buys.	Better requirements definition, solicitation development, and competition.
4. *Visit potential sources.* Target qualified potential sources who typically do not respond to solicitations.	Where history suggests that responses may be insufficient.	Identify and encourage new and possibly better qualified sources to respond to requirements.
5. *Attend industry and scientific conferences.*	All organizations which need to keep abreast of new developments, industry trends, and make contacts.	Knowledge of current technology and commercial successes and failures as applied to military requirements.
6. *Acquire literature* about commercial products, industry trends, product availability, reliability, and prices.	All requirements.	More sources to solicit. Affects how requirements are stated. Facilitates price analysis. Identifies new products.
7. *Analyze procurement history* by examining quality and extent of competition, prices, and performance results.	All buys.	Revise requirements, specifications, and contracting approach based on *lessons learned.*
8. *Evaluate* and *test commercial items fully* in a military operating environment.	Wherever seemingly artificial barriers to the use of commercial items exist.	Develop data about the performance of commercial items. Determine necessary adaptations and develop cost estimates.
9. *Advertise* in trade journals and other publications to solicit inquiries.	Any buy where competition is insufficient and CBD announcements are not reaching qualified potential sources.	More responses from new and perhaps better sources.
10 *Use the Commerce Business Daily (CBD); provide complete data; and* synopsize six weeks or more in advance of a solicitation.	All nonexempt procurements over $10,000	More inquiries and responses. *Sufficient time to receive* expressions of interest about a requirement and alert potential sources to the release of a solicitation.
11 *Determine why selected contractors do not respond* to a solicitation.	All procurements where responses are insufficient or apparently well-qualified sources do not respond.	Identify the impediments to effective competition. Document and publicize *lessons learned.*
12 *Examine* business and trade association *directories.*	All buys.	Identify additional sources to solicit and acquire basic information about these sources.
13 *Use Federal Procurement Data System* information.	All buys where an insufficient number of sources are responding.	Identify current Government contractors, what was purchased, and if the purchase was competitive. Information about past procurements of the same or similar supplies or services.
14 *Examine Federal Supply Schedules.*	All requirements that might be satisfied by commercially available products or services.	Identify products or services on schedules at a favorable price and terms.
15 *Use the PASS and PROFILE* data bases.	PASS is a data base of small business firms wishing to do business with the Federal Government. PROFILE is a data base of minority business firms interested in Federal contracts. Product and service listings are available.	Identify qualified small and minority businesses for inclusion in a bidders list.

Market research is used to obtain more competition and to facilitate contract pricing. The emphasis is on developing specifications and statements of work that are not restrictive and do not specify more than minimum military requirements. The purpose of this emphasis is to use commercially developed products whenever possible and to identify ways to make military requirements compatible with marketplace conditions. When such information is developed early, the procurement office can shape a procurement package to fit market conditions and encourage responses from the sources most capable of meeting the requirement. After a requirement has been set and the procurement package released, it becomes increasingly difficult (but not impossible) for market research information to redirect how the requirement is stated or the procurement is handled. If the requirement is not well defined, a competition of sorts will occur, but it may be directed to meeting a specification or statement of work that is inherently defective and restrictive of competition.

12.2 Planning for Maximum Competition

Acquisition planning and market surveys give you the chance to describe the requirement so as to provide for full and open competition. They also make requirements people aware of the effects their decisions may have on what they will have to pay for the product or service. Planning can result in cost savings by avoiding unnecessary or emergency buys. It also can alert you to special factors to take into account during price analysis.

Encouraging full and open competition

It is critical that you use planning to take full advantage of competition. FAR Part 6 requires you to obtain full and open competition whenever practicable. While uncontrollable circumstances may keep you from attaining this goal, the reasons must be legitimate requirements or other conditions of the procurement and not a lack of foresight and planning.

You can remove or skirt questionable barriers to competition at the planning stage by examining the need and making sure the description of the contract effort is not unnecessarily restrictive. To do this, you need to know what it is you are buying and its qualities and function, and you need to know who makes products that can meet the stated need. By opening up the solicitation to permit competition, you make your pricing job easier.

Competition advocates at the procuring activity help by challenging unnecessarily detailed specifications and unnecessarily restrictive statements of need. This FAR requirement for competition advocates provides a formal structure for a task that is and has been an integral part of the contract specialist's job. You are expected to know the items you buy and to review their procurement histories. If you don't know an item, you are expected to inspect a sample or, if that is not possible, a picture, drawing, diagram, or other graphic representation of it.

If barriers to full and open competition are eliminated so far as possible, substantially improved competition and lower prices should result. Table 12-2 identifies key barriers to effective competition, their likely effect, and specific ways to eliminate them.

Specifications, time, and money

Specially created military specifications restrict the opportunity for competition. Recent efforts to increase the use of commercial products and to discourage development and use of unique specifications and insistence on brand-name products are aimed at removing those restrictions. The law of supply and demand produces effective competition only when what is being bought and sold is offered by many sellers.

TABLE 12-2. KEY BARRIERS TO FULL, OPEN, AND EFFECTIVE COMPETITION: EFFECTS AND REMEDIES

BARRIERS	LIKELY EFFECTS	REMEDIES
Unnecessarily restrictive specifications	• Eliminate qualified sources • Higher prices	• Improve planning • Screen requirements more stringently
Unnecessarily restrictive solicitations that include requirements not fully justified and not in the Government's interest	• Well-qualified sources that do not bid • High costs for proposal preparation • Higher prices	• Simplify solicitations • Preview solicitation requirements independently • Encourage alternate proposals eliminating questionable requirements • Require offerors to price out cost of complying with requirements that are susceptible to deletion
Noncompliance with publicizing requirements	• Insufficient notice to prospective sources • Bid protests • Limited responses to solicitations • Inadequate data on market conditions	• Comply fully with requirements for publicizing • Increase use of presolicitation notices (FAR 15.404)
Organizational bias	• Inclination toward specific source • Higher prices • Discourage qualified sources	• Better understanding of the measurable benefits of full and open competition • More effective controls over noncompetitive procurements
Invalid selection criteria	• Improper contract award decisions • Unnecessarily high prices	• Improve screening of selection criteria • Cost/benefit analysis if higher prices are paid for reasons of technical superiority
Administratively created exigencies	• Restricted competition • Higher prices	• Improve planning

It is a basic principle that the products and services bought for the Government will meet the *minimum* requirements. This does not mean that the *cheapest* products and services will be bought, but that the objective is to buy only what is needed and not what might be nice to have.

Acquisition planning provides a forum in which the actual quality requirements of the user can be explored, delineated, and described. Requirements for compatibility, reliability, improved materials or workmanship, and exacting performance standards must be challenged to see the extent to which they are necessary. Life-cycle costs, the cost to buy, operate, maintain, and dispose of equipment, may be assessed. Maintenance, repair, and support costs can increase the ultimate cost of ownership significantly. Unless these factors are identified and examined during planning and considered in setting the specifications, there is little you can do about them later in analyzing the prices.

The need to examine and challenge a requirement during acquisition planning can be illustrated by the case of the $7,000 airborne coffee maker. Analysis of the proposal before award concluded that it would cost that much to make and that the price therefore was reasonable. You might question the analysis that led to that conclusion, but the real failure was in the planning stage

that produced the specification. The extraordinary specifications were not challenged, and a coffee maker costing over $7,000 was the result.

While the specifics of this example obviously are not typical, the potential for occurrence is real. Government requirements are expected to describe the minimum need and should be developed with probable cost and the size and nature of the market in mind.

Planning ways to satisfy the requirement

Determining how to obtain the needed product or service and the likely effect of the selected methods on competition and prices is a big part of your responsibility during planning. FAR requires consideration of (1) sources; (2) means for obtaining competition; (3) source selection; (4) contract type; (5) use of multiyear contracting, options, or other contracting methods to increase the quantity purchased (and priced); and (6) special solicitation or contract provisions. Decisions on each of these considerations will affect price either directly or indirectly.

Method of procurement is the set of procedures used to translate a requirement into a contract. There are two principal procedures for procurement, full and open competition and other than full and open competition. Competitive procedures also are two basic types, sealed bids and competitive proposals.

Sealed bidding uses competitive bids, public opening of bids, and award to the responsible bidder whose bid, conforming to the invitation for bids, will be most advantageous to the Government, considering only price and the price-related factors included in the invitation. Competitive proposals use requests for proposals to secure competitive offers and involve, usually, written or oral discussions with each offeror whose proposal is within the competitive range, and award to the offeror whose best and final offer is most advantageous to the Government, considering only price and the other factors included in the solicitation.

No amount of price analysis can produce a reasonable price if the procurement method and pricing techniques don't fit the situation. Sealed bids work when there is adequate competition based on price. It won't work if planning discloses that only one or two companies are likely to respond to the invitation or that competition should be based on technical, nonprice factors.

Table 12-3 demonstrates that selection of the procurement method is not a perfunctory task. Relatively simple factors like limited time to respond to a solicitation and unrealistic delivery dates may make it difficult to achieve adequate price competition. More complex factors like quantities that do not conform to industry standards (and therefore cause inefficient production runs) and requirements that lead to potentially negative tax consequences (as for a contractor that must incur start-up costs that can't be amortized within the contract period) also may make it difficult. Even where competition exists, technical, scheduling, reporting, quality assurance, and packaging requirements may cause bidders or offerors to quote prices higher than those they would quote nongovernmental customers.

TABLE 12-3. IMPLICATIONS OF KEY FACTORS IN SELECTING THE METHOD OF PROCUREMENT

IF . . .	THEN . . .
A review of procurement history indicates that the last solicitation evoked only two responses.	You should determine the causes for the poor response. If conditions have not changed, sealed bidding may be inappropriate.
The PR's expedited delivery requirements are judged legitimate.	Competitive proposals or noncompetitive procedures may be necessary.
The award is to be price-based and adequate competition is anticipated.	Sealed bidding is probably appropriate.
Technical considerations are significant.	Sealed bidding is inappropriate and you should use competitive proposals or other procedures.
Discussions with offerors are anticipated.	Competitive proposals or other procedures must be used. Discussions are not permitted under sealed bidding.

12.3 How the Purchase Request Can Help You Plan

A purchase request (PR) usually starts things moving in the contracting office. In small dollar procurements, the PR may be the first notice contracting people have of the requirement and it triggers the planning. In more complex procurements, the PR is an important checkpoint in the planning process.

You must make sure the PR is an adequate foundation on which to build. You need to identify and fix any planning shortcomings that might affect the procurement and the price adversely. Figure 12-1 summarizes the reasons for taking a close look at the PR.

FIGURE 12-1. WHY ANALYZE THE PURCHASE REQUEST?

To identify and fix shortcomings in the specifications

To validate the requirement

To validate delivery and other requirements that affect pricing

To facilitate planning for price-related evaluation of proposals

To identify and verify the target market

For price-related issues, your primary interest is to analyze and validate information that bears directly on the prices you might expect to get from the solicitation. Your review will cover all elements of the PR – from specifications to contract provisions to evaluation criteria – because all can affect competition and price.

The focus is on three elements that are basic to your analysis of prices: the Government cost estimate, the list of recommended sources, and the purchase history. This discussion stresses how each of these elements helps you plan the procurement and prepare for price analysis.

Government cost estimate

Each purchase request package should include a Government cost estimate, with an explanation of how the estimate was prepared. This backup should include the estimator's assumptions.

If the technical or program people are not aware of the cost factors and market forces that affect pricing, budgeted funds may be too high or too low. A close look at the estimate and its backup may help you spot problems with the funding.

In other cases, particularly when specialized equipment or services are involved, technical awareness and knowledge revealed in the documentation of the estimate may help identify obscure and unpublicized markets as well as technical complexities that may affect pricing.

Finally, take a good look at the estimate. Ask to see the estimating assumptions and the data used to make up the estimate. A close look at the Government estimate may show you that it has been influenced by a vendor's marketing efforts and is a thinly disguised justification for procurement from a single source.

List of recommended sources

The list of recommended sources accompanying the purchase request can reveal inadequacies in the requester's knowledge of the market. This will help you evaluate the cost estimate. When the market is specialized or new, the list of sources is a starting point for developing your own list of companies to receive the solicitation. Finally, the list can alert you to possible barriers to competition contained in the PR.

The list of sources, together with the cost estimate, can give you insight into the level of quality required and tradeoffs involved in situations where subtle variations in materials, workmanship, or quality control practices may cause significant differences in form, fit, and function and, therefore, in price.

Purchase history

A review of purchase history – sources, product identification, quantities, production or delivery rates, prices, sources solicited – can help your analysis of the independent cost estimate and the list of sources. It also can alert you to potential difficulties in getting competition, evaluating offers, and making cost – benefit tradeoffs.

Analysis of past procurements may point to poor or restrictive specifications as the causes of limited market response or user dissatisfaction. It can identify price-related factors that were not invoked earlier – life-cycle costs or option prices, for example. Finally, it can point to the need to change procurement method, quantities, quality requirements, or timing to make the most of advantageous price factors.

12.4 What You Will Need to Price the Buy

When sealed bidding is out of the question, one of your planning tasks is to determine whether the solicitation should require the offeror to submit cost or pricing data. When you make this decision, you are, in effect, deciding whether price analysis alone can do the job or whether cost analysis also will be needed. This decision influences the whole pricing process.

Your decision will depend on three main factors: the number of potential sources, the expected dollar value of the contract, and the likelihood of significant contract changes. If you expect several

responses to your solicitation and award is to be made on the basis of price-related factors, you may have adequate price competition and for that reason, would not expect to do a cost analysis. Therefore, you would not need or ask for cost or pricing data. If you don't expect competition to result and expect the value of the contract to be less than $100,000, you may need to use cost analysis and if you do, you will need cost or pricing data. Therefore, in that circumstance, you may require the offeror or offerors to submit it. If you don't expect competition but the contract will exceed $100,000, you must require submission of cost or pricing data as part of the proposal. If you expect significant changes in the contract, cost or pricing data will help establish the baseline against which to measure the value of changes.

An offeror may claim exemption from the requirement for cost or pricing data on contracts expected to exceed $100,000. Adequate price competition is one basis for exemption. The others are catalog or market prices, prices based on competitive prices or catalog or market prices, and prices set by law or regulation. These are stated in FAR 15.804-3 and discussed in Section 9.1 of this manual. They also are treated in detail in Chapter 13 because the actions taken to verify an exemption are part of price analysis.

You might request pricing information in the solicitation when you anticipate using price analysis. Pricing information available from the offeror would include sales data – product descriptions, prices, quantities, delivery rate, buyer identification – and catalogs, price lists, and discount schedules that also are available from companies making and selling similar products. Much of the information you might use in price analysis will be from sources other than the offeror. This is discussed again in Chapter 14.

CHAPTER 13

PRICE ANALYSIS BUT NOT COST ANALYSIS

CONTENTS

You must analyze every bid or proposal before making an award and how you do it will depend on many factors. You always will use price analysis so the issue always will be to know when price analysis is enough.

Price analysis is enough on all procurements under the small purchase limit, which currently is set at $25,000. Price analysis may be enough on all new procurements with a value between the small purchase limit and $100,000. Price analysis may not be enough when asked to price a contract modification, even if the estimated cost of the change is under $25,000. Price analysis is not enough if the procurement is expected to exceed $100,000 unless the procurement is exempted or the requirement is waived in accordance with regulations. If you anticipate that the purchase will not be exempted, you must require the offeror or offerors to use Standard Form (SF) 1411 and submit cost or pricing data to support its proposal or proposals. (The SF 1411 is entitled "Contract Pricing Proposal Cover Sheet.")

To restate, there are two types of limitations on when cost or pricing data are to be required:

- There are *dollar thresholds* requiring submission of data above stated dollar amounts but limiting or prohibiting submission below those amounts.
- There are *exemptions* from the requirements so that they will not be imposed in situations in which competition and pricing data are sufficient and cost analysis is not needed.

13.1 Thresholds and Exemptions

The interrelationship of thresholds and exemptions and their connection to the determination that cost analysis is or is not needed is depicted in the decision chart, Table 13-5, at the end of the chapter.

Dollar thresholds

For procurements over $25,000 but less than $100,000, submission and subsequent certification of cost or pricing data are optional. Within that range, you are responsible for determining whether data are needed. FAR 15.804-2(a)(2) discourages routine requests by stating that there should be relatively few cases under $100,000 in which data are necessary, by establishing that the data required to be submitted should be limited to those necessary to establish the reasonableness of price, and by requiring that you justify the request. You rarely will need cost or pricing data on contract awards of $25,000 or less and will not require the contractor to certify in the few cases when you do get data.

These restrictions on cost or pricing data do not prevent you from asking for market data or price breakdowns, or requiring a contractor to support proposed charges with a breakdown into component elements. You may require such information when you need it for price analysis, regardless of dollar amount.

Dollar thresholds apply to expected prices. A solicitation for a procurement that is not exempt and estimated to exceed $100,000 must include provisions relating to the submission of cost or pricing data.

Cost or pricing data must be required, unless an exemption applies, for any subcontract over $100,000 whenever the prime contractor or a higher tier subcontractor has been required to submit cost or pricing data.

Table 13-1 depicts the application of this requirement to contract modifications. The requirement for submission applies if a contract or subcontract modification involves an *increase* of $100,000 or more. The requirement also applies if a modification involves a *decrease* of $100,000 or more. Finally, a modification that involves *increases* and *decreases* which in the *aggregate* are $100,000 or more is subject to cost or pricing data requirements. For example, a $30,000 modification

TABLE 13-1. EFFECT OF DOLLAR VALUE ON THE DECISION TO REQUEST COST OR PRICING DATA ON CONTRACT OR SUBCONTRACT MODIFICATION

IF CONTRACT MODIFICATION INVOLVES . . .	THEN . . .	UNLESS
• An increase of $100,000 or more • A decrease of $100,000 or more • Increases and decreases which in the aggregate are $100,000 or more	Require cost or pricing data	Unrelated and separately priced changes not requiring cost or pricing data are included in the same modification for convenience

resulting from a reduction of $70,000 and an increase of $40,000 (an aggregate of $110,000), is a price adjustment exceeding $100,000. These rules apply to all contracts whether or not cost or pricing data were required for the original contract. They do not apply, however, when unrelated and separately

priced changes for which cost or pricing data would not otherwise be required are included in the same modification simply for administrative convenience.

Exemptions

Statutory exemption of certain transactions from the requirements for cost or pricing data and cost analysis is based on common sense. The need for such data arises when the Government doesn't have better and less-expensive ways to determine that an offered price is reasonable. In a highly competitive market, the law of supply and demand can work to give you the best possible prices. When prices are controlled by law or regulation, savings are not possible. Therefore, in these situations, it is not necessary to spend time analyzing cost or pricing data. The intent of the statutory exemptions is to provide a check on the requirement for submission of cost or pricing data.

Table 13-2 summarizes the exemptions and cites the FAR coverage for each. Considerations regarding the applicability and the implications of each exemption are discussed in Sections 13.2 through 13.4. Waiving the requirement is discussed in Section 13.5.

TABLE 13-2. EXEMPTIONS FROM THE REQUIREMENTS FOR SUBMISSION OF COST OR PRICING DATA

EXEMPTION	DESCRIPTION
1. Adequate price competition [FAR 15.804-3(b)(1) and (2)]	Two or more responsible offerors compete independently and submit proposals deemed responsive to the solicitation; there is no evidence that suggests that competition was restricted or that the lowest price is unreasonable.
2. "Based on" adequate price competition [FAR 15.804-3(b)(3)]	Price analysis alone can establish price reasonableness, despite the absence of direct competition, through comparison with current or recent prices for the same or substantially the same items purchased in comparable quantities, terms, and conditions as a result of adequate price competition.
3. Established catalog or market prices [FAR 15.804-3(c)]	Prices are established catalog or established market prices for a commercial item sold in substantial quantities to the general public.
4. "Based on" catalog or market price [FAR 15.804-3(c)(6)]	The item being purchased is sufficiently similar to a commercial item sold in significant quantities to the general public to permit any difference in prices between the items to be identified and justified without resort to cost analysis.
5. Prices set by law or regulation [FAR 15.804-3(d)]	Laws, regulations, pronouncements in the form of periodic rulings, reviews, or similar actions of a governmental body are sufficient to establish the price.

13.2 Adequate Price Competition

It is assumed that when competition is plentiful and real, the most efficient, effective producer will be able to meet the demand for its products at a price that covers costs and provides a reasonable profit. Similarly, less-effective producers will be forced to sell at a price that gives a smaller profit or even a loss. In time, the less-effective producers must increase efficiency if they are to meet competition and increase profitability. Therefore, when price competition is adequate, you do not need to spend time and money analyzing the sellers' costs; head-to-head competition among would-be sellers will produce reasonable prices.

Given the importance of adequate price competition, you must be able to determine when competition exists and whether it is adequate. Table 13-3 summarizes the conditions that govern this determination.

TABLE 13-3. DETERMINING THE EXISTENCE AND ADEQUACY OF PRICE COMPETITION

Price competition exists when . . . [FAR 15.804-3(b)(1)]	• Two or more responsible offerors submit proposals in response to a solicitation • Their offers are responsive • The offerors compete independently for a price-based award.
Price competition is presumed to be adequate unless . . . [FAR 15.804-3(b)(2)]	• The solicitation unreasonably restricts competition • The lower offeror has an advantage which undermines competition • You determine, and your determination is approved at a higher level, that the lowest offered price is unreasonable.

Price competition is considered to exist in a vast majority of cases when two or more competitors submit offers on a firm-fixed-price basis. However, you need to test for adequacy. If price competition is adequate, cost or pricing data are not required.

Comparison of offers with each other is a first check for adequacy. You would expect to find a fairly tight cluster of offers. Wide differences between low and next-low offers can mean the low offeror is very efficient, is far ahead in design or manufacturing technology, is buying in, or has made a mistake. You need to make other comparisons before making a decision. Past prices, catalog prices, and the Government cost estimates are three you might make.

As shown in Table 13-3, there are times when the price competition seems to be adequate, but the circumstances do not produce the desired results – as in situations where the lowest price is not reasonable or where competition has been restricted or undermined. Some suppliers so dominate a market that they control prices and escape the pressures exerted by supply and demand in a normal market. In such a case, cost analysis may be necessary.

Even where there is no dominant supplier, the market may not produce the desired results. The most efficient producer may have all the business it can handle. Other suppliers may take advantage of this disinterest and propose prices higher than usual; a marginal producer will be able to sell its product at a profit.

When you doubt that you will be able to get adequate competition and you doubt that price analysis can do the job by itself, ask for cost or pricing data in the solicitation. It is better to have the data and not need them than to need them and have to wait.

Additional considerations

Award based on factors in addition to price. The absence of an inducement to offer the lowest price is the prime indication that cost or pricing data and cost analysis will be required. When factors in addition to price are to be evaluated in contract award, you should assume that those producers motivated to furnish more than a minimum acceptable product may spend more money to achieve that result and will not be driven to produce at the lowest possible price. While competition still will be a driving force in the procurement, price probably is not the primary consideration.

The Comptroller General has held that the adequate price competition exemption may be applied in cases where price is a secondary factor. In *Serv-Air, Inc.* [58 Comp Gen 362, 79-1 CPD ¶212

and 52 Comp Gen 346 (1972)], the Comptroller General held that adequate price competition existed even though price was only a *substantial* factor in the award. The implication is that when an award is based on a combination of price and technical considerations and the competition is adequate, the award can be based on price analysis alone once an acceptable technical range has been established. This approach helps you get the best price for what you buy and, at the same time, helps make sure that what is bought satisfies the minimum need required.

Technical comparability. Another Comptroller General decision suggests that a lack of technical acceptability on the part of some proposals can affect the determination of whether adequate price competition exists. In 53 Comp Gen 5 (1973), price competition was held *not* to exist when only one of the proposals submitted was deemed acceptable and the quoted price was much higher than prices paid in prior procurements.

Remember that the interaction of supply and demand is presumed to ensure the adequacy of price competition only when there are many sellers of the same products or services that can satisfy the same need. You must compare what is being offered as well as the prices accompanying those offers. Price competition requires that offerors compete on the basis of the same requirement.

Based on adequate price competition

FAR also provides for exemption when direct competition is not present, when the price is *based on* adequate price competition. It says, at 15.804-3(b)(3), that "A price is 'based on' adequate price competition if it results directly from price competition or if price analysis alone clearly demonstrates that the proposed price is reasonable in comparison with current or recent prices for the same or substantially the same items purchased in comparable quantities, terms, and conditions under contracts that resulted from adequate price competition."

The key elements of this exemption are:

- The base price (the price used as the basis for comparison) must have resulted from adequate competition.
- The specific items being compared and the accompanying circumstances must be sufficiently similar to warrant comparison.

Applying the Exemption

This based-on exemption has been interpreted narrowly. The Armed Services Board of Contract Appeals (ASBCA) has held that the exemption can be used only when the item is normally purchased competitively in similar quantities. Where this is the case and special circumstances dictate a noncompetitive purchase, the exemption may apply if the price offered is reasonably close to that normally paid. [See *Norris Industries*, ASBCA 15442, 74-1 BCA ¶10482.]

While useful, this exemption has limitations. For example, the *based-on* exemption is not appropriate when significant time has passed since the base price was established. Generally, you should be wary of using base prices more than one year old. Also, it is not appropriate to use the exemption when the items are not sufficiently similar or when differences in prices cannot be justified. For example, assume that adequate competition fixes $250 as a fair price for a camera. Assume further that you are buying the same camera that has been hardened for military use and offered at a price of $500. In this example, the *based-on* exemption is not appropriate unless the product variation accounts for the $250 price differential and that difference is found to be reasonable.

13.3 Established Catalog or Market Prices

FAR 15.804-3(c) provides that the contracting officer shall not require cost or pricing data when quoted prices are, or are based on, established catalog or market prices of commercial items sold in substantial quantities to the general public. (You may require such data, however, based on a written finding that the price is not reasonable if that finding is approved at the next higher level in your organization.)

Basic criteria

The exemption is based on the assumption that the catalog or market price used for comparison has been shaped by the interaction of supply and demand and therefore represents the best price available for the specific product or service. You must verify this assumption before applying the exemption.

Substantial Sales to the Public

To fall within the exemption, there must be a history of *substantial sales* of the specific product or service to the public. You must get catalog sales information from the seller and sales information from the seller and others to determine whether there is a *market* price for the product or service. Further, the sales must be to the *public*. This does not mean that sales must be made exclusively to consumers but that sales to the Government are not to be counted.

Standard Form (SF) 1412, Claim for Exemption from Submission of Certified Cost or Pricing Data ordinarily is used to get information on sales. The need for an exemption exists when the total proposed amount exceeds $100,000 and more than one catalog item for which an exemption is claimed exceeds $25,000.

Commerciality

You must determine that the product or service is a *commercial* product or service. A commercial item is one sold to buyers other than affiliates of the seller for end use by nongovernmental entities. It is unlikely that the price of a rocket launcher or a submachine gun could qualify, even though arms dealers publish catalogs; the principal buyers for those products are governmental. You should be alert to this issue when dealing with military products and services, scientific equipment, and high-tech products. While the Government specifications might be similar, the products often are different from those sold to the public and the exemption might not apply.

Sometimes the exemption applies in part. When the product is not a commercial product but its price is based on that of a commercial product, you can apply the exemption if the differences between the two products are clear and the price to you can be explained by those product differences. The commerciality of the *based-on* product must be established before you can use this exemption. You will need to get sales data for both the Government and commercial products.

If you cannot find that the price to you is based on the price of the commercial product, you may limit the requirement for cost or pricing data to those data needed to evaluate the differences in the two products. You can establish a fair and reasonable price for the commercial products using the catalog price and price analysis. Any difference in price should then be due to product variance, which can be evaluated using cost analysis. If the difference in price for equivalent quantities is $100,000 or more, you must get cost or pricing data for the difference unless a separate exemption applies.

You can aggregate or stack exemptions. When the product proposed is not itself a commercial product but is made up of components for which there are catalog or market prices and the proposed price is the sum of the prices for the components, the exemption can be granted for the aggregate.

FAR Formulas for Catalog Price Exemption

FAR 15.804-3(f) provides the formulas for determining the commerciality of an item, and Section 9.1 of this manual provides examples of the working of those formulas. Sales of the item are divided into:

Category A – Sales to the Federal Government

Category B – Sales at catalog price to the general public

Category C – Sales to the general public at other-than-catalog price.

The applicability of the *catalog price* exemption is determined by comparing total sales (A, B, and C) in units to combined *B* and *C* sales in units, and then comparing the *B* sales to the combined *B* and *C* sales. Table 13-4 has the formulas. The logic chart in Appendix C provides guidance. It is a series of programmed questions designed to establish the applicability of the catalog or market price exemption. The formulas in Table 13-4 apply to catalog prices but the same concepts apply to market prices. [In the formulas, ≥ means greater than or equal to; ≤ means less than or equal to.]

TABLE 13-4. FORMULAS FOR DETERMINING APPLICABILITY OF THE CATALOG PRICE EXEMPTION TO AN ITEM

IF . . .	THEN . . .
B + C ≥ 55% of A + B + C *and* B ≥ 75% of B + C	The catalog exemption applies.
B + C ≤ 35% of A + B + C *or* B ≤ 55% of B + C	The catalog exemption does not apply.
B + C > 35% *but* < 55% of A + B + C *or* B > 55% *but* < 75% of B + C	Further investigation is required.

Market Price Determinations

To use the *market price* exemption, you must establish the prices at which the product is *offered* and at which it is *sold*. You must survey the market or get market data from the offeror so as to verify the market prices *independently*. The survey must disclose *sales prices*, not just bids.

You also must establish that:

- There is a commercial market in which the product is offered and sold in substantial quantities.
- Sales are to the general public.
- The product sold is substantially the same as that offered to the Government.

Problem Areas

The major practical problem in determining whether the catalog or market price exemption applies is assessing the quality and specificity of the data to be used in making the decision.

The Government's approach assumes that vendors have full knowledge of their sales practices and can disclose the facts concerning thousands or even millions of transactions that may or may not involve discounts. Often the opposite is true. A seller often does not know all of what its field offices do in terms of discounts.

You may ask for audit assistance in checking to see that the offeror's data comply with Government requirements and to spot check the sales records.

There may be problems in a changing market where Government sales have been dominant or where the product or service is relatively new. You must decide whether the prices are supported by substantial nongovernment sales within the meaning of the FAR. For example, the Federal Government has been leading in the purchase of *supercomputers;* most sales have been made to DoD. As the technology has advanced and prices have dropped, large private institutions have begun to purchase the same or similar equipment. If you are buying a supercomputer, you may receive a price list or market data supporting a claim for exemption. To decide if the exemption is warranted, you must review the data in light of the intent of the Truth in Negotiations Act. If the data support a finding that substantial sales at or based on catalog or market prices are being made to nongovernment buyers, you may exempt the transaction from the requirement to submit and later certify cost or pricing data.

In summary, analyzing sales and marketing data is not cut and dried. Your challenge is to determine the price at which an offeror will sell an item or service in any situation to any class of customer. Only when that is known and the facts warrant can you grant an exemption.

Based on catalog or market prices

The *based-on*-catalog-or-market-price exemption is similar to the *based-on*-competition exemption. FAR 15.804-3(c)(6) states that suppliers need not quote a catalog or market price to qualify for an exemption from the requirement to submit cost or pricing data. If the item is similar to a catalog or market item, the price offered can be the catalog or market price adjusted for components or features that are added to or deducted from the base item, factors such as bar coding, packaging requirements, and f.o.b. points. The adjustments can be made using catalog, price list, discount schedule, and other information.

You also may get limited (less-than-complete) cost or pricing data when the price offered is based on a catalog or market price but is not identical. The cost or pricing data can be limited to those data needed to explain the difference. If the difference is more than $100,000, you must get the cost or pricing data needed to explain the difference unless a separate exemption applies.

Applying the Exemption

You may use the *based-on* exemption when all of the following conditions are present:

- The base item is commercial. (The base item cannot be a Government item.)
- The base item is otherwise qualified for the catalog or market price exemption.
- The differences between the Government item and its commercial counterpart can be identified.
- The difference in price can be attributed to variations in items.
- The price difference is judged reasonable, using cost analysis if necessary.

13.4 Prices Set by Law or Regulation

FAR 15.804-3(d) provides that a price set by law or regulation is exempt from the requirement for submission of cost or pricing data. In addition, periodic rulings, reviews, or similar actions of a governmental body, as well as pronouncements embodied in laws, are sufficient to establish the price.

When the price is set by law or regulation, your pricing job is relatively simple. The offeror is required to identify the regulatory authority and specify the regulated prices.

Certain laws and regulations may not apply to Federal purchases and you probably will want to get legal advice. These include state fair trade laws and taxing mechanisms. Additionally, you must make sure the offeror is the entity being regulated. Some suppliers sell mostly to regulated industries and are subject to laws or regulations governing sales to those industries. Sales to the Federal Government may not be subject to those laws or regulations.

13.5 Waivers

Even where cost or pricing data are required and no exemption applies, the requirement can be waived in exceptional circumstances. This action requires a written determination and findings and approval by the agency head. The Court of Claims has ruled that the contracting officer cannot waive the requirement [*M-R-S Manufacturing Company v. U.S.*, 203 Ct. Cl 551 (1974)]

You will have few occasions to request a waiver. The approval requirements are meant to discourage use of this remedy. The need for waiver should arise only when:

- The supplier is adamant in refusing to supply cost or pricing data.
- The product or service is needed urgently.
- The supplier is the only feasible source.

The Comptroller General has approved an agency's refusal to waive the cost or pricing data requirement and its subsequent noncompetitive negotiation with another contractor. [Telectre-Mek, Inc., Comp Gen Dec. B-185892, 76-2 CPD ¶81 (1976)]

13.6 Conclusions

As discussed, your objective in every procurement is to obtain a fair and reasonable price. In some cases, you can achieve this objective through price analysis; in others, through both price and

cost analysis. Price analysis evaluates an offeror's total price within the existing market and also is used to evaluate the prices of selected cost elements. Cost analysis examines the individual elements of cost justifying an offered price and compares them using cost or pricing data. Cost analysis supports the effort to establish the reasonableness of price by ensuring that the offeror's estimated costs, upon which the offer is based, are reasonable.

Table 13-5 summarizes the points covered in this chapter. It illustrates the process of determining what analysis is required. That determination is based primarily on dollar value and the applicability of any of the five statutory exemptions or of a waiver.

TABLE 13-5. PRICE ANALYSIS/COST ANALYSIS DECISION CHART

IF . . .	AND . . .	THEN . . .
The anticipated dollar value exceeds $100,000	• No exemption to cost or pricing data requirements applies	You must require submission of cost or pricing data and conduct both price analysis and cost analysis.
The anticipated dollar value exceeds $100,000	• An exemption applies	No cost or pricing data shall be required. You shall rely on price analysis.
The anticipated dollar value is between $25,000 and $100,000	• Price analysis alone cannot establish price reasonableness; or • The purchase is for a new or complex item with significant potential for follow-on buys; or • You determine for other reasons that available pricing data are not sufficient	You may request cost or pricing data and analyze costs in addition to prices but only to the extent necessary to establish price reasonableness.
The anticipated dollar value is between $25,000 and $100,000	• Available competition and price analysis data are sufficient to establish price reasonableness	You shall not request cost or pricing data and shall rely on price analysis.
The anticipated dollar value is less than $25,000		Certification of cost or pricing data shall not be required; price analysis usually will be relied upon.

Remember that absence of the need to get cost or pricing data does not eliminate the need to analyze the price. In every case, the mix of analysis techniques used will depend on the presence of competition and market forces. In all cases, your objective is the same; making sure the price is fair and reasonable.

CHAPTER 14

PRICE ANALYSIS TECHNIQUES

CONTENTS

14.1 Hierarchy of Techniques

At its simplest, contract pricing is a matter of comparing offers received. However, even in competitive situations, you cannot assume that the job is over once the lowest price from a responsive, responsible offeror is identified. You are through with price analysis when you have determined that an offered price is fair and reasonable. To reach that point, you often may have to do more than make simple, direct comparisons and frequently you will need to negotiate in order to reach agreement on price.

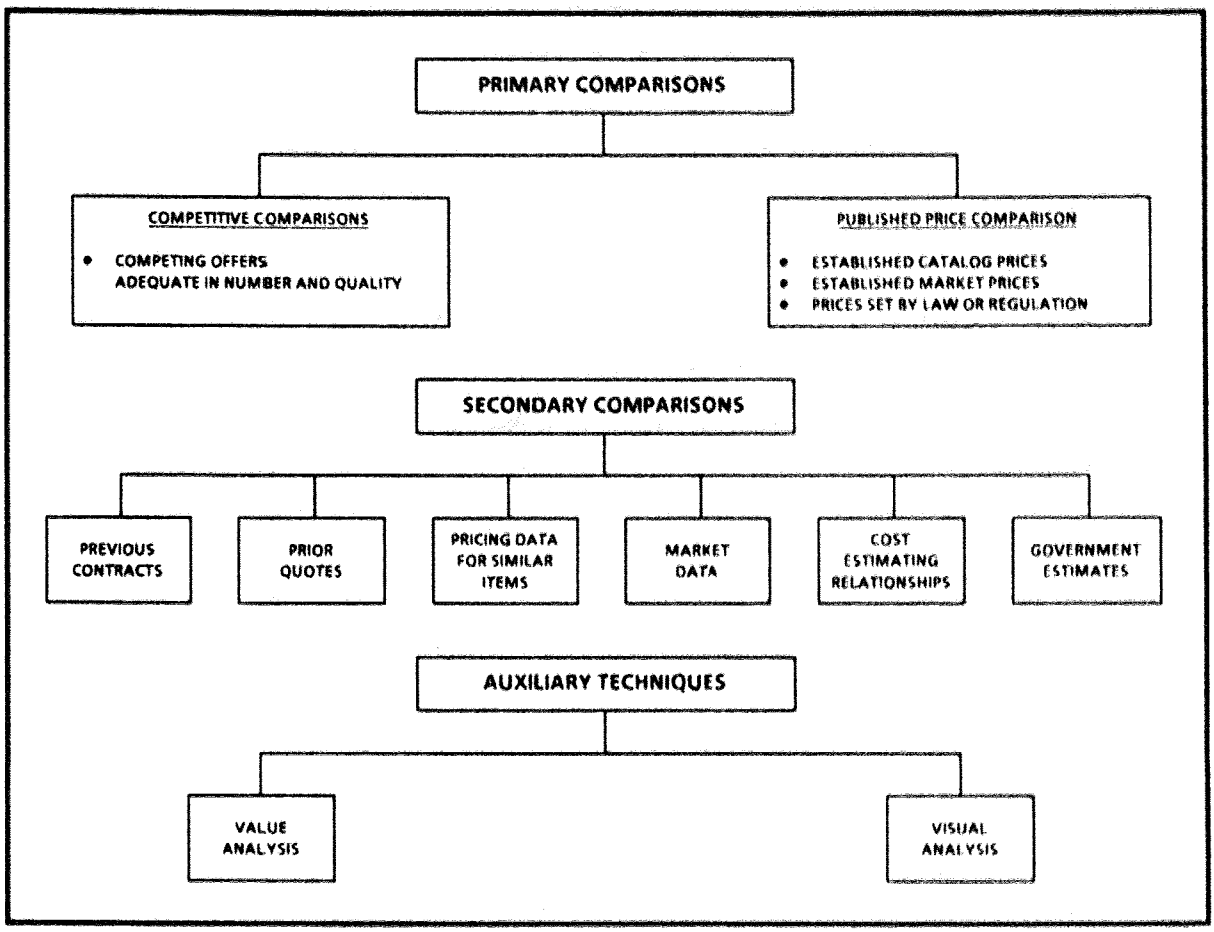
The techniques discussed here give you the means to analyze prices when competition is adequate and when competition is not present and comparison of offered prices is not possible. Some of the techniques allow *prediction* of prices in cases where new products or services are being procured or significant changes in quantity or quality are being made. Once again, the degree of competition, past and present, is important. It affects the data that will be available, the techniques that will be appropriate, and the difficulty in determining the reasonableness of an offer.

We have said that the essence of price analysis is comparison, but price analysis is not as simple as this truism might suggest. Meaningful comparisons require a thorough knowledge of the techniques and their limitations. The techniques used must match the procurement situation and you have to decide when analysis is sufficient and if the offered price is acceptable.

Figure 14-1 sets out the hierarchy of price analysis techniques. The techniques differ in several dimensions, including the data needed to support them, the situations in which they are used, the complexity of the analysis involved, and the relative value of the conclusions reached. The techniques are not mutually exclusive. They can be used in combination to match the circumstances

and your objective. In fact, the validity of an analysis depends on the number of comparisons as well as the techniques used. The more data points (comparable prices) used, the sounder will be your conclusion as to a fair and reasonable price.

FIGURE 14-1. HIERARCHY OF PRICE ANALYSIS TECHNIQUES



The hierarchy of price analysis techniques has three levels. These are primary comparisons, secondary comparisons, and auxiliary techniques. Primary comparisons involve contemporaneous prices of the same or similar items. Secondary comparisons involve comparison of present offers with prices for past purchases or purchases of different but similar items. Auxiliary techniques provide ways of assessing the differences in price between two items – not actual prices for comparison.

The following are general guidelines for the usefulness of the techniques. Later sections discuss how individual techniques are applied.

- *Primary comparisons.* When assembling and analyzing data, rely on primary comparisons when they are available. Primary comparisons are the most conclusive ones. There are two types. The first, competitive evaluation, is a comparison of current offers with each other. The second, comparison with published prices, is an evaluation of offered prices against prices established by catalogs, advertisements, laws, or regulations. The comparisons can be used to reinforce each other and they can be supplemented by lower tier comparisons.

- *Secondary comparisons.* At this second level is a family of techniques in which data other than competing offers or published prices are used for comparison. The data may be earlier quotes, previous contract prices, pricing data for similar requirements, cost estimating relationships, Government cost estimates, and general market data. When possible, you should use secondary comparisons to support tentative conclusions reached through primary comparisons. When no primary comparison is available, a combination of secondary comparisons may validate the reasonableness of an offered price.

- *Auxiliary.* These techniques cannot be used on their own to establish the reasonableness of price. Their results are subjective. They can be used to support conclusions reached with primary or secondary comparisons or to supplement cost analysis when the higher level techniques are not appropriate.

14.2 Primary Comparisons

The use of competitive proposals, multiyear procurements, and variations in pricing arrangements make the pricing task more complex. This increases the need to adjust the data to make it comparable.

If adequate price competition exists, competitive evaluation is your primary tool for analysis. You use other techniques only to the extent needed to validate conclusions reached by that comparison. Whenever catalog or market prices exist, you can compare an offered price with them. This is particularly useful when buying commercial products. You can supplement it with lower level comparisons and may need to make adjustments.

The usefulness of any technique depends on the quality of supporting data. Adequate competition is always the best source so competitive evaluation is preferred. At the same time, the evidence of published prices, with documented substantial sales to the general public, can give you conclusive evidence of the reasonableness of an offered price.

Competitive evaluation

In the simplest case, all you have to do in competitive evaluation is arrange the fixed-price offers in order of price and select the lowest price offer. For this to be enough:

- Specifications may not be restrictive.

- At least two offers must meet the requirements of the solicitation.

- Offerors must compete independently.

- The market must include many producers, none of whom is dominant and none of whom has an abnormal advantage in responding to the Government's need.

Even if all these conditions are met, any evidence that tends to refute the conclusion that the lowest price is fair and reasonable (e.g., a much lower Government estimate) should tell you to get other data to check the results of the competitive evaluation.

In sum, competitive evaluation is used whenever direct competition exists; it is to be supplemented whenever competition is less than adequate. For example, if five offers are received and they are tightly grouped, you may be able to conclude that competition is adequate and the lowest price is reasonable. You may compare it with the most recent prices paid or the Government estimate to make sure, but usually that conclusion is solid. However, if three offers were received and the

prices vary significantly, you should make secondary comparisons before reaching any conclusion about the prices.

Published price comparison

Use of published catalog and market prices rests on the assumption that the published price was influenced by market forces that produce the same results as direct competition. The catalog or market price thus is the starting point in negotiations.

To apply the published price comparison technique, you must get data to determine prices paid by classes of customers in given situations. The prices must be *established*. They must be prices of *commercial* items and be *sold in substantial quantities* to the *general public*. Some of these data will come from the offeror. So will sales data for analyzing discount terms.

When contracts are awarded without direct competition, as is the case with established catalog or market prices, you may need to make adjustments to account for price-related differences between the commercial price and the unique Government requirements.

Manufacturers frequently have multi-tiered pricing strategies. They may use four or five catalogs with varying prices, each catalog for a different class of customer. When you make published price comparisons, you want to identify the best terms offered to any customer and secure those terms for the Government. The rationale is that if the Government receives the best price offered by a supplier and that price is an established market price, the price is reasonable.

When you buy commercially available spare parts noncompetitively, the offeror is to (1) certify that prices for parts also offered for sale to the public are no higher than the lowest price charged to any other customer or (2) submit a statement specifying and justifying all price differences (FAR 15.813). There are exceptions to this policy.

You can make a useful comparison with published prices if you are buying a commercial item and the price is established. If the quantity is small, a comparison of catalog prices may be enough. If it is a large volume purchase, ask the supplier for sales data so that you can identify customers, prices, and other terms. You can compare this data with the offer to arrive at the discount.

Because published prices are adjusted periodically, you may have to analyze trends to factor a proper discount; the value of discount terms can be altered by inflation, seasonal variations, market changes, technology, and other conditions. These adjustments may alter your judgment as to the reasonableness of price.

You also will rely on published prices when the prices are set by law or regulation. However, if the price is based on but not controlled by such legally established prices, you should use the published price technique.

Even when published price comparison is a primary method of price analysis, you probably will use other techniques to validate the conclusions of that analysis.

14.3 Secondary Comparisons

Prior quotations and previous contracts for similar requirements are major sources of secondary data. When these sources reflect competitive situations, you may conclude the prices are fair and reasonable. To make them comparable with a current offer, you must adjust for time, quantity, and seasonal differences. Consequently, the results of these comparisons are not as

conclusive as those achieved by use of primary techniques. Other sources of secondary data are treated as circumstantial evidence, useful but less reliable.

Primary and secondary comparisons often overlap because published price information is a source of secondary data. For example, even if the offeror does not have catalog prices, competing offerors may. Similarly, even if an offeror has a catalog, you probably will need other secondary price information to establish commerciality.

Adjustment techniques are critical to valid comparisons, and the analytic tools used for cost projections and cost analysis become important.

Historical comparisons

The main sources of secondary comparisons are current prices for the same or similar requirement, past prices paid for the same or similar requirement, and past offers. These all are historical comparisons, although each is listed separately in the hierarchy of price analysis techniques. When the necessary data are available, you can use the techniques to support competitive evaluations. Historical comparisons are the most useful of the secondary comparisons if you can establish that the prices used for comparison were influenced directly by the market. However, that influence may be dated, or the current procurement may be based on different requirements. You must make sure the respective items and prices are comparable and that the historical prices resulted from adequate price competition.

Market data

A broad collection of potential comparisons in this category helps you shape your ideas about prices, market trends, and technological advances. Newspapers, trade journals, and market indexes can be used to validate assumptions, identify the need for adjustment, and even make adjustments. For example, the *producer price index* may be used to update a past price to make it comparable to a current offer. Indexes of all types may be used to develop estimates which may be compared with offered prices.

Cost estimating relationships (CERs)

CERs include yardsticks and parametric relationships such as dollars per pound, per square foot, per loaded labor-hour, and other units of measure. The value of these comparative estimates has increased with the development and use of quantitative analysis in contract pricing. These relationships identify differences that signal the need to alter the conclusions you reached through other comparisons. They also can be used to adjust other comparisons by establishing common denominators between dissimilar offers.

When primary pricing data are scarce, use and significance of cost-estimating relationships increases. With enough secondary data and knowledge of basic statistical techniques and adjustment techniques, you can do an acceptable analysis.

Government estimates

When price comparisons are not possible, the offered price may be compared with the purchase request estimate (if there is one) or other Government estimate. You also can use a Government cost estimate to validate conclusions or pinpoint discrepancies. For the estimate to be useful, however, you need to know the basis for it and have a good idea of its reliability. You need to find out how the estimate was made, what information and tools were used, where the information came from, and

how earlier estimates stacked up against resulting contract prices. It also may help to know who made the estimate.

A purchase request estimate can be a valid standard if it is based on a realistic engineering analysis or if the estimator has used past prices, explained why those prices were picked, and included the quantities. A useful engineering estimate of what an item should cost could be made after study of the drawings, after physical inspection or teardown of a sample, or by analyzing similar work and projecting a price based on the findings. You should compare earlier estimates derived in the same fashion with actual purchase prices before deciding a current estimate is reliable.

Too often, purchase request estimates are not reliable. Stock list prices, a frequently used source, can be misleading unless they are updated continually and annotated to indicate quantity and production rate. Lacking any other basis, the estimator may make an outright guess and this obviously is no good. Therefore, you need to look very carefully at a Government estimate and assess its realism and its value.

Noncompetitive procurements

Many procurements are noncompetitive, not because only one source can fill the requirement but because special circumstances do not permit competition. For example, awards under the 8(a) program are situationally noncompetitive. Further, noncompetitive procurements can result from emergency requirements or from the fact that few offerors are willing to do business with the Government.

Price information usually is available for both emergency procurements and other situationally noncompetitive actions. For example, market data may be available even though competitors are few or the procurement is urgent. Similarly, historical prices and offers received on similar jobs may be useful on 8(a) procurements. These data can be close to primary data in value.

14.4 Auxiliary Techniques

You can use auxiliary techniques to supplement primary and secondary comparisons. You also can use them to augment cost analysis when primary and secondary comparisons are not feasible. With them you can corroborate or challenge conclusions developed after other analyses. Value analysis and visual analysis are in this group. Value analysis attempts to develop the intrinsic worth of a product, and visual analysis is a practical, simple approach to establishing worth by inspecting the product or a drawing or picture of it. (Visual analysis also is called eyeballing, a descriptive but inelegant term.)

Value analysis

Value analysis traditionally has been an adjunct of cost analysis, but certain value-related principles can be used to supplement price analysis. Value analysis is the task of determining why similar products should be priced differently. This analysis obviously helps you understand the reason for price differences between past buys and present offers. It also can help you assess the degree to which an estimate may be influenced by value considerations that adversely affect comparability and erode the value of the estimate as a means of secondary comparison.

Value analysis assumes that value is the function of three variables: demand, use, and aesthetics. Demand factors are identifiable and can be analyzed through primary and secondary comparison techniques. Moreover, they usually depend on customer perceptions related to the second and third variables. Therefore, value analysis focuses on use and aesthetics.

Value analysis includes a two-part examination of the item being bought. First, you list the functions required and compare the required functions to those of alternative products. *Theoretically, an item that does less has a lower value and* should have a lower price. Second, you identify and compare the aesthetic requirements. When both utility and aesthetics indicate greater value, they support a price differential. However, when a price premium exists and is attributed to aesthetic rather than functional qualities, the differential is hard to justify.

As a consumer, you perform value analysis in many buying decisions. For example, a company recently raised the price for its stereo receiver by $100 over the previous model. The only difference you can find is that the new model is black and the earlier model was brushed aluminum. That analysis tells you that it doesn't make much sense to pay a premium for that difference.

Another example may clarify the relationship between market price and value. An imported sports car sells at $1,000 above list price. The interaction of supply and demand may make this a fair market price. Some customers are willing to pay the premium because of the aesthetic value they attribute to the car. Others are not willing, and to them the price is not reasonable unless, of course, there are no alternatives. You, as a Government buyer, are classified with those "others" and know that a fair market price is not always reasonable for Government purposes.

In most cases, value analysis is a supportive technique. If competitive evaluation, published prices, or secondary comparison techniques can't do the job, cost analysis usually is required.

Visual analysis

Visual analysis involves inspection of the item or the drawings of an item to develop an estimate of its value. It is similar to and may be used in conjunction with value analysis.

By itself, visual analysis may not do much. It is concerned with obvious, external features and provides general answers. However, it can prevent mistakes and oversights and lead to questions about offered prices. Several examples come to mind, examples in which eyeballing the product would have raised questions about high prices quoted for hammers, coffee makers, screws, and other relatively common items. Visual analysis is meant to be used to verify tentative conclusions reached through primary and secondary comparisons.

Other

You can take an approach embodying some aspects of both value and visual analysis. In evaluating an offer, you might ask "Is this item worth $3.75?" If it looks like the price ought to be closer to $.15, your next questions might be "How is this item to be used, in what environments? Do we really need this specific item? Is there another item that will do the job for less?"

To illustrate, assume an offer of $3.75 each for a quantity of 1" × ¼" bolts with standard thread and hex head. If the bolt is to be used to repair a piece of test equipment, you may not need the high-carbon, heat-treated steel bolt specified and should question the requirement and suggest an alternative. If, however, the bolt is to be used to repair an aircraft landing gear or other high-stress equipment, the heat-treated bolt may be necessary. Either way, *you still need to use other techniques* to find out what the price should be for a bolt suitable for each application.

CHAPTER 15

COMPARABILITY

CONTENTS

Comparability is the quality or state of being comparable. *Comparable*, in turn, means capable of or suitable for comparison. *Comparison* is examination of two or more items to establish similarities and dissimilarities.

These definitions lead to the question "Do two products have to be alike to be comparable?" You may answer, "No. Any two things can be compared, but the comparison may show that they have no characteristics in common." Thus, if your purpose is to pass judgment on the price of at least one of the two things, the comparison will have been a waste of time if they are unlike in every way.

For price analysis, then, a working definition of comparable is having enough like characteristics or qualities to make comparison useful. For example, you can compare the prices of apples and oranges, but it won't be much help unless either fruit will satisfy the need at hand and size, kind, and quality are immaterial. If only large apples will do, it might be helpful know the prices of Jonathan apples, MacIntosh apples, and Golden Delicious apples – large size only, of course. If only Jonathans will suffice, the comparability problem is still not solved.

The more similar the items are, the easier is the comparison. If your examination discloses significant dissimilarities, you may need to quantify the dissimilarities and make adjustments before you can reach valid conclusions about one price against another. The more judgmental the quantification, the more there are apt to be doubts about the conclusions, and the less likely is the comparison to be persuasive.

To summarize, comparisons will be controlled by what it is you are buying (the specifications and statement of work) and the similarities that exist in products or services being compared. The products or services must have some like qualities or characteristics for the comparison to be useful.

15.1 Factors That Affect Comparability

Both internal and external factors affect the suitability of prices for comparison. These are time, quantity or size, geographic location, inflation, extent of competition, technology, and special terms and conditions.

Time

The passage of time erodes comparability. For example, an effort to equate two prices separated by five years through a simple inflation adjustment probably would not be successful; too many variables are involved. You must not stretch data beyond their limits.

You should select the most recent prices available. The greater the time difference, the less comparable the prices are likely to be and the less reliable the comparison becomes. If you are comparing a current offer with a price paid previously, the ideal comparable would be a current contract price. That comparison would limit the effects of time. However, don't select prices for comparison merely on the basis of proximity of contract actions. The other factors also are important.

The passage of time brings about changes in markets, demand, technology, and other circumstances that affect prices. Knowledge of trends is vital. Lags often occur between data collection and contract award. Changes in policies and practices over that period can reduce the usefulness of the data assembled.

Quantity or size

Variations in quantity can have a significant impact on unit price although the specific effect may not be obvious. Variations in quantity can have an upward effect, a downward effect, or no effect at all. For example, in the commodities area, it usually is assumed that larger purchases command lower prices. Where economies of scale are involved, that should be the case. However, increases in lot size beyond a point may tax a supplier's capacity and result in higher prices.

Also, market forces may impose opportunity costs on a supplier which result in higher unit costs for greater volumes. For example, if the price of oil is expected to increase 20 percent over a 12-month period, a supplier may choose to withhold a portion for sale at a later date when the price is higher. In such a market, the effect of purchase quantity on price may not be as expected; at some point, increases in volume will result in higher unit prices as the supply of the lower priced oil is exhausted. Finally, if a price comparison is based on standard commercial items that are produced at a regular rate, variations in quantity may have no effect at all.

A meaningful comparison of prices requires that the effect of volume on price be accounted for. The best way to do this is to select prices for comparison based on equal volumes. If that is not possible, examine the specific suppliers and the nature of the market at the time of the purchase.

In the service area, the problems are different. Variations in size can sometimes be neutralized by reducing the comparison to price per square foot or price per productive labor hour. Because these approaches are not always effective, try to factor out size or quantity variations as much as possible. If you don't succeed, the price comparison will have little value.

Geographic location

Geography can have a range of effects on comparability. In major metropolitan centers, buyers generally will be able to rely on data from within that geographic region; in more remote, less urban areas, the buyer often must get data from beyond the immediate area. Prices for many nationally advertised products will not vary much from place to place. Nevertheless, because geographic location can undermine comparability, you should try first to evaluate prices against prices obtained from the same area.

When you must compare prices across geographic boundaries, take the following steps:

1. Check the extent of competition, which can vary from place to place.

2. Determine the extent to which variations in the price of labor must be neutralized if comparison is to be valid.

3. Check freight requirements and accompanying costs. These can vary considerably, especially for hazardous materials like chemicals.

4. Identify geographic anomalies or trends. For example, many items are more expensive on the West Coast than in the East.

Inflation

Inflation undermines comparability by eroding the real value of money. Because prices over time are expressed in the same denominations (dollars and cents), the denominations must have comparable values if comparison is to be meaningful. Analysis of the *producer price index* will isolate the impact of inflation so that you can reduce the value of a current offer to the value of the base price against which you want to compare it.

Extent of competition

Competition is the key to reasonable prices. When comparing one price with another, assess the competitive environment shaping the prices. For example, you can compare last year's competitive price with a current offer for the same item. However, if last year's procurement was made without competition, you may not have a good price with which to compare the current offer. A poorly written specification and an urgent need combined to make competition impossible last year, but now the specifications have been rewritten and the delivery is not urgent. Given these circumstances, a current offer could be the same as or less than the past price and still not be reasonable.

Technology

Prices from dying industries can rise because the technologies don't keep pace with rising costs. Conversely, technological advances in growth industries can drive prices down. The computer industry is an example. Technological advances have been coming so fast that a comparison of prices separated by a single year must account for these advances if the comparison is to have any value.

Engineering or design changes also must be taken into account. This means you must identify the new or modified features and estimate their effect on price.

Special terms and conditions

When you, a Government buyer, buy commercial products and services, you often must include provisions that are not required in the usual market transactions. Contracts between buyers and sellers in the private sector do not include provisions relating to the Davis-Bacon Act, the Service Contract Act, clean air and water, and many other special conditions. Consequently, evaluation of an offer with commercial prices may be difficult. Unique terms and conditions affect prices, but it is extremely difficult to assign a dollar value to their effects.

15.2 Establishing Comparability

If you have the option, get prices that already are comparable. If you can't do that, try to establish comparability by making adjustments. You may have to use statistical techniques or algebraic formulas to establish a common denominator.

Broadly speaking, you must complete two basic tasks in order to establish comparability:

1. Price-related differences must be identified and documented, taking into account the factors affecting comparability.

2. Price-related differences must be factored out.

The following checklist, Table 15-1, breaks down these two tasks into five steps and shows the considerations that come into play at each step.

TABLE 15-1. CHECKLIST FOR ESTABLISHING COMPARABILITY

STEP	CONSIDERATIONS
1. Select items or prices for comparison	Is this comparison valid? Are better comparisons available?
2. Identify product and price-related differences	Are the items or services compared the same? Are there discrepancies in terms and conditions which affect price? How do the environments shaping the respective prices differ?
3. Determine the precise effects of the differences	How do the noted differences affect prices? (Recall earlier discussion concerning variations in quantity.) How substantial might the differences be?
4. Select and apply method for adjustment	Can resources such as the *producer price index* be used to establish comparability? Must more sophisticated manipulative techniques be applied?
5. Make comparison	Have all price-related differences been accounted for? Have I developed a common base for comparison? If not, to what extent is the comparison still valid? Should it be discounted?

Restoring comparability by establishing a common denominator requires that you assign a dollar value to each identified difference. You can't do this always, however. The cost of terms and conditions peculiar to Government contracts is hard to estimate, so exercise discretion in such cases.

15.3 Adjustments

Adjustment techniques are used to establish comparability among the items to be compared. In many procurements, even where competition is adequate, competitive evaluation requires that the offered unit prices be adjusted to establish greater comparability. This can happen when unit prices are skewed by variations in quantity or product characteristics and by life cycle considerations. It also is brought into being by differences in the way in which requirements are stated. Buying organizations routinely use indefinite quantity and requirements contracts, options, economic price adjustment clauses, and time-and-material and labor-hour arrangements in addition to definite quantity, definite delivery contracts. Warranty rights may differ, and in contracting for services, offerors may quote on different levels of service.

Comparability is present when there are similarities in the products or services being compared and the environments within which prices exist are relatively equal. External forces must be neutralized and steps taken to see if comparability can be established. This section discusses several adjustment techniques. Most examples pertain to situations in which current offers are being compared using competitive evaluation. However, the adjustment methods also may be used to establish comparability between primary and secondary data.

Keep the following general rules in mind when making any adjustment:

1. Use of any technique must be anticipated and its use disclosed in the solicitation. (The Comptroller General repeatedly has ruled that offerors must be advised of the basis for evaluation. The particular adjustment techniques to be used must be identified in the solicitation.)

2. Any adjustment technique used must be realistic. (The purpose of adjustment is to facilitate a determination that the price to be paid is fair and reasonable. Adjustments must be based on realistic expectations and forecasts.)

3. Adjustments must be applied uniformly. (Impartiality is central in Government procurement. Similar offers must be adjusted by the same factors in the same way.)

Estimated quantity

Prices offered under indefinite quantity contracts usually are unit prices. Analysis of the offered unit price requires you to consider the probable quantity that will be bought. A reasonable price for a quantity of one probably would not be reasonable if you bought 500, but remember that volume increases can cause higher prices or can be irrelevant.

When indefinite quantity, requirements, time-and-material, or labor-hour contracts are used, make the following adjustments:

1. Establish a realistic estimate of the quantity that will be bought.

2. Apply unit prices to the estimated quantity.

3. Compare the extended prices of the competing offers, using competitive evaluation and other analysis techniques.

Adjustments to account for estimated quantities are important when two or more line items are to be bought in a single contract. The quantities applied to different line items materially affect the

determination of the lowest overall price. Suppose you solicit offers for heavy-duty batteries of two types (*A* and *B*) and receive two "all-or-none" offers (Table 15-2):

TABLE 15-2

TYPE	OFFEROR X	OFFEROR Y
A	$ 50	$ 60
B	70	65
	$120	$125

A competitive evaluation of the unit prices says that Offeror X has the lowest price, a combined price of $120 for Offeror X compared with $125 for Offeror Y. However, by analyzing past purchases and conducting a buyer survey, the requirements people estimated that 500 Type A and 2,000 Type B batteries will be bought. These quantities are to be used in evaluating competing offers and were included in the solicitations. Adjustment for estimated quantities leads to the conclusion that Offeror Y probably has offered the best overall price.

Assumed change (trend analysis)

Long-term contracts, including options, routinely provide for adjustments in prices based on actual cost experience or the movement of economic indexes. Price analysis using competitive evaluation techniques must consider the likelihood of those price adjustments by making *assumed changes*.

Most economic price adjustment clauses use *price index numbers* to measure the changes in price over time. Price adjustments are based on the application of the index to a base price. If all offerors are required to use the same base, the index normally will have a uniform effect on price. Consequently, price adjustment considerations can be disregarded in the competitive evaluation. However, if offerors can select or influence the base, the probable effect of an economic price adjustment clause must be considered.

Assumed change adjustments are applied as follows:

1. Identify the amount of change expected during the contract period.

2. Extend the offeror base by the assumed percentage of change.

3. Adjust the price by that percentage.

As an example of the working of this adjustment technique, assume that you solicit offers for 10,000 square feet of office space for a five-year period. (The example includes Tables 15-3, 15-4, and 15-5.) Assume that you receive two offers with the unit prices shown in Table 15-3.

TABLE 15-3

OFFEROR A	OFFEROR B
$10 per sq. ft. per year	$9.95 per sq. ft. per year

Offeror B's price appears to be lower than A's. However, in the solicitation you stated that you would adjust the bases for services and utilities using an assumed change of 3 percent compounded annually. The bases proposed and accepted are shown in Table 15-4.

TABLE 15-4

OFFEROR A	OFFEROR B
$3 per sq. ft.	$4.50 per sq. ft.

The offered price per square foot is adjusted by calculating the additional payment which would be made if the change were 3 percent each year, dividing the total additional payment by the lease term (five years) and adding the calculated amount to the lease price. The adjusted prices *for evaluation* are shown in Table 15-5.

TABLE 15-5

OFFEROR A	OFFEROR B
$10.19 per sq. ft. per year (low)	$10.24 per sq. ft. per year

As you can see, the result of the competitive evaluation is altered by the price adjustment.

When you use this technique, you must use forecasting skills to predict the amount of change likely to occur during the contract period. The assumed change must be reasonable and realistic; it takes more than arbitrary selection of a percentage.

A broader treatment of price indexes, forecasting, and other trend analysis methods is in Chapter 3 of this manual and in *Producer Prices and Price Indexes* and other Bureau of Labor Statistics publications.

Product variance

The most difficult adjustments are those related to differences in the products offered. The term *product* includes goods, services, and space. The clearest examples of situations in which adjustment for product variance is required are items offered with commercial warranties.

Product variance adjustment is called for when items are offered with differing commercial warranties. The fair and reasonable price for a product sold *as is* should be lower than for the same product sold with a full five-year warranty.

The general technique is as follows:

1. Determine the characteristics of the model product.

2. Identify the missing characteristics of the product offered (e.g., no warranty on the drive train).

3. Determine the reasonable price or cost of the missing characteristics (e.g., cost of service contract in lieu of a warranty).

4. Add the price or cost of the missing characteristics (i.e., the characteristics the Government will have to pay extra for) to the offer.

For example, assume the Government solicits offers for 10,000 square feet of space, requesting janitorial service and all utilities. Two offers are received as shown in Table 15-6.

TABLE 15-6

OFFER A	OFFER B
$10 per sq. ft. per year, fully serviced, all utilities included	$5.50 per sq. ft. per year, no janitorial, Government to pay for electricity separately

Obviously, the two offers are not comparable. Before you can make a valid comparison, you must determine the value (per square foot) of the services that *B* is not providing and add that amount to the unit price of *B*. The prices then will be comparable.

The product variance adjustments also can include Government administrative costs if that adjustment is disclosed in the solicitation. If it was disclosed, the administrative cost of obtaining a separate contract for janitorial service and utilities can be added to *B*'s offer in the example.

Ratio analysis

Ratio analysis can be used to overcome differences in service and other contract offers that would otherwise make direct comparisons difficult. Other awards, preferably from the geographic area in which the contract is to be awarded, are used to develop the data base. For instance, the technique can isolate the percentage markup over base labor (where the labor rate is presumed to be equal to the rate established in the Service Contract Act) for each awarded contract. In essence, the technique develops a ratio for each contract. The ratios compare the *price per loaded labor hour* (a loaded labor hour includes all indirect and direct costs plus profit) divided by the *base minimum labor rate per hour*. They indicate the *load on labor* for each contract price. This lets you figure the markup on base labor and allow for differences in base labor rates.

For instance, assume you are negotiating a guard service contract with a base labor rate of $6 per hour and an analysis of three recent guard service contracts reveals the following (Table 15-7):

TABLE 15-7

CONTRACTOR	PRICE PER PRODUCTIVE LABOR HOUR (a)	MINIMUM LABOR RATE (PER SERVICE CONTRACT ACT DETERMINATION) (b)	RATIO (a ÷ b)
X	$8.65	$5.15	168%
Y	9.29	5.50	169
Z	9.10	5.45	167

The ratios indicate that a load on base labor between 167 percent and 169 percent is fully supported by the price analysis. Therefore, a projected price range of $10.02 ($6 × 167 percent) through $10.14 ($6 × 169 percent) per hour is a good estimate of the fair market price.

Where the contract under consideration is materially different from the contracts used as comparables but the differences can be quantified, the projected price can be adjusted. For instance, if a guard contract to be awarded requires extraordinary amounts of equipment such as vehicles for perimeter patrols but the comparables were routine guard contracts requiring no large equipment expense, you could estimate an annual depreciated value of the vehicles and add it to the overall projected fair market price.

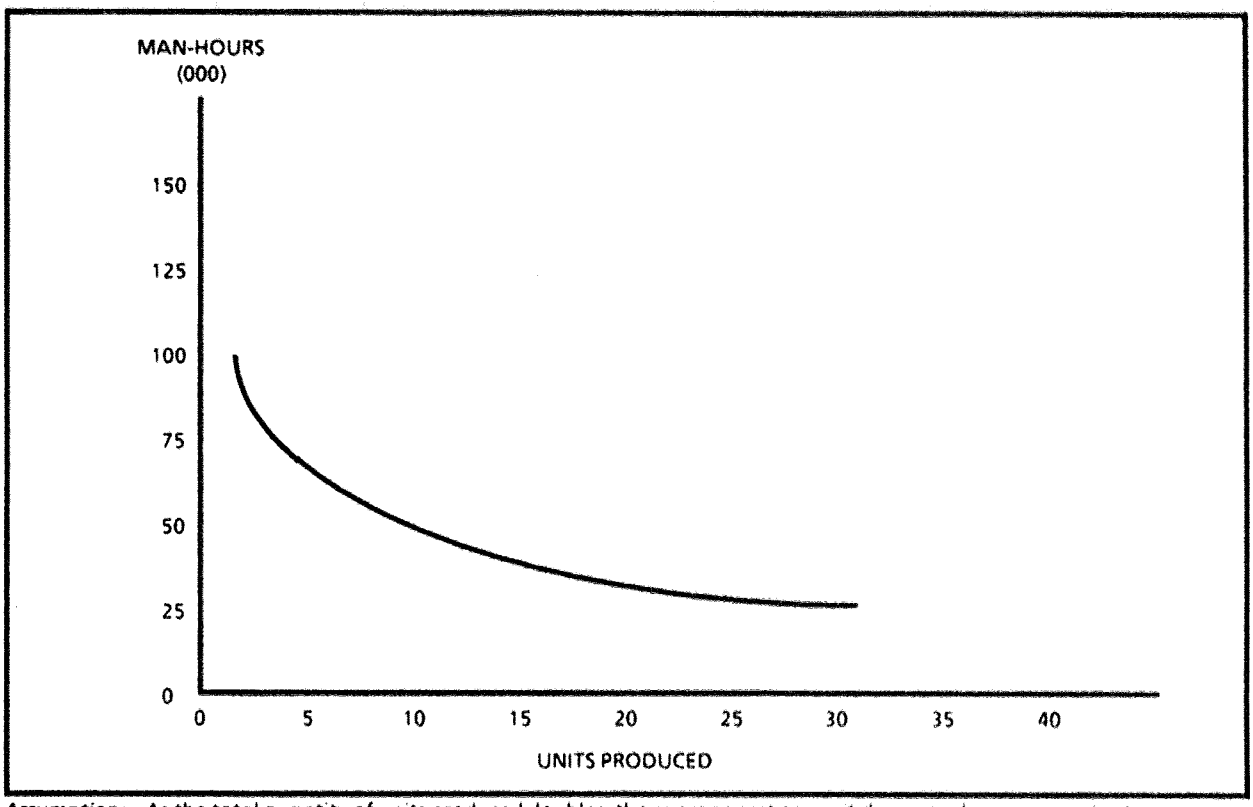
Additional techniques

Some noncompetitive procurements require more sophisticated adjustment techniques. Even with competition, procurements of new products or significant increases in the volume of regular purchases may benefit from more sophisticated analyses using principles normally applied in cost analysis. There have been major strides in the last few decades *in quantitative techniques for* analyzing business problems including pricing. Operations research and systems analysis have emerged and substantial efforts are being made to apply the principles of economics, productivity *research, engineering, and even sociology to pricing decisions.*

Detailed treatment of such specialties is beyond the scope of this manual. Nevertheless, two examples demonstrate the principles addressed by such disciplines and Appendix D is a reproduction of a portion of a pricing text addressing aspects of quantitative analysis.

The first principle is the learning curve. As the number of products being produced in sequence increases, the cumulative average direct labor hours per product decreases in a regular exponential pattern. That means that labor cost compared to quantity produced resembles the curve shown in Figure 15-1. The principle has been demonstrated in many industries, including services and construction. Of course, the actual curve varies from industry to industry, from company to company within an industry, and even from plant to plant within the same company. In addition, the learning curve phenomenon is, in part, a product of sound management and cooperative interaction between management and labor. However, you should be alert to the potential for reduced prices through improved labor productivity, even when analyzing the prices of new production items. The learning curve is discussed more fully in Chapter 3.

FIGURE 15-1. AN 80% LEARNING CURVE



Assumption: As the total quantity of units produced doubles, the average cost per unit decreases by some constant percentage.

The second principle, called market share pricing, is important when you and others in the Government are major buyers of commercial products. It states that because of economies of scale and fixed costs for plant, equipment, and other factors, including learning, businesses should concentrate not on their margins of profit per product but on increasing their share of the market. When the Government's buying activity is significant in the overall market, you should expect prices that reflect the market share factor.

These and other principles relating to pricing, costing, and market forces now are taught in universities and graduate schools and written about in specialized journals and texts. Check them out.

15.4 What If You Can't Establish Comparability?

What to do if you can't establish comparability depends on the situation. You have two major alternatives.

1. *You can disregard the data.* This option is both reasonable and advisable when you have an abundance of data. Remember that price analysis is a means, not an end. If one piece of information is not suitable and you have alternatives, try the alternatives. Don't force a comparison.

2. *The data can be discounted.* If you must use the data, you may estimate the value of the price comparison, given the gaps in comparability. You may be able to use probabilities

to estimate a discount value for the data. You may be able to approximate comparability and give reduced weight to the comparison in your overall evaluation of the price.

The question to ask yourself always is: Does the information, even with its limitations, contribute to the evaluation of price? If your answer is no, disregard the information. If the answer is yes, your challenge is to quantify the contribution.

CHAPTER 16

GETTING ADEQUATE DATA FOR PRICE ANALYSIS

CONTENTS

16.1 Sources of Data

For price analysis, you must get other prices and, if necessary to make them comparable, adjust them for differences in market conditions and contract terms (actual and proposed).

Price data can be divided into four categories: offeror-supplied data, historical data, other Government data, and market data. Within each category there are several specific sources that may be useful in a given situation. Data obtained from one source may be used to verify conclusions reached using information from a different source.

Offeror-supplied data

You start analysis with the competitive bids or proposals submitted for the procurement. If 10 bidders respond to an invitation for bids (IFB), there is a strong presumption that the lowest price from a responsive and responsible seller is fair and reasonable.

Competitive bids or proposals also may give you the basis for questioning the reasonableness of a price. Assume the situation where a low firm is disqualified on administrative grounds (e.g., for failure to sign the bid). In this case, existence of a large difference between the prices of the disqualified low bidder and the next lowest bidder may indicate that the next lowest price is not reasonable. Similarly, a proposal that offers slightly less technical merit but a major price advantage calls into question a proposal that offers somewhat more quality at a much higher price. Such questions must be resolved using data from other sources.

Offerors may provide pricing information in addition to their competitive proposals. These include:

- Data used to support an exemption from the requirement to submit cost or pricing data.

- Data regarding past contracts for similar work, often required in order to demonstrate responsibility.

- Line-item prices, important for analyzing whether a balanced proposal has been submitted.

- Supplier catalogs and subcontractor data offered, for example, to support an "or equal" determination.

You can use this information in many comparisons and verification tasks. For instance, you can:

- Compare the offered price to the catalog or market price of *each* offeror.

- Compare what is being offered to what was charged on previous contracts by both the same offeror and others.

- For an indefinite quantity contract, verify the quantities estimated by the Government for use in evaluating competitive proposals.

- Evaluate the price implications of limiting the procurement to a particular brand name.

Although a good deal of data are received from offerors as a matter of course, you must spell out specific data requirements in the solicitation. If you don't, you may find that data are presented in ways that make comparisons difficult, or are not submitted at all.

Historical data

Price analysis uses the price history of an item or service to evaluate a current offer. The contract files of previous buys will tell you how those earlier prices were analyzed and justified.

Historical data usually are available within the contracting office, but you may have problems locating the right files. Some offices maintain manual or automated systems that index procurements by commodity or service; others organize files by contract number and perhaps by contractor. The best way to find files that are not indexed by commodity or service is to talk to other buyers.

You also can get historical data from prospective contractors. Requesting information on prior contract awards helps you get market and price information and determine the responsibility and technical skills of offerors. However, don't impose an unnecessary burden by routinely requiring such information.

You also may get historical information from other buyers, within and outside the Government. Many of the same products and services are bought by Government offices and private businesses. While there is no formal method for exchanging this sort of information, you can develop and maintain contacts through contract management, purchasing, and trade associations. A call to an associate may get you valuable information.

Other Government data

You generally have at least one important data source, the independent Government estimate included as part of the purchase request package, when you initiate a procurement. This estimate may be based on substantial knowledge of the market or on nothing more than an advertisement for

the product. No matter what its basis, the estimate is a starting point; the requisitioner may have based the budget allocation on it.

The significance of the independent estimate varies from one procurement to the next depending on the availability of other information and your assessment of the situation. You need to know how the estimate was prepared, what the assumptions were, and how reliable it is. Try to find out the basis for the estimate and make sure the information and assumptions are reasonable.

You can get other information from Government sources. Through statistical and "market watch" functions, some Federal agencies collect, maintain, and report valuable data concerning the pricing of thousands of products, services, and commodities. The major data sources are the Department of Commerce (Census Bureau and Bureau of Economic Analysis) and the Department of Labor (Bureau of Labor Statistics). The Departments of Agriculture and Energy also have price and cost information on specific commodities.

DoD components have experts who can advise on construction costs, on a wide variety of services, and on product design, manufacturing, and pricing. You also can consult with experts in other agencies and get technical data published by these agencies as well as by the National Technical Information Service.

Of all the data, you probably will use the consumer price index and the producer price index most often. Each index compares changes in price to stated bases. The indexes, along with subindexes for individual groups of commodities, can be used as general indicators of price trends, as comparison points for purchase prices of listed products, and as guides to price escalation and inflation. Put another way, the indexes help establish a common denominator between a price paid 15 months ago and a price offered now.

Producer Price Index

The producer price index (formerly called the wholesale price index) has greater utility than the consumer price index. The producer price index is published by the Bureau of Labor Statistics. It tracks changes in prices that producers receive from the initial commercial purchasers of their products. It reflects the selling prices of selected manufacturers or the prices quoted on organized exchanges such as the Chicago Board of Trade. The prices usually are f.o.b. origin for immediate delivery.

The producer price index is published in a monthly report, *Producer Prices and Price Indexes*. This report also includes average prices for selected commodities.

The Bureau of Labor Statistics also publishes articles on patterns and trends in producer prices in its *Monthly Labor Review*. Two Bureau of Labor Statistics (BLS) reports also may be of use. These are *The BLS Industrial Price Program: A Survey of Users* (Report 509, 1977) and *Producer Price Indexes: A Guide for Contracting Parties* (Report 570, 1979).

The Consumer Price Index

The consumer price index also is published monthly by the Bureau of Labor Statistics. This index provides a guide to changes in "retail" prices. It is used as a price adjustment factor in some areas of procurement (leasing in particular) and as a general gauge of inflation. However, the producer price index usually is a better source of data on price trends because the Government usually is a "wholesale" buyer.

Market data

This category includes everything from informal telephone quotes to formal market surveys to prices advertised in trade journals and newspapers.

A great deal of price information is available through privately published sources. Trade associations, user organizations, and individual companies regularly provide information which, if used, greatly simplifies the tasks of market research and price comparison.

Trade journals contain a great deal of information. They address topics as diverse as chickens (*Poultry and Egg Weekly*) and paint (*The American Paint Journal*). There are local publications that report price information within the immediate trade area (for example, "Black's" reports on commercial lease prices for selected East Coast cities). A complete listing of such publications can be found in most large libraries in the Index to Periodicals. Trade associations also can supply information.

In addition, trade and user associations often publish useful market indexes. They indicate price trends, often with more specificity than the Government indexes. However, because the indexes usually are compiled from data gathered from association members, you need to find out if the membership is representative of the total market. The Bureau of Labor Statistics has reviewed many association surveys and can help you.

The *Wall Street Journal* is a prime source of general market data and of index, quotation, and sales data as well. A national business publication, the *Journal* has information on every aspect of business. Get familiar with the indexes, charts, and reports of quotations, sales, and other business developments available on a daily or weekly basis in the *Journal*.

Other newspapers, both specialized and general circulation, regularly have useful data. Advertisements are very important sources. The easiest possible comparison of prices can be made by checking prices offered in newspaper and magazine ads. If you find a product offered to you at $25 advertised in the paper for $20, you may be on the way to finding the quoted price too high. Before you reach that conclusion, identify and evaluate the pricing environment. You might find that $20 is a one-day sale price and not reflective of market price.

The price of an advertised product also may be found in published catalogs. Both retail and wholesale catalogs will give price information with which to compare offers. Catalogs generally are available at little or no cost directly from manufacturers or dealers, as well as in the business sections of many libraries.

Market data also can be obtained through market surveys (see FAR 7.101). You may do this by asking both suppliers and users for price information. You may do this by phone or by letter. Any survey should be structured to elicit as much specific information as possible, including terms and conditions that could affect price. FAR 15.405 provides instructions and conditions for the use of "information-only" solicitations.

You also can use requests for quotations, Commerce Business Daily announcements, and in some cases, local newspaper announcements to get price quotations for informational purposes. However, the information received by these means are asking prices and not actual sales information.

16.2 Considerations in Gathering Data

Consider three principal factors in gathering pricing data:

- *Timing.* To be useful, data must be collected in a systematic and timely manner. Data needs must be anticipated.

- *Quantity and kind.* Determine how much and what kind of data are needed. The more data points (different comparisons) you have, the sounder your analysis will be. Your objective is to get those data that will help determine and demonstrate the reasonableness of prices.

- *Quality.* Quality and usefulness of data depend on the data's accuracy, completeness, currency, and comparability.

In assembling data, the key will be how much the data reveal. Often the kinds of data available and their quality will determine the quantity of data you will need. In the following discussion, it will be increasingly clear that the three considerations are interrelated and that data must be assembled and assessed with all three considerations in mind.

Timing

Decide early what method you will use to organize price and market data and the sources from which you will seek the data. Timing is critical. If you are to do a market survey, you must allow time for survey preparation and data collection and analysis. If you are going to ask for informational quotations, allow time for advertising, source selection, mailing, and response. Even market research using published sources takes time.

Beyond time allowances, anticipate the types of data needed. If data requirements are to be placed on the offeror, tailor the solicitation to include the right provisions. Especially in procurements where you are not familiar with the technical issues, decide in advance what technical assistance you will need and make the necessary arrangements.

Quantity and kind

Deciding how much and what kind of data to collect, as well as how to organize it and how to use it is tough. Before issuing the solicitation, decide how much data to ask for. Just as too little data can make meaningful analysis difficult, too much can make it difficult to sort out the relevant data. You want to decide if the offer is fair and reasonable and not to develop a model of an ideal price.

You must know the product or service you are to buy. A decision to pay $400 for a hammer would be a breakdown in the data assembly process. If you know what you are buying, you will need very little data to realize that the quoted price is way off.

Questions and considerations to be addressed in assembling data are set out in Table 16-1. The list is a guide to key topics, not an exhaustive list of all things.

TABLE 16-1. KEY CONSIDERATIONS IN ASSEMBLING PRICING DATA

Type of Product

- Is the product a basic commodity with established trading organizations?

  Raw materials, foods, and other staples often are sold on exchanges for which excellent market data exists. These data may help when making bulk purchases.

- Is the product a general-purpose commercial item with major retail and wholesale markets?

  Products may be sold at established catalog prices. Retail or wholesale catalogs may indicate fair and reasonable prices.

  Publications such as *Producer Prices and Price Indexes*, and even *Consumer Reports* may provide useful information on price and quality issues.

  A competitive market may be expected. The primary source of data may be the bids themselves.

- Is the product built to Government specifications?

Type of Market

- Is the market stable or fluctuating?

  In a stable market, historical data are useful; adequate competition is likely to have existed and changes in relative values of prices are fewer, thus simplifying analysis.

  In an inflationary market, Government price indexes help you determine reasonable escalation.

  In technologically advancing markets, trade journals and user-oriented publications can alert you to product improvements and price *decreases* caused by product obsolescence.

  In markets threatened by foreign competition, you may, through market surveys, trade journals, and informational quotes, learn of price decreases caused by competitive pressure.

- Is the market broad-based or does it tend toward monopoly?

  The existence of many suppliers reduces the need for data as competition should drive price to the lowest level.

  With few sources, use all available data.

  Failure of suppliers to respond may indicate a problem with specifications. An independent technical review may be required.

- Are there other buyers?

Agency Expertise

- Is the product within the requisitioner's area of expertise?

  If the requisitioner repeatedly relies on a given market, confidence in the Government estimate can increase.

  If the activity is buying outside its mission or for a new mission, more product and price analysis is required.

  If the activity is buying outside its mission or for a new mission, outside technical assistance and the experience of other agencies may help.

Time of Purchase

- What is the time of the purchase?

  Market data from published sources may indicate a potential for countercyclical buying (buying when demand is down and supply is up).

  Trade journals and other publications may indicate unusual price increases caused by brand-name popularity, indicating a need for caution in pricing and perhaps a need to identify other products.

  Government indexes, market surveys, and trade journals may forecast price changes and thus indicate a buying strategy of either stocking up to hedge against shortages or delaying purchase until a price decreases.

Quality

No matter how much data you collect, make sure the data are valid for the task. The quality of the data has important implications for how much data will be required.

Accuracy and Relevancy

Pricing data can be relevant but inaccurate, or accurate but irrelevant to a particular pricing task. For example, suppose you get an offer of $69 for a wheelbarrow at a time when a local hardware store is advertising the same item in the paper for $29. Before tossing out the offer as unreasonable, take the following steps:

- Verify that the advertised product is in stock and actually for sale at the advertised price; that is, determine the data's accuracy.

- Compare the advertised product to the product that is being offered and to the specifications for your buy; that is, determine the data's relevance.

- Analyze the conditions affecting the offered price, the terms of sale. This involves evaluation of the comparability of the data.

Failure to take these steps can lead you to wrong assumptions. Analysis may show that the $29 wheelbarrow is part of a promotion and that its availability at that price is limited. The cheaper wheelbarrow may be inferior to the $69 one and unsuitable for the use intended. The price may reflect a one-time sale or an effort to clear inventory. The newspaper ad gives you pricing data but its value must be tested.

Other situations that require verification of accuracy, relevance, and comparability include:

- Data received from an interested party such as a trade association or a large business prohibited from competing by a small business set-aside.

- Data received from a dissimilar buying organization; commercial products may not meet the requirements of military-use end items.

- Conflicting data received from two or more sources.

Completeness

Data must be complete. An offeror may submit some but not all the data that are requested and needed. For example, an offeror who was asked to provide information about past procurements may select cases where the buyers paid list prices and omit sales to dealers or original equipment manufacturers on the grounds that the Government is not a dealer or manufacturer. Similarly, published data may not account fully for price differentials resulting from differences in warranty, material, design, and maintainability.

You will be in a good position to request the necessary data and judge its completeness if you know what you are buying, its function, its size, and the markets it is sold in. Knowing the product, you can spot gaps and inconsistencies in the data. Then you ask questions and follow up on anything that is not explained, is not clear, or seems irrelevant. For example, if you are buying items that are or seem to be commercial, analyze the data submitted to support claims for catalog or market price exemptions. The sales data required for those claims are of such a nature that there almost always will be holes that demand questioning and clarification.

When necessary data are not supplied, despite repeated requests by you and those above you in the organization, you may declare the offeror nonresponsive and turn to another. This decision involves a number of considerations, including time demands and the availability of other acceptable sources, and your efforts to get the data, including requests of superiors, must be forthright.

With data that comes from sources other than the offeror, what you do about missing information will depend on the circumstances. If a specific piece of data cannot be verified but a wealth of other information is available, disregard the questionable data and use the other. Sometimes data from a particular source will not stand alone but is useful when combined with other data. Generally, however, partially understood information creates more problems than it will solve. Incomplete or unverified information should not be used if you have alternatives.

Currency

Even if data are accurate and complete with prices that are comparable to and support the current offer, you don't necessarily have anything if the prices were established months ago, particularly if there have been sales in the intervening period. Currency of data is particularly important in a changing economy or fluctuating market. Data collected 12 months ago concerning

the prices of microcomputers, sensors, propulsion units, and valves are worthless today unless adjusted using other pricing information.

Keep up with the markets within which you operate. Know how the markets are influenced by interest rates and inflation, raw materials and labor conditions, and changes in taxes and other laws.

Stress the techniques that elicit current prices. Use competitive procedures and market surveys, and review current published price data whenever possible. The discussion of primary comparisons in Chapter 14 expands on this.

When using past prices in comparisons, remember that a price paid yesterday is more valuable than a price paid two years ago, other factors being equal. Currency can be achieved through statistical and other methods of adjustment, but the older the information, the more work it will take.

Field pricing support

Field pricing support is furnished by administrative contracting officers (ACOs), price analysts, engineers, auditors, and others outside the contracting office. Field pricing support usually is furnished for those procurements in which cost or pricing data are required and cost analysis is to be performed. As a practical matter, DFARS generally restricts requests for field pricing support to fixed-price contracts over $100,000, fixed-price-incentive contracts over $250,000, and cost-reimbursement contracts over $500,000, and for these reasons you rarely may ask for help in price analysis.

This is not to say that you (the contracting officer) shouldn't ask for and expect assistance when you need it. When you do ask, understand that for years the principal focus in the field has been on costs, cost or pricing data, projections of costs into future periods, and testing incurred costs for allowability. Be explicit in describing what you want and the kind of information you need.

Ask the field support team to review the data submitted with a claim for exemption from the requirement for cost or pricing data, particularly when you decide that further investigation is required before you can determine commerciality in connection with the catalog price exemption. The auditor can verify sales data and investigate whether reported sales are categorized properly as *A*, *B*, or *C*. The opinions of the field support team as to the meaning and significance of the pricing data and the reasonableness of price are advisory. Final responsibility for price analysis and price is yours alone.

16.3 Evaluating Data

Each piece of pricing information must be analyzed in light of other information. For example, catalogs may indicate the going price for a machine tool is $15,000 and a market survey may tell you that because of a strike in the steel industry, the going price is $16,500. Meanwhile, a trade journal article alerts you to a new laser tool priced at $18,000 and twice as efficient as the one contemplated by the purchase request. Reading further, you learn that the laser tool is a prototype and the price is an estimate. At this point, the accuracy, completeness, relevance, and utility of the $18,000 price is questionable. Even if accurate, complete, and current, the information does not contribute to the procurement of a piece of equipment for present needs at a reasonable price. The information's principal value is the clue it gives you about possible future price decreases in equipment prices due to technological obsolescence.

Few sources of data have absolute values. Each piece of information is a part of the whole upon which price reasonableness is predicated. Each new piece of information can affect conclusions about

the quality of other assembled data. You must assess the relative accuracy of the data source, the amount of market information provided by the source, and the currency of the information.

CHAPTER 17

DETERMINING THE EXTENT OF PRICE ANALYSIS NEEDED

CONTENTS

There are two major facets in deciding how much analysis is needed and warranted to establish the reasonableness of an offered price. One is the role of price analysis in terms of the reliance to be placed on it, as against cost analysis. The other is the relative complexity of the analysis to be undertaken. The depth of analysis will depend on the comparisons to be made, the data needed and available, and the time and effort needed to make the comparisons. The pivotal factor in deciding how much price analysis is needed is the degree of price competition obtained; competitive and noncompetitive situations require different approaches.

17.1 Factors Affecting the Extent of Price Analysis

The extent of price analysis is a function of several factors. Your evaluation will be judgmental, but based on specific factors. The most important are:

- Method of procurement
- Type of product or service
- Basis for award
- Quality of price competition
- Dollar value
- Cost analysis and price analysis.

These factors are discussed individually, but isolating their effects is artificial and can be misleading. No factor exists in a vacuum. They interact with each other in unique combinations to shape the analysis requirements for any given procurement.

Method of procurement

The method of procurement is a good determinant of the extent of analysis needed. If sealed bidding is used and a number of responses are received, all you may need to do is review the bids to decide which is most advantageous to the Government. For example, if five responsive bids from responsible bidders are closely grouped and comparable to last year's prices, you probably will need to do little more in the way of analysis. If only two or three bids are received or if the spread of prices is wide, from high to low, you probably will need to go deeper in analysis.

When competitive proposals are solicited, the story is much the same. If, based on the number of offers received and the grouping of those offers as to price, you conclude the competition is effective, a comparison with past prices may be all you need to do. If few responses are received or if there are wide differences among the several offers, you probably will dig some more, look at the market situation, the trends in the economy, and similar factors. Cost or pricing data and cost analysis may be needed.

If you use other than competitive procedures, you will use price and, when the dollars dictate, cost analysis. The nature and extent of price analysis in noncompetitive situations depends on the existence of a market for the same or similar item or service and the existence and availability of price histories.

Type of product or service

Suitability of price analysis can be equated to the type of product or service being acquired and the degree of commerciality. As the requirement becomes more unique, the utility of price analysis tends to decrease and the need for cost analysis to increase; uniqueness reduces the possibility of meaningful comparisons. Conversely, the more available an item or service is through regular commercial channels, the more likely it is that price analysis will be paramount. When you buy an item or service with commercial characteristics, you may rely on price analysis but use cost or pricing data and cost analysis to evaluate differences between commercial and Government items.

In any event, the use and extent of price analysis is controlled by many factors in addition to type of product or service. These include:

- Length of contract period
- Quantities, both total and delivery order
- Nature of the market
- Sellers' pricing strategies such as discounts and catalog price structures.

Basis for award

When price analysis is paramount, the extent of analysis can range from minimum (e.g., a sealed-bid award with solid competition) to extensive (e.g., a situation with weak competition requiring heavy reliance on use of market, historical, and other data, and many adjustments to achieve comparability).

When technical considerations are paramount, you use both price analysis and cost analysis. If you don't, you may end up paying excessive prices for small increases in technical capability. In most procurements, the solicitation should provide that cost and price will become the deciding factors if offerors' technical approaches and capabilities are equivalent.

When contract award is based on factors in addition to price, price analysis alerts you to the price tradeoffs required to achieve the specified degree of technical excellence. This analysis is equivalent to that which you might undertake in deciding for your own use among a Chevy Cavalier, a Ford Escort, and a Mitsubishi Tredia, or a Toyota Corolla, a Mercury Sable, and a Mercedes 300D. Each level of quality and performance requires additional investment that may or may not be required to accomplish your purposes. The proper mix of price and technical evaluation will help you buy the necessary quality at a reasonable price.

Quality of price competition

Competition often is the most important factor, though never the only factor, in determining the extent and scope of price analysis. In a competitive procurement, the need for a detailed price analysis effort increases as the number of bids or offers decreases. When only a few responses are received from a competitive solicitation and the competition is judged to be inadequate, you may need data from other sources even though these data might not be as useful as data from the competition itself. In noncompetitive procurements, price information may be limited, but this does not mean that price analysis will be unimportant.

In a market dominated by one or a few producers, pressures on price generally are light. Even the marginal competitor need not sharpen its pencil too finely to maintain its market position; it only needs to price its product enough below the dominant producer's price to attract the bargain hunters. The dominant producer can price its products just low enough to discourage new capital investment. In capital-intensive industries, this price may yield much more than the cost of production plus a reasonable profit. You may need to be cautious in certain markets to be sure the price you pay isn't the result of a few dominant producers' market-making activities.

Dollar value

The extent of price analysis, the number of comparisons, generally increases with dollar value simply because greater dollars justify extra effort to determine the reasonableness of prices and, when negotiations are necessary, to establish negotiation objectives. The effect of dollar value will vary, depending on the product or service being bought and the competition present. In addition, a first-time buy with significant follow-on potential deserves a more thorough analysis than its dollar value would otherwise call for.

You may make purchases of $1,000 or less without competition if you consider the prices to be reasonable. However, if you suspect or have information that suggests the price may not be reasonable, you will verify the reasonableness of price. Similarly, you would analyze when you purchase an item for which useful pricing information is not available, as when you buy an item that is not the same as or similar to other items that have been bought recently through competition.

Between $1,000 and $25,000, small purchase procedures apply and you analyze the prices to verify their reasonableness. If price competition is less than adequate, you may base your decision on comparison with prices found reasonable in previous purchases or on the basis of current price lists, catalogs, advertisements, or such other information. Generally, price analysis is paramount on buys up to $100,000, but whether it really is will depend on the interaction of factors already discussed.

Cost analysis and price analysis

An inverse relationship exists between reliance on cost analysis and reliance on price analysis. Without cost analysis, almost total reliance must be placed on price analysis. In the case of full cost analysis, price analysis may be limited to that necessary to establish value in comparison to the asking price. Other factors such as dollar value and basis for award will influence the actual scope of price analysis in any given procurement.

Cost analysis cannot assure fairness and reasonableness, but cost analysis can support assumptions that give an indication of reasonableness. The strength of these assumptions influences the extent of price analysis needed to substantiate reasonableness and worth.

17.2 Price Analysis in Competitive Procurements

In competitive situations, you have competitive bids or offers and market data with which to start analysis. Review of these data may give all the information you need to reach a sound conclusion about the price. In other cases, you may need to make other comparisons. Even in highly competitive situations, such factors as market conditions, inflation, interest rates, and the state of applicable technology may point to further analysis.

You likely will have procurements in which many sellers compete but in which award will be made on the basis of an evaluation plan that provides for tradeoffs between price and technical excellence. When this happens, price analysis is much more than a review of offers received. A price analysis technique like value analysis may validate price differentials even though costs may not justify any price difference between competitors. Product variations alone may justify a price variance even when the costs of production are equal.

17.3 Price Analysis in Noncompetitive Procurements

In most noncompetitive situations, cost or pricing data will be available and the absence of competing suppliers will limit the amount of pricing information. The absence of competition does not mean you can't use price analysis any more than the absence of competitive responses means that a market does not exist or that past competitions were inadequate. Historical and market data are valid bases for price comparisons.

While the role of price analysis is reduced in noncompetitive situations, its importance is not. Recurring publicity about exorbitant prices paid for spare parts and common-use items suggests that price analysis has not been used in some noncompetitive procurements and that buyers sometimes don't know or are unable to learn what it is they are buying.

Price analysis of noncompetitive procurements prevents contractors from seizing on the absence of competitors to exact unreasonable prices for goods and services available in the market. It protects you from paying more than a private buyer would pay in similar circumstances. Finally, price analysis gives added assurance that the Government does not underwrite inefficient performance or uneconomical practices.

Effect of exemption

The several exemptions from the requirement to submit cost or pricing data can apply when competition is absent from the procurement, and they can influence the role of price analysis. Price analysis becomes paramount when an exemption applies in a noncompetitive procurement.

Price analysis bears the burden of establishing the reasonableness of prices. For instance, if the offeror claims a catalog or market price exemption, analysis begins with the catalog or market

price. Because the existence of a catalog or market price does not mean a price is fair and reasonable, you must analyze the price in light of quantity, character of the catalog sales (retail or wholesale), variations in terms, and other market information.

Relative emphasis

When cost or pricing data are required, you will conduct both price analysis and cost analysis. The basic question becomes how much reliance to place on each. The answer usually depends on the facts of the situation. The reasons for not using competitive procedures range from urgency to lack of interest on the part of suppliers to the case of the truly sole source. In any given procurement, the analysis may be mostly price-oriented, mostly cost-oriented, or evenly mixed. However, there are some general guidelines.

When to Rely on Price Analysis

The key is that the end result should be a decision that the *price* paid is fair and reasonable. Therefore, when price information is available and especially when a fixed-price contract is likely, price analysis should be the principal method. Cost analysis would be a secondary tool rarely used, except perhaps to check on pricing practices. Even in cost-reimbursement contracts, you should look at price information concerning materials, labor, and subcontracts to see if the seller is using sound purchasing practices and doing a good job of pricing.

When to Rely on Cost Analysis

Cost analysis is a primary tool for pricing large dollar noncompetitive awards for the acquisition of new or unique products or services using cost-reimbursement contracts. (*Noncompetitive* refers to the absence of *effective price competition.*)

In cost-reimbursement contracting, you agree to pay the actual costs of contract performance. This means you accept the risk of poor performance and even failure. *Price* is largely a meaningless word, at least until the contract is finished, long after price analysis might have been useful. Cost analysis is the primary tool, although prices of material, subcontracts, and labor are integral parts of the costs estimated for those elements and price-related techniques can be used to evaluate those cost elements. Whenever possible, compare estimated costs with actual costs incurred on similar projects.

In the purchase of a new, unique product, significant market data rarely exist and there is little help from prices paid for functionally similar items, even when you are able to identify such products. In this circumstance, the focus shifts to the cost of contract performance as the standard against which to measure the seller's offer. Cost or pricing data (the estimating assumptions and the rationale for the quantities and prices of material, labor, and tooling) are used to analyze the estimated costs supporting the offer. Cost analysis dominates, but price analysis still is needed.

Summary

Price analysis is appropriate in every procurement. Even in sole-source procurements, somewhat similar products or services may have been marketed; price information for those products or services can be used for comparison.

Table 17-1 illustrates the extent to which price analysis should be used in various noncompetitive situations.

TABLE 17-1. EXTENT OF PRICE ANALYSIS IN NONCOMPETITIVE SITUATIONS

APPLICABLE CIRCUMSTANCES	SCOPE OF PRICE ANALYSIS
Exemption from submission of cost or pricing data	Broad analysis using historical data, catalog or market data, and other information
Urgent requirement Lack of competitor interest Shortage of supply	Broad analysis using data available
Inability to establish risk of performance	Analysis of subelements (e.g., purchased parts, components), using external data available
Sole source	Analysis of subelements as part of cost analysis and Analysis of similar products, even though not suitable for need

17.4 Price Analysis in 8(a) Program Procurements

Section 8(a) of the Small Business Act, as amended, provides authority for Federal agencies to award contracts on a noncompetitive basis for performance by companies owned and controlled by socially and economically disadvantaged individuals. An agency technically awards a contract to the Small Business Administration (SBA) which, in turn, subcontracts the entire effort to the eligible firm. As a practical matter, the acquiring agency deals primarily with the 8(a) "subcontractor."

It would seem that the extent of price analysis in 8(a) contracting would be the same as for any noncompetitive procurement. However, because of the unique nature of the program, analysis is somewhat more complex.

An 8(a) firm is, by definition, one that needs help in order to become a going concern. The firm often faces obstacles that affect analysis of its proposed price. Most 8(a) firms have bare-bones cost accounting systems that may not collect detailed cost or pricing data. For this reason, price analysis assumes a more important role than it otherwise might. This role is underscored by the fact that most 8(a) contracts are for goods and services usually purchased in highly competitive markets through sealed bidding (e.g., support services and construction).

At the same time, price analysis by itself is not sufficient. Many 8(a) firms are relatively inexperienced and not as efficient as older, better established businesses. In fact, when an 8(a) firm becomes *viable*, it is removed from the program.

The scope of price analysis in 8(a) contracting should approximate that for other procurements where competition is limited. Available data normally includes historical prices and bids and offers received on similar jobs past and present. The initial determination of a fair and reasonable price through price analysis is an indicator of the *fair market price* that should be offered by the 8(a) firm and paid by the Government.

You also may analyze cost issues affecting 8(a) performance. Although agencies are not permitted to pay 8(a) firms more than the fair market price, there are *business development funds* available to cover costs exceeding that price. Without the benefit of analysis, an 8(a) firm may not know enough about pricing its work to recognize it is underpriced. The firm may accept a contract price that would be profitable to a larger, more experienced company but extremely restrictive given the 8(a) firm's size and experience. A combination of cost analysis and price analysis can justify the

need for business development funds and thereby to pay more than the fair market price. Failure to do this may have worse consequences for the Government than would an overpriced contract.

Cost analysis may identify the causes of differences between the prices of 8(a) firms and those of other firms. If you can't identify or justify such differences, look to the 8(a) contractor for additional information. You also might ask SBA to give the 8(a) firm pricing assistance and to consult with it on accounting, purchasing, work planning, and other functions.

CHAPTER 18

USING PRICE ANALYSIS IN NEGOTIATIONS

CONTENTS

In sealed bidding, price analysis leads to award or, if no bids are found to be reasonable, to cancellation of the procurement. There are no discussions between buyer and sellers prior to award; the bids must speak for themselves without clarification or modification.

With competitive proposals, you usually will conduct written or oral discussions with all offerors whose proposals are within the competitive range. (Written or oral discussions and competitive range are discussed in Section 8.2.) You also will negotiate (bargain) with one or more offerors to reach agreement on price and other contract terms before awarding the contract. Similarly, when you must use noncompetitive procedures, you also will bargain to reach agreement on contract terms, including price.

When you use either competitive proposals or noncompetitive procedures, you will use the findings from analysis, either price or both price and cost analyses, when you enter into negotiations. How good a job you do negotiating will depend in large measure on how much you have learned about the product or service through analysis and how you use that knowledge in shaping your negotiation objective.

This chapter addresses the development of the price objective that will form the basis for your negotiation strategy. It discusses how various factors can influence your plans. It discusses how a prenegotiation review can test the objectives. As the person responsible for price analysis and the person who will take the lead in price negotiations, you play a key role in formulating the price objective and overall negotiation strategy.

18.1 Establishing Price Objectives

Negotiation is the process of reaching agreement on one or several issues. Price analysis, which aims to identify a fair and reasonable price, is sound preparation for negotiation. It can give you:

1. Thorough understanding of the requirement.

2. Knowledge of market forces that affect the procurement.

3. Awareness of the strengths and weaknesses of your position.

4. A grasp of the offeror's pricing policies and market position and a good guess as to the offeror's negotiation objectives.

5. Ability to make a good case for your position.

6. Knowledge of which issues are negotiable.

Negotiation is communication with a purpose. Both you and the offeror want to reach agreement, but probably on different terms and different price levels. You want the best deal for the Government, but you must state this objective in much greater specificity. The price objective should represent what you believe to be possible through negotiation, a goal that you can achieve. In addition, the objective should encompass a range of reasonable prices.

Establishing formal objectives helps make sure you don't miss anything significant in negotiation. In the more complex procurements, many factors may affect quality and price. If you don't follow a systematic procedure in preparing for negotiation, you may overlook important issues.

Factors affecting price objectives

Price, quality, quantity, and terms and conditions are interrelated but you will consider each factor separately before establishing your price objective. Specific factors related directly to pricing and the price objectives of each party are shown in Table 18-1.

TABLE 18-1. THE EFFECT OF KEY FACTORS ON A PRICE OBJECTIVE

FACTOR	EFFECT ON PRICE OBJECTIVE
Past and projected volume of sales; past and present dollar amount of purchases	Larger volume or amount usually means lower prices. Potential loss of income puts pressure on the offeror. Lower volume or amount might mean higher prices. In either case, consider total volume or added dollars, not just your order.
Current market conditions	A seller's market with high demand weakens your position. Similarly, an inflationary market indicates higher prices. Excess capacity can create a buyer's market and strengthen your position.
Extent of competition	Market forces tend to drive prices down when competition is strong. If competition slacks but demand stays strong, balance shifts to seller. Your expectations for lower prices are weaker.
Desire for Government business	An offeror eager for work can be expected to propose attractive prices. The relationship between idle capacity and fixed costs should indicate the offeror's need for business. Similarly, an offeror's interest may lag when it operates at capacity.
Inventory	An offeror with excess inventory is likely to propose attractive prices to reduce inventory carrying costs.
Differences between Government and other customers	Prices should tend to be lower because of assured and prompt payment, centralization, and volume of purchases.
Most favored customer determination	If terms and circumstances of a Government purchase are equivalent to a firm's pricing arrangement with its most favored customers, the prices also should be equivalent.
Special concessions, terms, and conditions	If the Government demands extra rights or concessions from the offeror, prices will tend to be higher. Government concessions should be reflected by lower prices.
Financing	Banks may give special concessions to firms holding Government contracts. These concessions may reduce the cost of doing business.
Type of product	A mass-produced commercial product should be priced lower than a product unique to the Government. Studies indicate that the Government pays more when buying to its own specifications.
Price adjustment provisions	An offeror should accept lower prices when contract provisions reduce risk.
Urgency of purchase	Purchases requiring additional effort because of short delivery normally command higher prices.

Approach

To establish a price objective, review the procurement situation, take another look at the proposals, inspect the products offered or services proposed, and validate the purchase request requirements. Next, consolidate and validate the findings from price analysis, evaluate the data and each price, and establish your objective, the range of prices you are willing to pay. You can do all this by yourself or with the help of specialists.

Most of the time you will have a range of prices, any of which might be acceptable, rather than a single objective. Because of imperfect knowledge, you probably will make assumptions as to specific facts, physical differences in products and the effect these have on price, for instance. If an assumption proves to be sound, one price might be okay. If the facts don't support that assumption, a different price would be indicated. That is why a range of prices is preferred over a single point price as a negotiation objective. Part of negotiation is spent in establishing the facts that support a price you want to pay. A difference in facts should lead you to a different conclusion as to price. A range recognizes the possibility of justifiable shifts up and down during negotiation. It is good business to understand that you may, with good reason, move away from your preferred price and still end up with one that is fair and reasonable.

After establishing the range, compare it with the offer or offers to identify significant differences. You may want to speculate about the firmness of the offers, to anticipate responses to your facts and counteroffers, and to estimate the likelihood of a take it or leave it response or a compromise offer.

18.2 Prenegotiation Review

Prenegotiation reviews may be face-to-face meetings or they may be reviews of written memoranda called business clearances, prenegotiation briefing memorandums, or some other name, depending on organizational preferences. In any event, prenegotiation reviews will be carried out in accordance with departmental or local requirements and procedures.

If a face-to-face meeting, you should expect to meet formally or informally with your supervisor and, sometimes, with higher levels of management before negotiating with the offeror. Usually you will describe the requirement, any special features of the solicitation, the offer or offers, what you found in analysis, what you hope to negotiate, and what you think your chances are.

The value of a prenegotiation review varies with your experience and need and the significance of the procurement. At the very least, the review enhances communication within your organization and provides a check on the soundness of your price objectives. It also lets you get any policy guidance you need.

In preparing for negotiation, one tends to focus on the detail and the narrow issues of the procurement. Prenegotiation review forces a fresh look at the situation. It is an opportunity to spot gaps and weak points and explore different approaches. In addition, management review before you reach agreement with the offeror reduces the chances of significant problems in getting the contract approved later.

Prenegotiation review should occur as soon as possible after other preparations have been completed. That way, needed changes can be made without delaying the procurement. The review may be a short, informal conference with your boss for a small-dollar, relatively simple procurement. For major buys, a formal oral or written presentation to a group of top procurement managers may be required. Your purpose always will be to give management the broad plan so as to preserve the flexibility you will need in negotiations. The review should examine the range of objectives to make sure they cover all reasonable expectations of what will come up during the negotiations. In every case, the review should cover the results of your analysis, your price objectives, and the support for those objectives.

Expect to get supervisory review of even the most routine procurements, at least until you and your boss are sure you have the hang of the pricing job. Even after you do, there will be times when you will want your boss to see small procurements with unique or novel factors. In larger procurements and sensitive or complex procurements of interest to Congress and to the public, senior management should be given the chance to critique and comment. Be careful not to box yourself by proposing a range of prices that will leave you very little room to move in the negotiation. Your objectives almost always will be based on assumptions as to what is likely to happen and interpretations of facts, some of which may prove to be wrong when you get into negotiations. Therefore, leave room to move up or down from targets without having to go back for management's approval.

18.3 Using Findings in Negotiation

Perhaps the most important lesson to be learned from price analysis is that it is the price, the *bottom line*, that is important. You bargain to reach agreement on the price for the work, even when you used cost or pricing data in analyzing the offer.

Price analysis focuses on value and the realities of the marketplace. In so doing, it prepares you to respond to offerors' assertions and objections. For example, if an offeror alleges that acceptance of your price objective would mean a loss on the contract, you can demonstrate that the offeror will not be competitive without a reduction, no matter what the offeror's costs look like. In so demonstrating,

of course, you cannot disclose the prices of other offerors or tell the offeror a price to meet in order to get the award. Further, you might respond to an offeror's attempt to raise prices 15 percent above the prices paid on the last procurement by noting that the producer price index indicates only a 4-percent increase and that market data show a 10-percent decrease in the cost of raw materials. You might go farther and suggest that the offeror review the advertisements and published catalogs and price lists of other producers, suggesting thereby that the offeror's price is not competitive.

Such approaches remind the offeror that it must be competitive to obtain the award, no matter what its costs are and no matter what profit it would like to realize. The market, more than any auditor or any challenge to the offered price, will help you get a reasonable price.

18.4 Documenting a Price Analysis

A *price analysis report* is a written summary of the analysis for a given procurement. The report is prepared for each procurement to summarize the basis for your conclusion that a price is fair and reasonable. It is included in the official contract file.

The report may be a separate document, particularly if there is to be no negotiation conference, or the findings of the price analysis may be incorporated in the price negotiation memorandum as part of the explanation of the prenegotiation objective and as part of the justification for the price agreed to. There are strong arguments, however, for requiring a written report of price analysis before the negotiation. The discipline of writing the report requires you to sift through the data, reconstruct the process and its events, restate key issues and decisions, and state your conclusions based on these findings. After doing this, you will find yourself in good shape to develop and explain your negotiation objective.

A report shapes the negotiation objective and provides a foundation for the strategy to achieve that objective. A sound analysis and thoughtful summary will prepare you for negotiation in that you:

- Will know the range within which a fair and reasonable price should fall.
- Can support your position with specific and convincing facts.
- Can refute offeror's arguments supporting higher prices.

The report should demonstrate the:

- Information that was considered.
- Weight given to each piece of information and why.
- Logic supporting the determination that an offeror's price is or is not reasonable.
- Soundness of that logic.

The length and detail in a price analysis report depends on the nature of the procurement. Similarly, the specific elements included depend on what it takes to establish reasonableness and what is available.

18.5 Documenting a Negotiation

Once analysis and negotiation have been completed, you must prepare a complete and accurate account of the negotiations. This written account is called the price negotiation memorandum, or PNM.

The PNM tells the story of the negotiation. It is, first, a document that establishes the reasonableness of the agreement you have reached with the company and one of its purposes is to sell your contract to management. Second, it is the permanent record of your decision. It charts the progress from proposal through negotiations and does so in specifics.

The PNM provides a reader who may lack direct knowledge of the contract with clear and concise information about the key issues. It tells:

- What the contractor proposed.
- What analysis revealed.
- What happened in negotiations.
- The basis for deciding that the agreed-to price was fair and reasonable.

A PNM should present a concise summary of all offers received. It should note the exceptions taken by offerors to the requirements of the solicitation. It should detail the offeror's proposal, your going-in position, and the final terms negotiated and should explain all significant differences. The PNM should identify the counteroffers made during the negotiation and explain your response to them. It should include the findings and conclusions from price analysis. The PNM must be clear and support the negotiated price. If the agreed-to price is beyond the range established as a prenegotiation objective, you must explain why.

A well-written PNM provides a clear trail for anyone who wants to find out what happened and how central issues were handled; it can be a great help to anyone who needs to reconstruct the events of a contract action. It also can be of great use in future procurements as a source of valuable pricing information. It can illustrate what analysis was done and how successful those efforts were. It can highlight problems and provide information that may prevent repetition of past mistakes.

CHAPTER 19

SITUATIONS AND DISCUSSIONS

This chapter presents and discusses a number of procurement situations to illustrate pricing problems. It covers specific day-to-day problems. Note that the text following the specific situation is a *discussion* rather than *an answer* because, in many situations, there is no single answer. Normally, each problem requires you to use judgment.

1. *Situation.* Using invitations for bids (IFBs), you receive three responsive bids from responsible contractors. Accordingly, the price is reasonable and you award to the lowest bidder.

Discussion. The fact that three bids were received only confirms that competition is present. To determine that there is adequate price competition, that a price is reasonable, you need to review the bid prices and the circumstances under which the bids were made. A wide spread in the bid prices or bid prices out of line with previous competitive prices or with the independent cost estimate tell you to keep working, you don't have a reasonable price. For example, you may discover that the delivery of a previous order was compressed causing that price to be much higher than current bid prices.

2. *Situation.* You receive one bid in response to an IFB. Because this was a sealed bid procurement and 69 firms were sent or requested copies of the IFB, you can award to the sole bidder without further analysis.

Discussion. It is difficult to conclude that there was adequate price competition with only one response. Sealed bidding may not be the right method for this procurement. When you have doubts about getting adequate price competition, you should use competitive proposal procedures. However, cancellation of the IFB and resolicitation takes added time that you may not have. Therefore, if you can determine through price analysis that the one bid is reasonable, you may make the award.

3. *Situation.* You solicited sealed bids but only received one bid. That bid is high in relation to the last contract award, but you are sure that you can get the offeror to lower the price.

Discussion. This is a sealed bid solicitation and you cannot discuss the bid or bargain with the bidder to get a lower price. If you believe that the bid price is unreasonable and can support that conclusion, your only recourse may be to cancel the solicitation and resolicit for competitive proposals or, if you have reason to believe only the one company is interested, for a sole-source proposal.

4. *Situation.* You have a total small business set-side using sealed bidding procedures. Award will be made to the lowest bidder. Because this is a set-aside, you see no reason to perform a price analysis and validate the reasonableness of bid prices.

Discussion. There is no distinction between total and partial set-asides as far as the need for price analysis and the need for contracting at reasonable prices. In contrast, the fact that a solicitation is restricted to one class of sellers places a greater burden and responsibility on you to assure that the prices are fair and reasonable.

5. *Situation.* You have a competitive procurement with award to be made on the basis of the lowest evaluated price. Four acceptable offers were received. You determine that adequate price competition exists; therefore, there is no need for a price analysis.

Discussion. You already used price analysis in deciding that the price competition was adequate. The things you look at – past prices, other offers, independent estimate, advertised prices – all point toward real competition and a fair and reasonable price.

6. *Situation.* You receive only one offer in response to a competitive RFP. The price is 8 percent higher than the last purchase price nine months ago. Therefore, you may make the award because the price increase was less than the overall rate of inflation for that period.

Discussion. There are several points to consider in this situation. First, what were the conditions of the previous award and how was the reasonableness of that price established? You need to know the adequacy of price competition, the quantities bought, and the other conditions that could affect the prices, e.g., production rate and delivery schedule. Once you have established these facts, and if they do not distort the pricing result, you should then examine the 8 percent price increase. The overall rate of inflation may be a guide; however, if the dollar value is large enough, you should examine the inflation factor in more detail. You need to consider such things as the types of material and labor that make up the item or service. Then compare the rate of inflation for those items to the 8 percent increase for a comparable time period.

7. *Situation.* You receive a single offer of $500 each for a quantity of 100 items. You discover another buyer, three months ago, paid $492 a unit for the same item, after evaluation of competitive offers and for a similar delivery schedule. Therefore, you make the determination that the price is *based on* adequate price competition and make the award.

Discussion. Most of the factors required for the determination that the price is *based on* adequate competition are present. However, one key factor is missing. You should compare the quantities in each situation. For example, the previous buy could have been for a much smaller quantity. If so, you should negotiate a price based on quantity differences.

8. *Situation.* You receive one offer of $115 each for a quantity of 500. You bought 565 of the same item several months ago for a unit price of $115. Because the price is the same, you make the award.

Discussion. In this situation, you have not established the nature of the previous buy. You don't know if the previous buy was competitive, catalog or market price, based on, or sole source. You need to establish the validity of the price on the prior procurement, identify it by contract or purchase order number, and learn the exact time period before you profitably can compare that price with the current quote.

9. *Situation.* You have a solicitation in excess of $100,000 which requires the submission of cost or pricing data, but you think you can support the reasonableness of price through price analysis. Therefore, you do not need to obtain cost or pricing data and analyze the cost estimate supporting the offeror's proposal.

Discussion. You may use price analysis as your principal tool, but if the offeror must submit cost or pricing data, it means the procurement is not exempt from that requirement. You must get the data and analyze the cost proposal submitted with the SF 1411.

The exemption from the requirement to submit cost or pricing data applies only if you determine in writing that the price is based on (a) adequate price competition, (b) established catalog or market prices of commercial items sold in substantial quantities to the general public, or (c) price set by law or regulation. Ordinarily, the offeror will claim exemption in its response to the solicitation and furnish an SF 1412 to support that claim. However, a waiver of the requirement can be granted in accordance with FAR 15.804-3(i).

10. *Situation.* You are the contracting officer and a buyer gives you a proposed contract for signature. You note that the requirement calls for JCN electric typewriter parts at a price of $40,000. You are satisfied with the sole-source justification and review the price analysis report which says: "JCN prices to commercial customers are the same as prices offered to the Government." As the contracting officer, is the price analysis adequate and will you sign the contract?

Discussion. The buyer probably did the price analysis on the basis of a catalog price. However, the documentation does not support the action. From the buyer's personal knowledge, it was probably known that the parts were *sold in substantial quantities to the general public.* This is okay. However, there should at least be a statement to this effect in the price analysis report. Also, there should be a reference to the catalog or price list including date and page number. In addition, the matter of quantities and discounts should be addressed.

11. *Situation.* You have a procurement estimated to cost $185,000. The proposal states that the items are commercial catalog items. The offeror also provides information that indicates about 75 percent of its total business is in commercial sales. Does this sales data support the claim that items are sold to the general public in substantial quantities?

Discussion. The fact that 75 percent of an offeror's sales are to commercial customers doesn't support a catalog price exemption. The offeror must be able to show that each item you are buying is sold to the general public in substantial quantities.

12. *Situation.* You have a purchase request for an item with an estimated price of $215,000. The company uses product line pricing to establish unit prices. The product line price is cost-based, with standard costs assigned to individual parts and to factory operations. As a part is manufactured, its standard cost is added to a total base standard cost of the item. An adjustment factor is added to the base cost to reflect statistical computations of the difference between standard and actual costs for the manufacturing operations within the accounting period. A factor for general business expense and profit is added to the adjusted base cost to produce the final price. The firm sells the total product line in substantial quantities to the general public, but the item you want has been sold only to the Government. Instead of furnishing cost or pricing data, the seller argues that it is meaningless and will demonstrate that its pricing procedure is the same regardless of the eventual user. It shows you product line data that support that contention and demonstrate that the profit margins are reasonable. Are you satisfied?

Discussion. This information will help establish your negotiation objective, but it does not satisfy the regulatory requirements. You are buying an item that must be sold in substantial quantities to the general public or its price must be based on the price of a similar item that is sold in the marketplace in substantial quantities to be exempt from the requirement to submit cost or pricing data. There are several ways to handle this problem if you are convinced you have a good price. One way is to have the company show you that the item is made up of components included in items that are in fact sold in substantial quantities to the general public. If the company can do this, you may be able to base your price on the other catalog prices. Another way is to ask that a waiver be

granted on the basis that the data provided demonstrate convincingly that the price is good. On the other hand, if you are not convinced that the price is good, you must get cost or pricing data and analyze it even though this may be costly to the seller and total plant data may be required to support the add-on factors.

13. *Situation*. You have a purchase request for a catalog item typically sold in small quantities, shipped prepaid, and warranted for one year. You need a large quantity shipped on a Government bill of lading for use at a location too remote to make it economical or feasible to take advantage of the warranty. Can you use the catalog price for this procurement?

Discussion. You should negotiate a price based on the catalog but adjusted to reflect the realities of volume, shipping, and warranty. To make these adjustments you may need cost or pricing data about the specific factors, but you will not need to get a certificate unless the adjustment exceeds $100,000.

14. *Situation*. You have a purchase request for an item that is similar to a catalog item. You need a quantity of commercial devices, but you want them painted a different color. You also need a small flange welded on for mounting on a special piece of equipment, but you don't want a stand that normally is part of the device. The offeror states that the changes you want minus the stand is a "wash" and you can buy the devices for the catalog price. Will you accept the offer?

Discussion. This is a situation where you can use the *based-on* catalog price concept. You will need to negotiate so you develop your objective starting with the catalog price and adjust for the add-ons and deductions. You may or may not agree the adjustments even out.

15. *Situation*. The ABC company submits the lowest evaluated price in response to an IFB and is awarded a firm-fixed-price construction contract for $4 million. Six months later you process a change to the contract. The independent cost estimate totals $143,000 for the change. Because the original contract was competitive and you have an independent cost estimate, you don't have to get cost or pricing data from the ABC company to support its proposed price for the change.

Discussion. Although the award was made by sealed bidding and cost or pricing data were not needed or used, you will get cost or pricing data in this situation because the aggregate cost of the change exceeds $100,000. (FAR 15.804-2(a)(1)(ii).)

16. *Situation*. You send a request for proposals to 10 suppliers. The requirement is for a large quantity of a component for a 25-year old out-of-production system. You only get one response, and checking the files, you learn that the unit price is 15 percent higher than the last price paid four years ago. You also learn that the offeror is not a manufacturer; the component was one of several parts salvaged from a quantity of surplus systems bought two years ago at 10 cents on the dollar. You scratch your head. The offered price can't be fair and reasonable.

Discussion. In order to use price to judge the reasonableness of the offer, what price do you use? Even though it is the most recent recorded purchase of the component, it's four years old. What do you know about how the buyer decided it was okay to buy at that price? Was it competitive? Was it a catalog or market price? Were and are there other products that perform the same function? Could any of these other products be substituted? Does the user absolutely have to have the component?

If you want to use cost to test the reasonableness of the offer, what cost do you use? Is the actual cost to manufacture, assuming you could find out what it was, a valid basis for comparison? What about the cost to the offeror, the price paid to acquire the surplus systems? How would you calculate what part of the system purchase price to ascribe to the component you want to buy?

It is likely that the actual cost to manufacture is irrelevant, given the facts of the case. Assuming you could find someone to make the part, (unlikely because no one other than the salvager responded to your RFP), that supplier's estimate of the cost to manufacture the component today might be relevant. It would represent the cost of an alternative to buying from the dealer and thus a basis for comparison.

If you try to ascribe some portion of the system purchase price to the component, you have reentered the realm of price analysis. You could estimate that the component made up 20 percent of the system and therefore could bear 20 percent of the purchase price. You might add a factor to cover the cost of carrying the component in inventory for two years and something to recognize the risk that if the Government decided to phase out the system, there would be no market for the component.

You undoubtedly would need to negotiate because the odds are great that the offeror's asking price still is higher than you have been able to justify. A situation like this will test your skills and, if there is no alternative to dealing with the offeror, you may have to bring the big boss into the proceedings.

Appendix A

LIST OF ACRONYMS

APPENDIX A

LIST OF ACRONYMS

Terms, titles, and phrases that are shortened to acronyms are spelled in full the first time they appear and are accompanied by their acronyms in parentheses. The following is an alphabetical list of all ASPM acronyms and their meanings.

ACO	Administrative contracting officer
A-E	Architect-Engineer
ASBCA	Armed Services Board of Contract Appeals
B&P	Bid and proposal
BLS	Bureau of Labor Statistics, U.S. Department of Labor
CASB	Cost Accounting Standards Board
CCDR	Contractor cost data reporting system
CDRL	Contract data requirements list
CERs	Cost estimating relationships
CPAF	Cost-plus-award-fee
CPFF	Cost-plus-fixed-fee
CPIF	Cost-plus-incentive-fee
CPPC	Cost-plus-percentage-of-cost
CR	Cost contract
CS	Cost-sharing
CURFI	Computerized least squares curve fit
DCAA	Defense Contract Audit Agency
DCAAM	Defense Contract Audit Agency Manual
DCAS	Defense Contract Administration Services, Defense Logistics Agency
DFARS	DoD FAR Supplement
DoD	Department of Defense
FAR	Federal Acquisition Regulation
FFP	Firm-fixed-price
FIFO	First-in, first-out
FMS	Foreign military sales
FOB	Free on board
FPI	Fixed-price incentive
FPIF	Fixed-price incentive, firm target
FPIS	Fixed-price incentive (successive targets)
FPR	Fixed-price with redetermination
G&A	General and administrative
GAO	General Accounting Office
GNP	Gross national product

IFB	Invitation for bids
IR&D	Independent research and development
L-H	Labor-hour
LIFO	Last-in, first-out
MTBF	Mean time between failures
MTM	Methods time measurement
MTTR	Mean time to repair
N/C	No charge
OSD	Office of the Secretary of Defense
PCO	Procuring (or procurement) contracting officer
PF&D	Personal, fatigue, and delay
P.L.	Public law
PNM	Price negotiation memorandum
PR	Purchase (or procurement) request
R&D	Research and development
RFP	Request for proposals
RFQ	Request for quotations
RTP	Request for technical proposals
TCO	Termination contracting officer
T-M	Time and materials
TMU	Time measurement unit

Appendix B

GLOSSARY

A glossary does not define its terms but, rather, explains or characterizes them within the general context of their use. This glossary is a collection of some of the terms used in this manual, as well as others commonly associated with contract pricing. While it is always instructive (and sometimes necessary) to search the law or regulatory base for the specific meaning and application of terms, there are times when it is helpful to understand their fundamental sense and everyday usage. That is the objective here.

There are dozens of terms that reflect the contract pricing environment, but few of them are subject to precise, unerring definition. Many are terms of art, colored by circumstance and application in different situations. So, while the following explanations and characterizations are sound, the reader is cautioned to remember that this is a glossary, not a dictionary.

APPENDIX B

GLOSSARY

Acquisition planning: The process by which the efforts of all personnel responsible for acquisitions are coordinated and integrated through a comprehensive plan for fulfilling the agency's needs in a timely manner and at a reasonable cost. Includes developing the overall strategy for managing the acquisitions.

Actual cost: A cost sustained in fact, on the basis of costs incurred, as distinguished from projected or estimated costs.

Adequate price competition: A condition that serves as an exemption from the requirement for submission of cost or pricing data. This condition exists when two or more responsible offerors compete independently and submit proposals deemed responsive to a solicitation, and there is no evidence that competition was restricted or that the lowest price is unreasonable.

Adjustment techniques: Procedures performed to support a comparison by establishing comparability between data items. The Government's intention to use such techniques must be disclosed to offerors in the solicitation, and the techniques must be applied uniformly to all offers.

Advance payment: An advance of money made by the Government to a contractor prior to, in anticipation of, and for the purpose of performance under a contract or contracts.

Allocable cost: A cost is allocable if it is assignable or chargeable to one or more cost objectives in accordance with the relative benefits received or other equitable relationships defined or agreed to between contractual parties.

Allowable cost: A cost is allowable if it meets the tests of reasonableness and allocability, is in consonance with standards promulgated by the Cost Accounting Standards Board (if applicable), or otherwise conforms to generally accepted accounting principles, specific limitations or exclusions set forth in FAR Part 31, or agreed-to terms between contractual parties.

Audit: The systematic examination of records and documents and the securing of other evidence by confirmation, physical inspection, or otherwise for one or more of the following purposes: determining the propriety or legality of proposed or consummated transactions; ascertaining whether all transactions have been recorded and are reflected accurately in accounts; determining the existence of recorded assets and inclusiveness of recorded liabilities; determining the accuracy of financial or statistical statements or reports and the fairness of the facts they present; determining the degree of compliance with established policies and procedures relative to financial transactions and business management; and appraising an accounting system and making recommendations concerning it.

Auditor: A professional accountant acting as a principal advisor to contracting officers on contractor accounting and contract audit matters.

Auxiliary techniques: Price analysis techniques that do not on their own establish reasonableness of price but may support conclusions reached through primary or secondary price comparisons or by cost analysis.

"Based on" catalog or market price: Condition that serves as an exemption from the requirement for submission of cost or pricing data. A price may be considered to be *based on* established catalog or

market prices of commercial items sold in substantial quantities to the general public if the item being purchased is sufficiently similar to the commercial item to permit the difference between the prices of the items to be identified and justified without resort to cost analysis.

"Based on" adequate competition: Condition that serves as an exemption from the requirement for submission of cost or pricing data. This condition exists when current competition does not exist but a comparison of the offered price with current or recent prices paid is sufficient to establish price reasonableness. Prices used for comparison must be for the same or similar items bought in comparable quantities under contracts awarded after adequate competition.

Bill of materials: A descriptive and quantitative listing of materials, supplies, parts, and components required to produce a designated complete end-item of material or assembly or subassembly. May also show estimated costs or fixed prices.

Burden: (See *Indirect cost.*)

Change order: A written order signed by the contracting officer directing the contractor to make changes that the Changes clause of the contract authorizes the contracting officer to direct without the consent of the contractor.

Commerciality: One of two conditions that must be met if an item is to qualify for the established catalog or market price exemption from the requirement for submission of cost or pricing data. A commercial item (which may be either supplies or services) is of a class or kind that is (1) regularly used for other than Government purposes, and (2) sold or traded in the course of conducting normal business operations. (The other condition – that the item be *sold in substantial quantities to the general public* – is met when the facts support a reasonable conclusion that the quantities regularly sold to other than affiliates of the seller for end use by other than the Government agencies are sufficient to constitute a real commercial market.)

Commercial pricing: Refers to the process of establishing that an offered price is reasonable by first verifying that the item or service is commercial and then comparing the offered price and proposed terms against the commercial value for the item or service.

Comparability: A condition that exists between an offered price and some other price against which it is compared. This condition is necessary for effective price comparison and exists when all price-related differences have been identified and accounted for so that the prices being compared are based on relatively equal assumptions.

Competition: An environment of varying dimensions relating to buy-sell relationships in which the buyer induces, stimulates, or relies on conditions in the marketplace that cause independent sellers to contend confidently for the award of a contract.

Competitive proposals: A competitive procurement that (1) is initiated by a request for proposals, which sets out the Government's requirements and the criteria for evaluation of offers, (2) contemplates the submission of timely proposals by the maximum number of possible offerors, (3) usually provides discussion with those offerors found to be within the competitive range, and (4) concludes with the award of a contract to the one offeror whose offer is most advantageous to the Government, considering only price and the other factors included in the solicitation.

Competitive range: A range appropriate to the postevaluation, preaward phase of competitive procurements. Determined by the contracting officer on the basis of price, cost, or technical and other salient factors. Unless excepted by circumstances prescribed by regulations, the contracting officer

must conduct written or oral discussions with all responsible offerors who submit proposals within the competitive range.

Constructive change: During contract performance, an oral or written act or omission by the contracting officer or other authorized Government official, which is of such a nature that it is construed to have the same effect as a written change order.

Contingency: A possible future event or condition arising from presently known or unknown causes, the cost outcome of which is indeterminable at a present time.

Contract: A term used to describe a variety of agreements or orders for the procurement of supplies or services. An agreement, enforceable by law, between two or more competent parties, to do or not do something not prohibited by law, for a legal consideration.

Contract modification: Any unilateral or bilateral written alteration in the specification, delivery point, rate of delivery, contract period, price, quantity, or other provision of an existing contract, accomplished in accordance with a contract clause (e.g., change order, notice of termination, supplemental agreement, exercise of a contract option, and so forth).

Contract pricing: A series of actions used to obtain, evaluate, assess, verify, and adjudge cost or pricing information, and to record the steps taken to ascertain that prices agreed to have been found to be fair and reasonable.

Contract pricing proposal cover sheet: The vehicle for submitting to the Government a pricing proposal supported by estimated and incurred costs by contract line item. The Standard Form 1411 (SF 1411) is the cover sheet for the required submission which shall be prepared to satisfy the instructions and formats of FAR Table 15-2.

Contract type: Refers to specific pricing arrangements employed for the performance of work under contract. Specific pricing (or compensation) arrangements, expressed as contract types, include firm-fixed-price, fixed-price incentive, cost-plus-fixed-fee, cost-plus-incentive-fee, and several others. Among special arrangements that use fixed-price or cost-reimbursement pricing provisions are instruments called indefinite delivery contracts, basic ordering agreements, letter contracts, and others.

Contracting officer: Any person who, either by virtue of position or by appointment in accordance with prescribed regulations, is vested with the authority to enter into and administer contracts and make determinations and findings with respect thereto, or with any part of such authority. [In this manual, three contracting officers are identified: procuring (or procurement) contracting officer (PCO), administrative contracting officer (ACO), and termination contracting officer (TCO).]

Contractor financing (order of preference): While exceptions may arise in specific cases, the following order of preference generally should be observed: (1) equity capital, (2) private financing on reasonable terms, (3) customary progress payments, (4) guaranteed loans, (5) unusual progress payments, and (6) advance payments.

Cost accounting: A system of accounting analysis and reporting on costs of producing goods or services, or of operating programs, activities, functions, or organizational units. The system also may embrace memorandum records, cost estimating, determination of cost standards based on engineering data, and comparison of actual and standard costs for the purpose of aiding cost control.

Cost analysis: The review and evaluation of a contractor's cost or pricing data and of the judgmental factors applied in projecting from the data to the estimated costs. The purpose is to form an opinion leading to a position on the degree to which the contractor's proposed costs represent what contract

performance should cost, assuming reasonable economy and efficiency. It includes appropriate verification of cost data, evaluation of specific elements of costs, and projection of these data to determine the effect on price factors like cost necessity, allowances for contingencies, and the basis used for allocation of overhead costs.

Cost estimating: The process of forecasting a future result in terms of cost, based upon information available at the time.

Cost incurred: A cost identified through the use of the accrued method of accounting and reporting, or otherwise actually paid. Cost of direct labor, direct materials, and direct services identified with and necessary for the performance of a contract, and all properly allocated and allowable indirect costs as shown by the books of the contractor.

Cost or pricing data: Data consisting of all facts existing up to the time of agreement on price, which prudent buyers and sellers would reasonably expect to have a significant effect on price negotiations. Being factual, these data are types of information that can be verified. They do not reflect on the accuracy of the contractor's judgment about estimated future costs or projections; they do, however, reflect on the data upon which the contractor based its judgment.

Cost overrun (or underrun): A net change in contractual amount over (under) that contemplated by a contract target price (FPI contract), estimated cost (any cost-reimbursement type contract), or redeterminable price (FPR contract), due to the contractor's actual costs being over (under) target or anticipated contract costs, but not attributable to any other cause of cost growth (e.g., quantity changes, engineering changes, economic changes, or changes in estimates of program project costs).

Cost reimbursement: Refers to a family of pricing arrangements that provide for payment of allowable, allocable, and reasonable costs incurred in the performance of a contract, to the extent that such costs are prescribed or permitted by the contract. In the case of a CPFF arrangement, costs may vary under or over the initially agreed-to estimate, but the fee remains fixed as an expressed dollar amount and is not subject to adjustment by reason of the contractor's cost experience during the life of the contract.

Defective cost or pricing data: Certified cost or pricing data subsequently found to have been inaccurate, incomplete, or noncurrent as of the effective data of the certificate. In this case, the Government is entitled to an adjustment of the negotiated price, including profit or fee, to exclude any significant sum by which price was increased because of the defective data, provided the data were relied upon by the Government.

Direct cost: Any cost that is specifically identified with a particular final cost objective, but not necessarily limited to items that are incorporated in the end product as material or labor.

Discount data: Information submitted by offerors in support of requests for exemption from the requirement for submission of cost or pricing data. This information reveals the extent to which and conditions under which the offeror sells at less than published prices.

Economic price adjustment: An alteration permitted and specified by contract provisions for the upward or downward revision of a stated contract price upon the occurrence of certain contingencies that are defined in the contract.

Escalation: A term traditionally used to indicate an upward or downward movement of price. *Economic price adjustment* is the contemporary term used to express the sense of escalation.

Established catalog price: A price included in a catalog, price list, schedule, or other form that (1) is regularly maintained by a manufacturer or vendor, (2) is published or made available for inspection

by customers, and (3) states prices at which sales are currently or were last made to a significant number of buyers constituting the general public.

Established market price: A current price, established in the usual and ordinary course of trade between buyers and sellers free to bargain, which can be substantiated from sources independent of the manufacturer or vendor, although such pricing data may have to come from the seller.

Fair and reasonable price: A price that is fair to both parties, considering the agreed-upon conditions, promised quality, and timeliness of contract performance. Although generally a fair and reasonable price is a function of the law of supply and demand, there are statutory, regulatory, and judgmental limits on the concept.

Fee: In specified cost-reimbursement pricing arrangements, fee represents an agreed-to amount beyond the initial estimate of costs. In most instances, fee reflects a variety of factors, including risk, and is subject to statutory limitations. Fee may be fixed at the outset of performance, as in a cost-plus-fixed-fee arrangement, or may vary (within a contractually specified minimum-maximum range), as in a cost-plus-incentive-fee arrangement.

Field pricing support: Involves the analysis of contractor pricing proposals by any or all field technical and other specialists, including plant representatives, administrative contracting officers, contract auditors, price analysts, quality assurance personnel, engineers, and legal and small business specialists.

Fixed price: Refers to a family of pricing arrangements whose common discipline is a ceiling beyond which the Government bears no responsibility for payment. In the case of a firm-fixed-price arrangement, the agreed-to price is not subject to any adjustment by reason of the contractor's cost experience in the performance of the contract.

Formal advertising: (See *Sealed bidding.*)

Government estimate: Refers to any estimate of the purchase price for an item or service which has been prepared by or for the Government. As used in this manual, the term refers to the estimate submitted with the purchase request or requisition prepared by program or technical personnel.

Incentive arrangement: A negotiated pricing arrangement that structures a series of relationships designed to motivate and reward the contractor for performance in accordance with the contract specification. In fixed-price incentive arrangements, the structure involves the negotiation of a target cost, target profit, target price, ceiling price, and sharing (or adjustment) formula for costs incurred under or over the target cost. In cost-reimbursement incentive arrangements, the structure involves the negotiation of a target cost, target fee, minimum and maximum fees, and sharing formula; or in the case of award fee arrangements, the payment of a fee (beyond the negotiated base or fixed fee) tied to criteria that are susceptible only to subjective measurement and evaluation.

Incremental funding: The obligation of funds to a contract containing a total price or estimated cost, in periodic installments against prescribed performance goals or objectives.

Index numbers: Ratios, usually expressed as percentages, indicating changes in values, quantities, or prices. Typically, the changes are measured over time, each item being compared with a corresponding figure from some selected base period.

Indirect cost: Any cost not directly identified with a single final cost objective but identified with two or more final cost objectives or with at least one intermediate cost objective. Also referred to as overhead or burden.

Indirect cost pool: A grouping of incurred costs identified with two or more cost objectives but not specifically identified with any final cost objective.

Invitation for bids: The solicitation document used in sealed bidding and in the second step of two-step sealed bidding.

Learning curve: A tool of calculation used primarily to project resource requirements, in terms of direct manufacturing labor hours or the quantity of material (for this purpose, usually referred to as an improvement curve) required for a production run. Used interchangeably with the term *improvement curve*, the concept of a learner's curve was adopted from the observation that individuals who perform repetitive tasks exhibit a rate of improvement due to increased manual dexterity. Learning or improvement curve theories include the following:

- *The Boeing or unit curve theory:* As the total quantity of units produced doubles, the cost per unit decreases by some constant percentage (the rate of learning).
- *The Northrop or cumulative average theory:* As the total quantity of units doubles, the average cost per unit decreases by some constant percentage (the rate of learning).

Letter contract: A written preliminary contractual instrument that authorizes the immediate commencement of activity under its terms and conditions, pending definitization of a fixed-price or cost-reimbursement pricing arrangement for the work to be done. Must specify the maximum liability of the Government and be superseded by a definite contract within a specified time. Not to be used except when a written determination is made that no other type of contract is suitable.

Level of effort: The devotion of talent or capability to a predetermined level of activity, over a stated period of time, on the basis of a fixed-price or cost-reimbursement pricing arrangement. Payment is usually based on effort expended rather than on results achieved.

Market analysis: Refers to the process of analyzing prices and trends in the competitive marketplace for the purpose of comparing product availability and offered prices against market alternatives and establishing the reasonableness of offered prices.

Market data: Any information concerning price, quality, or availability of products in a particular market. Includes information obtained from market surveys, price quotes, newspapers, trade journals, and other sources. Such data are used to establish the reasonableness of an offered price.

Market survey: Refers to attempts to ascertain whether other qualified sources capable of satisfying the Government's requirement exist. This testing of the marketplace may range from written or telephone contact with knowledgeable federal and non-federal experts regarding similar or duplicate requirements, and the results of any market test recently undertaken, to the more formal sources-sought announcements in pertinent publications (e.g., technical/scientific journals or the Commerce Business Daily), or solicitations for information or planning purposes.

Marketplace: The commercial world; the realm of business, trade, and economics; the environment in which buyers and sellers bargain to achieve their separate and mutual ends.

Methods of procurement: The procedures followed to translate requirements into contracts. The Government uses two major methods of procurement: *competitive and other-than-competitive*. Competitive procedures may be sealed bidding or competitive proposals. Other-than-competitive procedures are used in accordance with statutory authorities.

Monopoly: Degree of competition that exists when there is one seller and many buyers of a product that has no close substitutes and when the seller, absent regulation, has considerable control over price.

Monopsony: Degree of competition that exists when there are several sellers and one buyer of interchangeable products, and sellers therefore have little effective control over price.

Most favored customer: As used in this manual, refers to an offeror's best price for an item or service to any class of customers. Reasonableness of price is established by comparing the price and terms offered to the Government against the offeror's most favored customer price.

Negotiation: A bargaining process between two or more parties, each with its own viewpoints and objectives, seeking to reach a mutually satisfactory agreement on, or settlement of, a matter of common concern.

Negotiation objectives: A range of goals, including desired costs or prices, which Government analysis indicates as the limits within which fair and reasonable contract provisions can be negotiated. These objectives should summarize all Government positions and assumptions relevant to price and other factors.

Overhead: (See *Indirect cost.*)

Partial payment: A payment authorized under a contract, made upon completion of the delivery of one or more complete units (or one or more distinct items of service), called for, delivered, and accepted by the Government under the contract. Also a payment made against a termination claim upon prior approval before final settlement of the total termination claim.

Prenegotiation review: Meeting between contracting officer, supervisor, and, sometimes, other Government representatives before negotiating with offerors. Purposes include corroborating price objectives, eliciting management guidance, and obtaining approval to proceed.

Price: A monetary amount given, received, or asked in exchange for property or services, expressed in terms of a single item or unit of measure for such property or services.

Price analysis: The process of examining and evaluating a prospective price using pricing information largely derived from sources other than the offerors. It often is used to complement cost analysis. It may be accomplished by a comparison of submitted quotations, a comparison of quotations with catalog or market prices of the same or similar items, a comparison of price quotations and contract prices with past prices or current quotations for the same or similar items, the use of yardsticks (dollars per pound, for instance), or a comparison of proposed prices with independently developed Government estimates.

Price analysis report: Written summary of the price analysis conducted for a given procurement. The report demonstrates the scope of analysis, describes techniques, presents data sources, and demonstrates the logic supporting the determination that an offer is or is not fair and reasonable.

Price comparison: The foundation for all price analysis techniques. Refers to the process of comparing an offered price against other prices to assess the reasonableness of the offered price. The other prices may be previous or current offers, previous or current prices actually paid, market prices, or Government estimates. An integral part of this process involves establishing comparability between the offered price and any price against which it is compared.

Price negotiation memorandum: The document that tells the story of the negotiation. It is a sales document that establishes the reasonableness of the agreement reached with the successful offeror. It

also is the permanent record of the decisions the negotiator made in establishing that the price was fair and reasonable. Called the PNM.

Pricing: The process of establishing the amount or amounts to be received or paid in return for providing goods and performing services.

Pricing arrangement: An agreed-to basis between contractual parties for the payment of amounts for specified performance. Usually expressed in terms of a specific cost-reimbursement or fixed-price type arrangement.

Primary comparison techniques: The most conclusive of the price analysis techniques. Included are two types of techniques: (1) competitive evaluation, in which current offers are compared with each other and (2) published price comparison, in which offerors' prices are evaluated in light of prices established by catalogs, market forces, or law.

Probability: A probability is a number between 0 and 1, inclusive, representing the chance or likelihood that an event will occur. A probability of 0 means that the event is impossible, while a probability of 1 means that the event is certain to occur. A probability may also be stated as a percentage ("... there is a 50 percent chance of this happening") or as an odds ratio ("... there is a 3 to 2 chance of this happening"). The concept of probability assumes two things: an average over a long series of possibilities for an event to occur, and no ordering of events.

Profit: Generally characterized as the basic motive of business enterprise; on occasion referred to as "the wages of risk." In contract pricing, profit represents a projected or known monetary excess realized by a producer or performer after the deduction of cost (both direct and indirect) incurred or to be incurred in the performance of a job, task, or series of the same.

Profit objective: That part of the estimated contract price objective or value that the contracting officer concludes is appropriate for the procurement at hand. Where cost analysis is undertaken, a profit objective should be developed – developed, that is to say, after a thorough review of proposed contract work and all available knowledge regarding an offeror as well as an analysis of the offeror's cost estimate, and a comparison of it with the Government's estimate or projection of cost.

Progress payment: A payment made as work progresses under a contract on the basis of percentage of completion accomplished, or for work performed at a particular stage of completion.

Prospective pricing: A pricing decision made in advance of performance, based on analysis of comparative prices, cost estimates, past costs, or combinations of such considerations.

Public Law 87-653: Generally referred to as the "Truth in Negotiations Act." Created in law, it is the requirement for the submission, either actually or by specific identification in writing, of cost or pricing data and certification of their accuracy, completeness, and currency for the award of any negotiated contract expected to exceed $100,000. Certain exceptions apply that are tied to adequate price competition or other conditions reflecting a competitive marketplace.

Reasonable cost: A cost is reasonable if, in its nature or amount, it does not exceed what would be incurred by an ordinarily prudent person in the conduct of competitive business.

Request for proposals: A solicitation document used in other than sealed bid procurements. When an RFP so states, the Government reserves the right to award a contract based on initial offers received without any written or oral discussion with offerors.

Request for quotations: A solicitation document used in other than sealed bid procurements. An RFQ is a request for information. Quotes submitted in response to it are not offers that the Government may accept without some confirmation or discussion with offerors.

Request for technical proposals: The solicitation document used in the first step of two-step sealed bidding.

Retroactive pricing: A pricing decision made after some or all of the work specified under contract has been completed, based on a review of contractor performance and recorded cost data.

Risk: An assumption of possible monetary loss or gain in light of the job or work to be done. One of the elements to be considered in the negotiation of a fair and reasonable price, as well as in determining the type of contract under which performance will occur.

Sampling: A method of obtaining statistics from a large body of data without resorting to a complete census. Two broad methods of selecting samples are probability sampling (in which sample units are selected according to the law of chance) and nonprobability sampling (in which personal choice, expert judgment, or some other nonprobabilistic rationale is used to select sample units).

Sealed bidding: A method of contracting that uses competitive bids, public opening of bids, and awards. A latter-day version of what used to be known as formal advertising, similar to but not the same as that method. Shares equal billing with competitive proposals.

Secondary comparison techniques: A family of price analysis techniques in which data other than competitive offers – including prior quotations, past prices paid for similar items, independent estimates, and cost estimates – are used as the basis for comparison. Such techniques may be used on their own or in support of primary comparison techniques.

Should cost: A concept that holds that the objective of cost analysis and contract pricing is to price on the basis of what it should cost the offeror to produce, assuming reasonable economy and efficiency of operation; an attempt to minimize the ill effects of cost-based pricing with its tacit acceptance of will-cost as a standard.

Single source: Characterized as one source among others in a competitive marketplace which, for justifiable reason (e.g., immediate or past experience, or current contractual involvement), is found to be most advantageous for the purpose of contract award. (Sometimes used interchangeably with the term *sole source.*)

Small purchase: A procurement action whose aggregate amount does not exceed a prescribed dollar value.

Sole source: Characterized as the one and only source, regardless of the marketplace, possessing a unique and singularly available performance capability for the purpose of contract award. (Sometimes used interchangeably with the term *single source.*)

Standard cost: A cost determined to represent an expected value; a goal or baseline that is used to expedite the costing of transactions, determined from historical experience or contrived from the best information available. Excepting costs attributable to precise and highly predictable operations, actual costs will almost always vary from standard costs because of factors that affect performance, like employee fatigue, unforeseen interruptions, and other delays.

Subsystem: A subset of subassemblies or devices or an individual unit of hardware that constitutes a defined part of a system (e.g., the avionics of an aircraft system, the fire control mechanisms of a ship system, the transmission/receiving elements of an electronic system).

Sunk cost: A cost that is not recoverable and has little or no foreseeable future benefit.

Supplemental agreement: A modification to an existing contract that is accomplished by the mutual action of the parties.

System: A group of subassemblies or devices or individual units of hardware (e.g., subsystems) that collectively meet or serve the total performance requirements of one or more defined functions (e.g., an aircraft system, a ship system, a land vehicle system).

Technical analysis: An evaluation of functions that cause costs to occur. May be done by any one, but usually by engineering and technical personnel. Vitally important to understanding cost projections as they relate to the job to be done. For example: technical analysis can provide an informed and useful opinion about the validity of projections for direct materials and usage factors; about scrap and its relationship to the use of hand, semiautomatic, or automatic operations; about the number and types of workers it takes to do a job; and about differences between the estimated labor mix and planned operations.

Trend analysis: An adjustment technique, sometimes called the assumed change technique, used in pricing leases and other longer term contractual arrangements in order to account for price escalation over time.

Value analysis: A systematic and objective evaluation of the function of a product and its related cost. The analyst evaluates the product characteristics in terms of aesthetics, utility, and demand. As a pricing tool, value analysis provides insight into the inherent worth of a product.

Variable cost: A cost that changes with the rate of production of goods or the performance of services. As distinguished from *fixed* costs (which do not change with the rate of production or performance), there may be *semivariable* costs (neither entirely fixed nor variable) and *variable* costs as defined here.

Visual analysis: The visual inspection of an item or its drawings, from which a general estimate may be made about probable value. In most instances, visual analysis deals with obvious external features.

Weighted guidelines method: A technique the Government uses to ensure consideration of the relative value of appropriate profit factors in establishing a profit objective and conducting negotiations. Also used in documenting and explaining the final pricing agreement reached between buyer and seller.

Will-cost: A conclusion that much contract pricing is based on the submission and evaluation of what an offeror estimates it will cost to do the job in a specified future period. As a concept, it is the opposite of should-cost. Cost or pricing data should be evaluated for their application to a projection of future costs, as well as whether or not these data may be perpetuating past inefficiencies.

Appendix C

LOGIC CHART FOR THE CATALOG OR MARKET PRICE EXEMPTION

ARMED SERVICES PRICING MANUAL (ASPM)
1986

Volume 1
Table 9-2

APPENDIX C

TABLE 9-2. LOGIC CHART FOR THE CATALOG OR MARKET PRICE EXEMPTION

EXEMPTION CRITERIA, QUESTIONS, AND ACTIONS	IF YES, GO TO	IF NO, GO TO
1. Is there an established catalog or market price?		
a. Is there a printed catalog, price list, published price, or other formal document showing prices and discounts?	2	b
b. Is there common knowledge of a marketplace procedure, such as auction, or regulated price?	2	c
c. If there is a formal price listing with optional discounts, do accompanying sales data validate the discount offered?	2	d
d. Can field contract administration personnel (or audit) validate from offeror's records that the price offered is a regular catalog or market price with appropriate discounts?	2	5
2. Is the item or service a commercial item?		
a. Is the item or service identical to that described in the catalog or obtained in the marketplace?	3	b
b. Is the item or service so similar it can be priced by reference to catalog or market?	3	c
c. Can the differences be identified and priced as add-ons or deducts from catalog or market prices by value analysis or from other known prices?	3	d
d. Can the differences be identified and the cost/price difference determined by cost analysis using data submitted by the offeror (and certified if over $100,000)?	3	5
3. Are there sales to the general public?		
a. Is there general knowledge of large public sales of products regularly stocked by dealers or regularly traded in the marketplace?	4	b
b. Does the offeror's data show sales over the appropriate past period as between Government and commercial customers?	4	c
c. Can field contract administration personnel validate from the offeror's records that sales have been made to commercial customers?	4	d
d. Can audit personnel make the validation?	4	5
4. Are there substantial sales to commercial customers who meet the test of the general public?		
a. Are reported sales to commercial customers at least 55% of total sales and those at catalog price at least 75% of this amount?	6	b
b. Are reported sales to commercial customers at least 35% of total sales and those at catalog price at least 55% of this amount and can you determine this is a reasonable commercial market?	6	c
c. Can field contract administration personnel verify from the offeror's records that commercial sales meet the regulation's criteria?	6	d
d. Can audit verify the data?	6	5
5. With no *yes* to these four questions, the proposal does not meet the test for exemption. Get cost or pricing data and, if over $100,000, certification after negotiation		
6. Exempt. Document file. Determine reasonableness of price		

Appendix D

EXPLANATION AND EXAMPLES OF SOME QUANTITATIVE TOOLS OF ANALYSIS

Excerpted from Principles of Contract Pricing, 4th Ed.; School of Systems and Logistics, Air Force Institute of Technology, WPAFB, Ohio.

CHAPTER 2

Cost-Volume-Profit Analysis

Both price and cost analyses involve a comparing of the contractor's proposal with data from previous contracts and other market information. Analysis of this data is enhanced by the ability of the analyst to understand and apply certain fundamental skills of mathematical analysis, including graphic and algebraic trend analysis.

Graphic analysis involves a pictorial evaluation similar to that shown in figures 2-1 and 2-2. Individual points reflect what some dependent variables, such as price, would be for a given value of an independent variable, such as volume. If a trend relationship exists, movement of the dependent variable will be caused by (dependent) changes in the independent variable. In figure 2-1 no such relationship exists. Points appear in a random manner. Normally, however, total cost of a purchase would increase as the volume of items purchased increases as shown in figure 2-2. This knowledge would make us better able to evaluate the proposed cost of a given quantity of the item. For example, using the data in figure 2-2, a contractor proposed cost of $1,500 for a volume of 500 would probably be suspicious. The price would appear inflated.

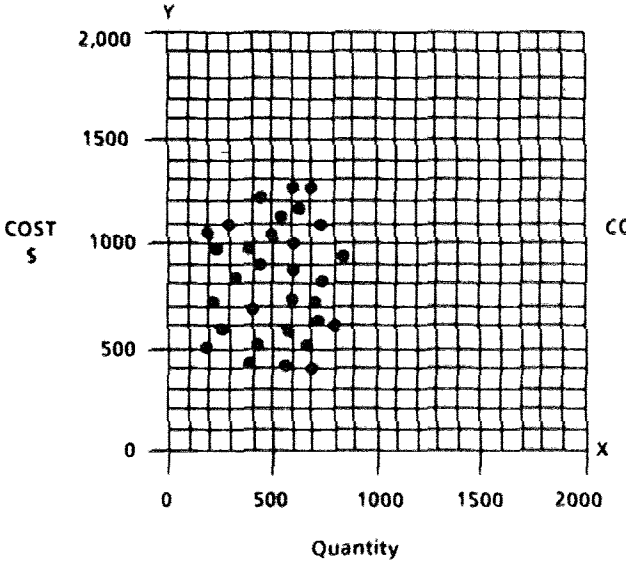


Figure 2-1. Random data.

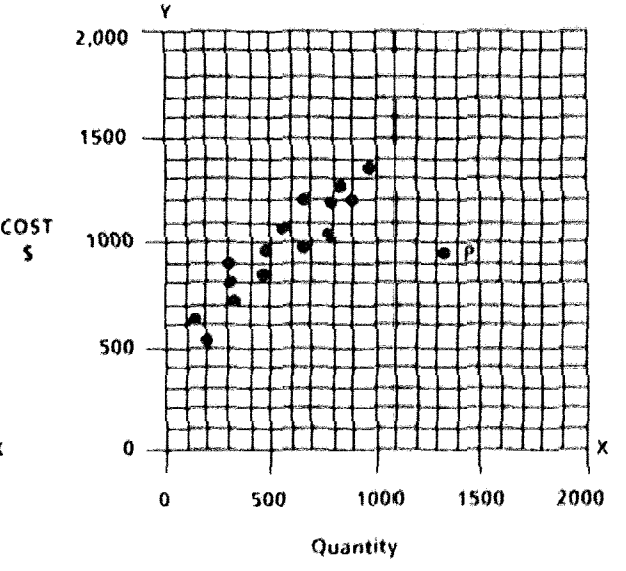


Figure 2-2. Data with a trend.

Algebraic analysis performs a similar function. Algebra may be defined as a method of generalized reasoning about quantitative relationships, using letters to represent unknown numerical values. For example, letters such as X and Y may be used to represent unknown numbers in mathematical expressions. These letters may be added, subtracted, multiplied, or divided just as the values they represent might be. By use of algebra, we are able to write general mathematical expressions that may be used in prediction of a dependent variable.

Thus, while graphic and algebraic analysis may at first appear radically different, both may be used to express a general relationship between independent and dependent variables. Mastering

these techniques will augment the analyst's judgment in determining a fair and reasonable price for a commodity or service. The remainder of this section discusses these techniques.

2-1. Graphic Analysis

024. Summarize the general purposes of graphic analysis, and list the steps in the construction of a graph.

Graphing of pricing data is useful to the analyst for three general purposes:

- A graph may provide sufficient analysis without requiring further computation.

- A graph can be used as the first step of analysis as a visual guide to planning subsequent algebraic computations.

- A graph can be used to depict more in-depth analysis for briefings and other discussions with management and contractor representatives.

Constructing the Graph. Suppose we were given the following information concerning values of a dependent variable for given values of an independent variable. When the independent variable is 12, the dependent variable is 18. When the independent variable is 6, the dependent variable is −12. When the independent variable is −8, the dependent variable is 2. When the independent variable is −18, the dependent variable is −14. This information might be summarized as in table 2-1. How would we graph this data? We would have to construct a graph coordinate system, select a graphing scale, and plot the data.

Table 2-1
Relationship of Independent and Dependent Variables

Independent Variable	Dependent Variable
12	18
6	−12
−8	2
−18	−14

Constructing the Coordinate System. The first step in the construction of a graph to plot these points is to draw two straight lines perpendicular to each other and imagine them to be unbounded in length (fig. 2-3). Each of these lines is called an axis. It is mathematical convention to call the horizontal line the "X" axis and the vertical line the "Y" axis. The arrows indicate the positive directions of this coordinate system, upward and to the right. The point where the axes cross is known as the origin. At this point, the values on both the X and Y axis are zero. As we move to the right of the origin on the X axis, numbers increase in the positive direction. As we move to the left of the X axis, the negative value of the numbers increase, showing movement from the origin in the negative direction. On the Y axis, upward movement from the origin is in the positive direction, and downward movement is in the negative direction.

When graphing this rectangular coordinate system, the X axis is conventionally considered the axis of the independent variable, and the Y axis is conventionally considered the axis of the dependent variable. In other words, an independent variable such as volume will be measured along the X axis, while a dependent variable such as cost would be measured along the Y axis.

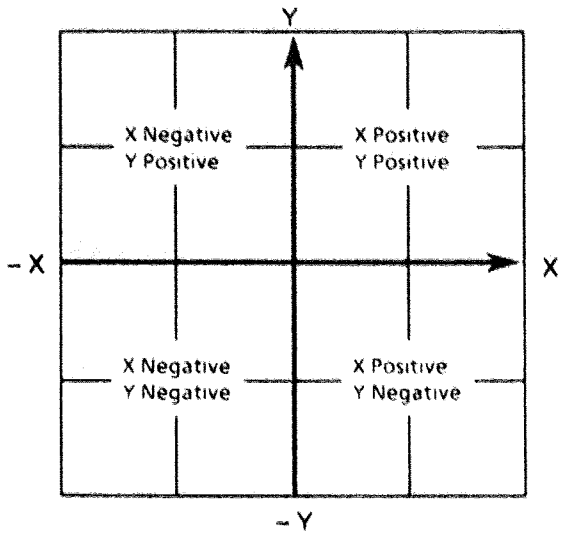


Figure 2-3. Coordinate system.

Selecting a Scale. The next step in graphing data is that of selecting a scale for the X and Y axes to most advantageously display the data. The proper choice of scale requires judgment. In each case, the analyst must determine the factors of importance and relate them to the size of graph paper being used. Some considerations should be:

1. What historical ranges of the independent and dependent variable (X and Y) are of interest?

2. At what values of X will predictions be made; that is, how much space on the graph is required for analyzing future events?

Normally, we want to display data in as large an area as possible so that we may better isolate and project trend relationships. The graph paper shown in figure 2-4 is a square with 40 blocks available in each direction. To determine the largest scale possible, we must find the difference

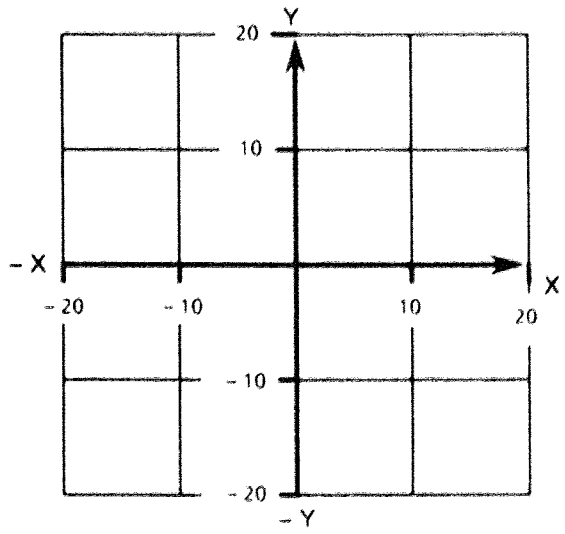


Figure 2-4. Setting scale.

between the largest and smallest values to be graphed and divide that number by spaces available. In table 2-1, X ranges from −18 to +12, so the total difference would be 30. Dividing 30 into 40 (the number of blocks available), we find that each unit of X can be represented by as many as 1.33 blocks on the graph paper. In this case, it may be better to graph using one block for each unit of the variable since one block would give almost the same size display and points would be easier to plot. Plotting points at block intersections is easier and more accurate than estimating points within the blocks. Here it is important to note that we can reduce the number of blocks representing one unit to one, but we could not increase to two blocks. Such an increase would put the largest values of X off the graph. The Y variable ranges from −14 to +18, so the difference would be 32. Dividing 32 into 40, we find that X may be represented by 1.25 blocks on the graph paper. Again, it may be more advantageous to use one block for each unit on the graph for the same reasons. Thus, we may construct the X and Y axis with the scale shown in figure 2-4.

Plotting Points. Once the scale is established, each point (X = 12, Y = 18, for example) may be located on the graph by proceeding along the X (horizontal) axis until the value of X (for example, 12) is located; and proceeding vertically parallel to the Y axis until the corresponding Y value (for example, 18) is located as in figure 2-5. The spot on the graph where the distance parallel to the X axis is 12 and the distance parallel to the Y axis is 18 is the placement location of the point labeled (12, 18) in figure 2-5. This placement procedure may then be repeated for all known data points. The values of each point of table 2-1 were recorded in figure 2-6 next to the point to assist the analyst in rapidly recognizing data without referring to the raw data table. If there are many raw data points, this notation may become impractical. As the expertise of the analyst increases, the need for this recording of data decreases. However, it is beneficial to follow the practice of noting the points on the graph. This notation is always done with the independent value first and the dependent value second in the format (X, Y).

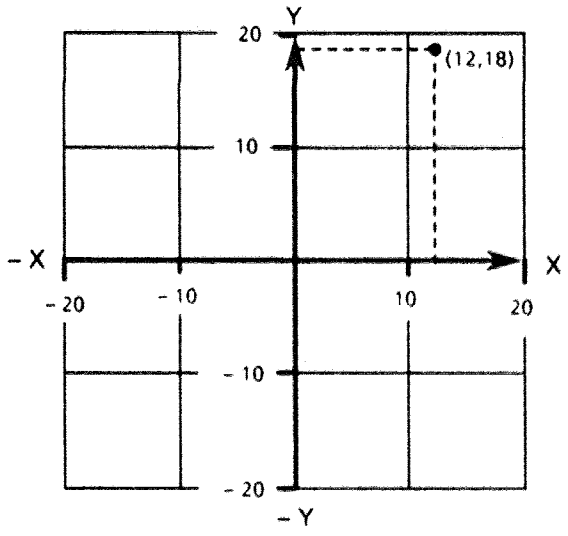


Figure 2-5. Plotting a point.

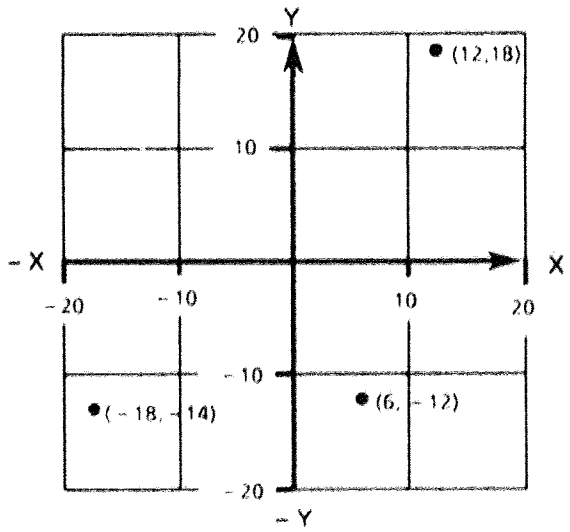


Figure 2-6. Points plotted from table 2-1.

Exercises (024):

1. One of the first steps to be taken in the analysis is to determine if a meaningful trend exists. This determination is greatly enhanced by graphing the data. True or False.

2. According to convention in graphic analysis, the dependent variable is graphed in the

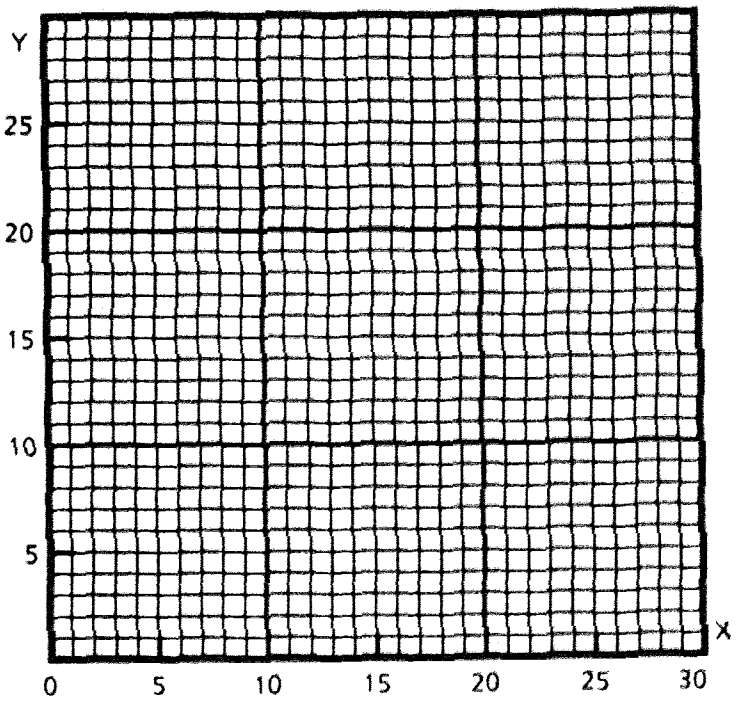
   a. vertical axis.
   b. Y axis.
   c. unknown axis.
   d. X axis.

3. Graphic presentation is often helpful in management presentations to quickly and clearly inform management of the rationale used in supporting a position without laboriously presenting many detailed data considerations. True or False.

4. Plot and label the following points in Graph 1.

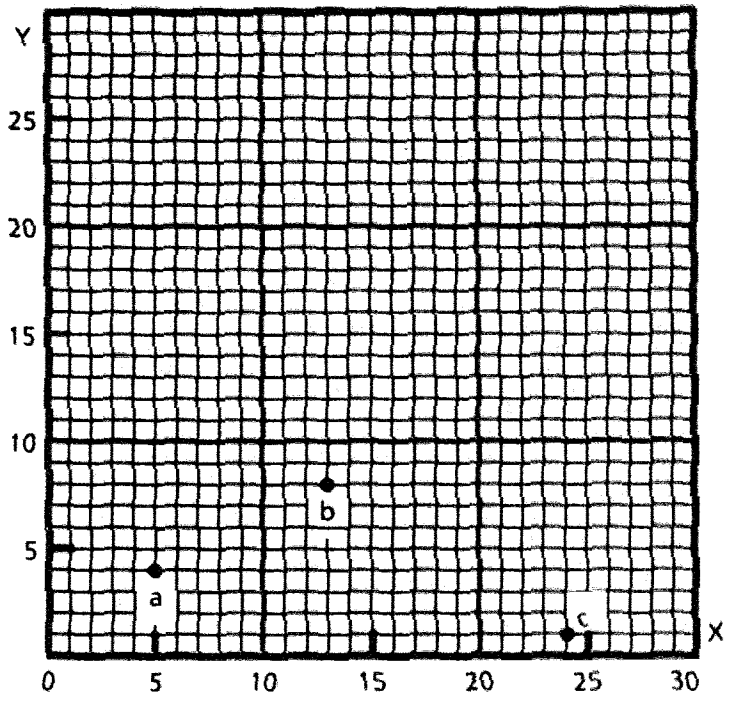
	X	Y
a.	4	4
b.	8	1
c.	1	9
d.	15	1

GRAPH 1



5. Read and record the coordinates from Graph 2 below.

GRAPH 2



X Y

a.
b.
c.

025. Construct a linear graph, calculating the slope, the Y intercept, and the equation of the line.

Straight Line Prediction. We can see that the data in table 2-1 and figure 2-6 is randomly scattered throughout the graph. Such data would be of little use in cost or price analysis. Fortunately, many cost or price analysis situations involve data that results or nearly results in a straight line when plotted on graph paper. The data shown in table 2-2 and figure 2-7 depicts such a straight line relationship.

Table 2-2
Setting up a Coordinate System

X	Y
14	18
8	12
- 2	2
- 16	- 12

Since each point falls on the straight line, it is possible to determine the value of any dependent variable Y for a given value of the independent variable X. If we had historical data such as that given and we were interested in projecting a value of Y for a given value of X, we could do so by simply

reading data from the graph. For example, given the relationship depicted in figure 2-7, what is the value of Y when X is 10? To answer this question, we have redrawn the linear graph developed in figure 2-7 as figure 2-8. To find the value of Y, when the value of X is 10, we simply find the point on the line where X = 10. If a straight line relationship exists between an independent variable and a dependent variable, there will be only one possible value of the dependent variable for any given value of the independent variable.

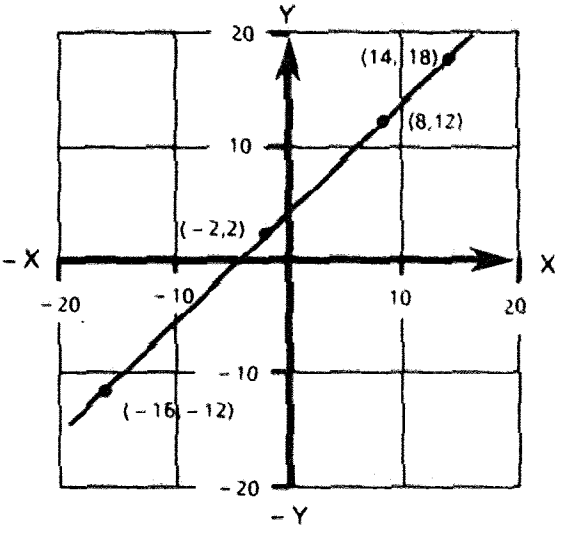


Figure 2-7. Linear graph.

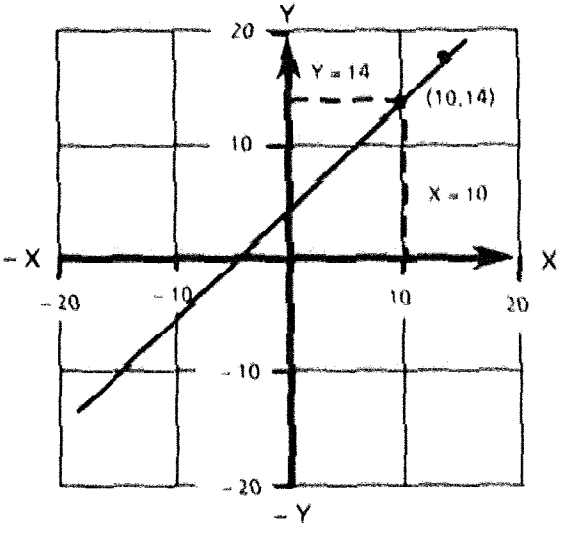


Figure 2-8. Prediction.

Slope. The slope of the line refers to the change in Y for each change in X. It is normally written as a single number representing the fraction:

$$\frac{\text{Change in Y value}}{\text{Change in X value}}$$

In figure 2-8, for each unit change in X, Y changes by an equal amount. For example, as the value of X goes from 5 to 6, the value of Y goes from 9 to 10. As X goes from –1 to –2, Y goes from 3 to 2. Here the slope would be

$$\frac{\text{Change in Y value}}{\text{Change in X value}},$$

which would be

$$\frac{1}{1}$$

or 1. So the slope of this line would be 1. Slopes may have either positive or negative values. The slope is positive when the value of Y increases as the value of X increases. The slope is negative when the value of Y decreases as the value of X increases.

Intercepts. The point where the graph line crosses the Y axis is known as the Y intercept. This is the value for Y when X = 0. In figure 2-8, Y would equal 4 at this point. A similar point exists where the line crosses the X axis, known as the X intercept. This represents the value X would have when Y = 0. In figure 2-8, Y would be zero when X is –4. In straight line analysis, we are particularly interested in the Y intercept.

Redrawing the graph. Most but not all price and cost analysis deals with positive values of X and Y. Such values are plotted exclusively in the upper right quadrant of the standard rectangular coordinate system where both X and Y are positive (see fig. 2-3). In this quadrant, every linear graph has, at least, one intercept (X or Y) and may have both. Every linear graph also has a slope, even though it may be zero. With the intercept and the slope we can easily construct a linear graph as we did in constructing figure 2-8 from figure 2-7.

Suppose we were told that a graph had a Y intercept of 7 and a slope of $\frac{1}{4}$. The Y intercept value would mean that the graph line would cross the Y axis at 7 (see fig. 2-9), the slope would mean that as X changed by one unit, Y would change by

$$\frac{1}{4}\text{ unit}\left(\frac{\text{Change in Y value}}{\text{Change in X value}}\right).$$

A change of 4 in the value of X would result in a change of 1 for the Y value. Since the slope is positive, we can find the value of Y when X = 4 by adding 1 to the Y intercept value of Y, 7, to get 8. The point (4,8) can easily be located on the coordinate system in figure 2-9. By connecting the Y intercept with this point, we can now reconstruct a straight line graph developed from past analysis.

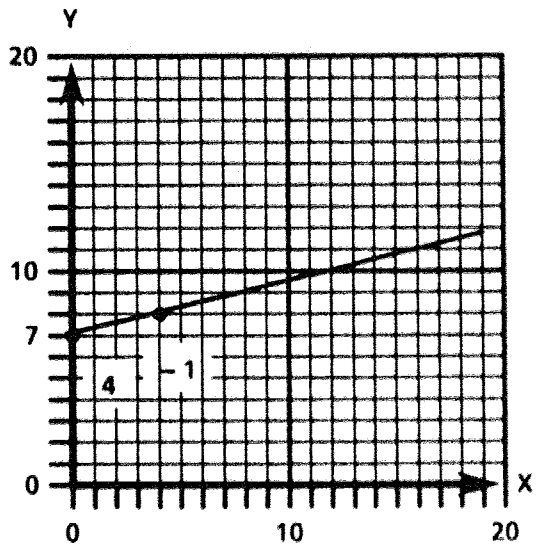


Figure 2-9. Using intercept and slope to construct a graph.

We may now use this line for analysis and prediction. For example, when X is 12, what is the value of Y? From figure 2-10 we can see that when X is 12, Y must be 10.

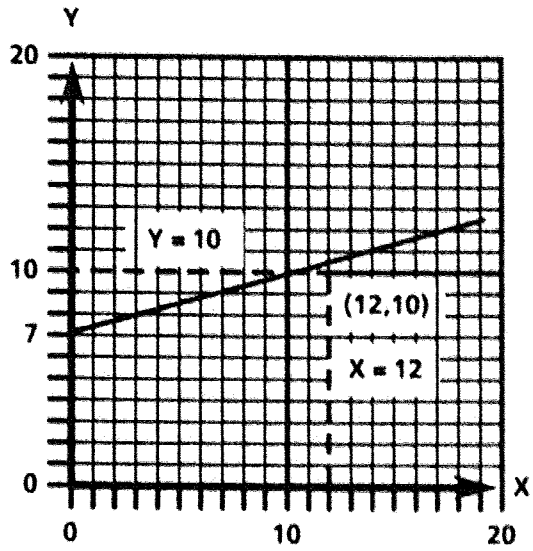


Figure 2-10. Prediction.

Exercises (025):

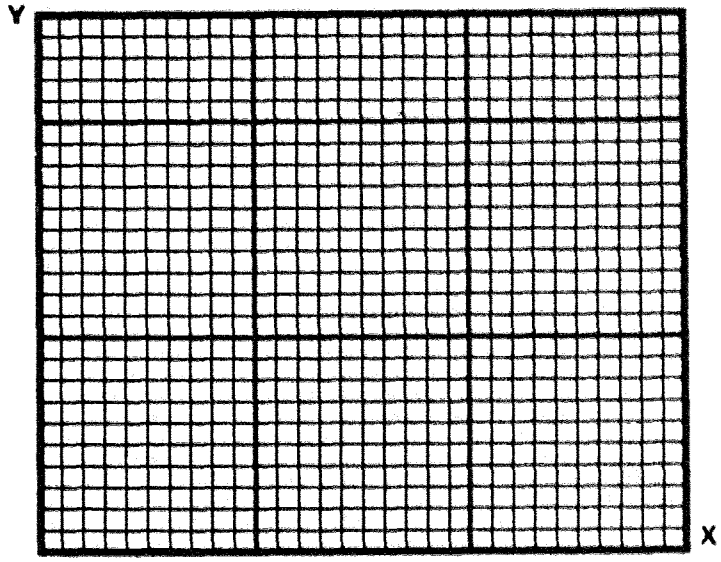
1. Given the equation $Y = 5 + 0.5X$, calculate the values of Y associated with the given X values.

	X	Y
a.	0	
b.	4	
c.	10	

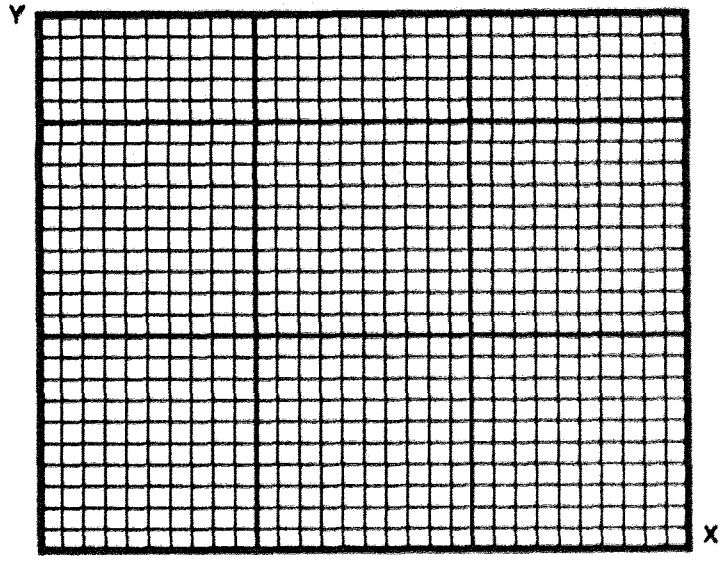
2. Plot the following points on Graph 3a, b, and c. Connect the following points with a straight line. Calculate the slope of the line and label each line with its slope. Determine the Y intercept. Record the equation of the straight line.

	X	Y	X	Y
a.	(10,	10)	(5,	10)
b.	(10,	10)	(2,	6)
c.	(12,	5)	(22,	0)

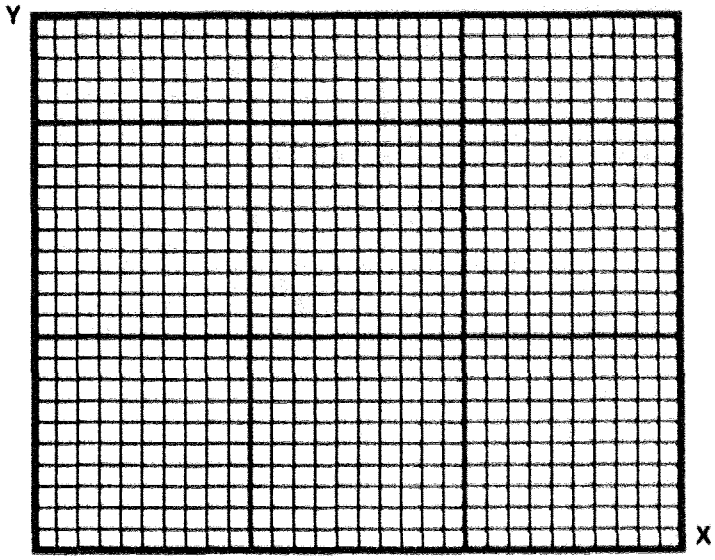
GRAPH 3a



GRAPH 3b



GRAPH 3c



2-2. Algebraic Analysis

026. Define the elements of an equation of a straight line, and apply the formula to find the value of each element.

Now that we have seen the value of graphic analysis, we must consider one of its major limitations. As numbers become larger, it is increasingly more difficult to accurately isolate and project price or cost trends. Thus, while graphic analysis should always be used to determine if a linear relationship exists, specific projections often require algebraic analysis.

Equations. As the name indicates, an equation is an expression of an equality by the use of an equals (=) sign. This may be done with known or unknown values. We could write $2X + 4X = 6X$. Both sides total 6X.. By using the rules of addition, subtraction, multiplication, and division, equations may be manipulated to isolate specific terms in one side of the equation. This manipulation is called "solving the equation." An equation is considered to have been solved for an unknown when the unknown, for example, X or Y, is isolated without coefficients or other terms on one side of the equation with all terms on the other side of the equation in the most simplified format possible. The equation $X = 2Y + 4$ could be considered as having been solved for X. The X value is isolated on one side of the equation, and the terms on the other side are in the most simplified format possible. The equation $2X = 4Y + 6$ has not been solved for X because the X value has not been isolated from the coefficient 2. The equation $Y = 2X + 4X + 8$ has not been solved for Y because the term $2X + 4X + 8$ could be further combined or simplified to $6X + 8$. To isolate a term on one side of an equation, manipulation of terms from one side to the other is necessary. To do this, we must remember that *in manipulation, equality of the two sides of the equation can only be maintained when equal changes are made to both sides of the equation.* For example, if subtraction is required to remove a term from one side of the equation, the exact term must be subtracted from the other side too.

Example 1: Solve the following equation for X:
$X + 3 = 7$

Solution: To isolate the X value, subtract 3 from each side, therefore
Equation: $X+3=7$
Subtract: $X+3-3=7-3$ (Subtract 3 from both sides)
Solution: $X=4$

Example 2: Solve the following equation for Y:
$Y=.20Y+80$

Solution: Gather the Y variable and isolate it on one side of the equation.
Equation: $Y=.20Y+80$
Gather Y: $Y-.20Y=.20Y-.20Y+80$ (Subtract .20Y from both sides)
Subtract: $.80Y=80$

Isolate Y: $\frac{.80Y}{.80}=\frac{80}{.80}$ (Divide both sides by the coefficient of Y which is .80)

Divide for solution: $Y=100$

Example 3: Solve the following equation for X:
$X+4=.5X-6$

Solution: Gather the X variable and isolate it on one side of the equation.
Equation: $X+4=.5X-6$
Gather X: $X-.5X+4=.5X-.5X-6$ (Subtract .5X from both sides)
Subtract: $.5X+4=-6$
Gather other terms: $.5X+4-4=-6-4$ (Subtract 4 from both sides)
Subtract: $.5X=-10$

Isolate X: $\frac{.5X}{.5}=\frac{-10}{.5}$ (Divide both sides by .5, the coefficient of X)

Divide for solution: $X=-20$

Straight Line Equation. Armed with a basic knowledge of algebra, we are now ready to consider the equation (algebraic relationship) of a straight line that will be used throughout the remainder of the course.

The general equation of a straight line is $Y=A+BX$
(1) X is the independent variable.
(2) Y is the dependent variable.
(3) A is a constant representing the Y intercept. (The Y value when $X=0$.)
(4) B is the slope of the line. (Slope represents the change in Y for any change in X.)

The straight line equation can be used to generalize a linear relationship between an independent and dependent variable. Suppose we were given the following data concerning a cost/volume relationship:

Table 2-3
Volume Related to Cost

Volume Produced	Cost
X	Y
10	$ 60
15	$ 85
20	$110

How would we determine if a linear relationship exists, and how would we reduce it to an equation?

Step 1. The first step would be to graph the data to determine if there is a linear relationship. Examination of figure 2-11 indicates that such a relationship exists.

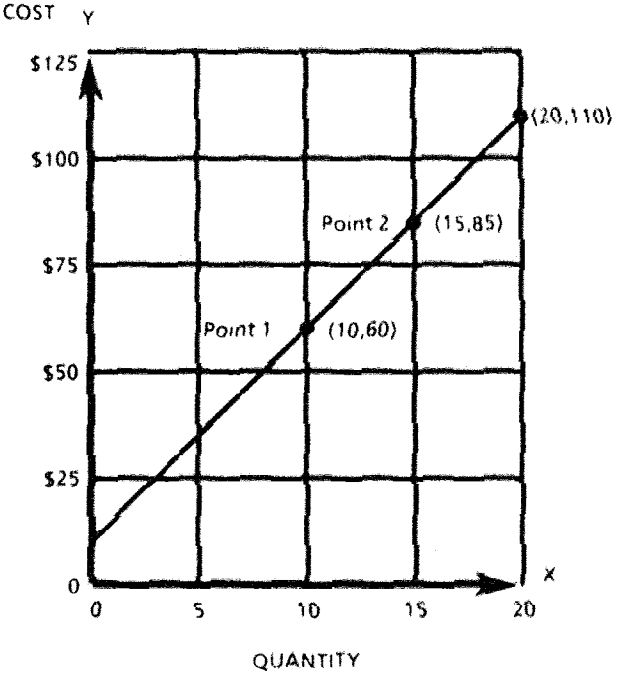


Figure 2-11. Graphing data from table 2-3.

Step 2. Now that we know that data falls on a straight line, we want to develop a specific equation for that line. Remembering that the general equation of a straight line is $Y = A + BX$, we want to be able to predict values of Y given specific values of X. To do this, we need to know the value of A (the value of Y at the Y intercept) and the value of B (the slope of the line). With the information given and the knowledge that it falls on a straight line, we can directly determine the value of B for this equation. since B is

$$\frac{\text{Change in Y value}}{\text{Change in X value}},$$

we can determine the value of B for this equation by dividing the change in Y between any two points by the change in X between these points. A general formula (algebraic relationship) for this may be written:

$$B = \frac{Y_2 - Y_1}{X_2 - X_1}$$

X_1 and Y_1 represent the X and Y coordinates from some Point 1 on the line in figure 2-11.
X_2 and Y_2 represent the X and Y coordinates from some other Point 2 on the line.
In this case let:

$X_1 = 10$
$Y_1 = 60$
$X_2 = 15$
$Y_2 = 85$

$$B = \frac{Y_2 - Y_1}{X_2 - X_1} = \frac{85 - 60}{15 - 10} = \frac{\$25}{5 \text{ units}}$$

$$B = \$5 \text{ per unit}$$

NOTE: If Point 1 and Point 2 were reversed, the results would be exactly the same.

Then:

$X_1 = 15$
$Y_1 = 85$
$X_2 = 10$
$Y_2 = 60$

$$B = \frac{-\$25}{-5}$$

$$\left[\text{Remember } \frac{(-)}{(-)} (+)\right]$$

$$B = \$5 \text{ per unit}$$

The value of B will remain constant no matter what two points on the line are chosen for the calculation. This means that for each unit produced, a cost of $5 must be added to costs.

Step 3. Now that we have found the value of B for the equation, we can find the value of A. The value of A, like the value of B, is constant for all values of X and Y in a specific linear equation. Therefore, if we know the value of B for the equation and the value of X and Y at a specific point, we can find the value of A for the equation by substitution.

	$Y = A + BX$
By manipulation:	$A = Y - BX$
Let (X, Y)	= (10,60) Point 1
	$B = \$5$
By substitution:	$A = \$60 - \$5\,(10)$
	$B = \$60 - \$50$
	$A = \$10$

Once again, any point on the line can be used to obtain identical results.

Let (X, Y) = (15, 85) Point 2
B = \$5
By substitution: A = \$85 + \$5 (15)
A = \$85 – \$75
A = \$10

Step 4. Having found values for A (\$10) and B (\$5 per unit), we can write a specific equation to predict values of Y, given a value of X.

$$Y = \$10 + \$5 (X)$$

Step 5. Using this equation, we can find the value for Y given a value of X. For example, what is the value for Y when X is 18?

Solution: Y = \$10 + \$5 (X)
Y = \$10 + \$5 (18)
Y = \$10 + \$90
Y = \$100

This same procedure may be followed to find the equation of any straight line.

Step 1. Graph the data to insure that the given points fall on a straight line.

Step 2. Find B (slope by using the formula values for X_1, Y_1) and (X_2, Y_2).

$$B = \frac{Y_2 - Y_1}{X_2 - X_1}$$

Step 3. Find A (the Y intercept) by substitution in the formula values for Y, B, and X.

$$A = Y - BX$$

Step 4. Write the specific equation for the line, using the calculated values for A and B.

Step 5. Predict dependent values for given independent values.

Example: Given the following data, determine the equation of a straight line fitting the data.

Table 2-4
Data for Determining the Equation of a Straight Line

X	Y
3	6
8	16
10	20

Solution:

Step 1. Graph points. Figure 2-12 shows that the points fall on a straight line.

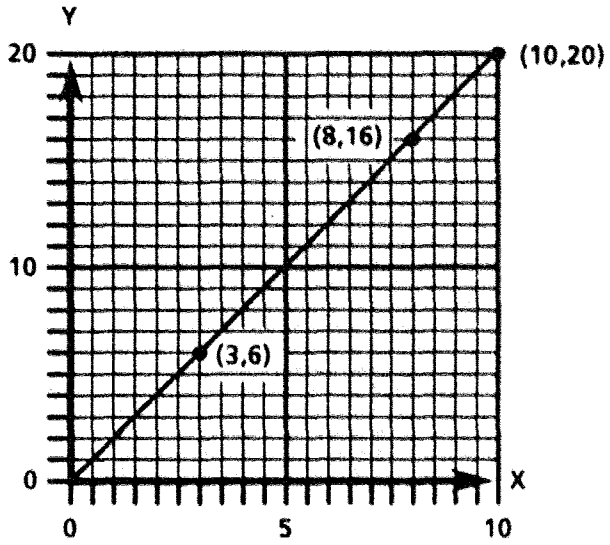


Figure 2-12. Graphing data from table 2-4.

Step 2. Find the slope B.

$$B = \frac{Y_2 - Y_1}{X_2 - X_1}$$

Use the points $(X_1, Y_1) = (3, 6)$ and $(X_2, Y_2) = (8, 16)$

$$B = \frac{16 - 6}{8 - 3}$$

$$B = \frac{10}{5}$$

$$B = 2$$

Step 3. Find the Y intercept A. Use $Y = 6$, $X = 3$, and $B = 2$.

$A = Y - BX$
$A = 6 - 2(3)$
$A = 0$

Step 4. Write the equation.

$Y = A + BX$
$Y = 0 + 2X$ or
$Y = 2X$

Step 5. Predict Y. If $X = 5$, what is Y?

$Y = 2X$
$Y = 2(5)$
$Y = 10$ (when $X = 5$)

Exercises (026):

1. Define the elements of the equation of a straight line if $Y = A + BX$.

   a. Y
   b. A
   c. B
   d. X

2. Solve the following equations for the dependent variable Y:

   a. $4X + 2Y = 14$
   b. $3X + Y - 7 = 0$
   c. $9 - 9X - 3Y = 15$
   d. $4(X + 2Y) = 8$

3. Find the slope and Y intercept for the following equations:

   a. $Y = 2X + 6$
   b. $Y = 4X + 10$
   c. $Y = .5X + 5$

4. What are the equations of the line through each of the following sets of two points?

   a. (2,4) (5,10)
   b. (4,0) (0,6)
   c. (0,0) (5,4)
   d. (3,2) (5,2)

5. Given that a straight line has a slope of 12 and a Y intercept of 3,

   a. what is the equation of the line?
   b. what is the value of Y when $X = 4$?

6. Given the data points (22, 60) and (16, 48), find the value of Y when $X = 8$.

7. Given the data points (15, 24) and 27, 48), find the value of Y when $X = 5$).

3-5. Fitting a Line

036. List the steps in visually fitting a line to a graph of data.

Data points used in price analysis do not usually fall exactly on a straight line. Most of the change in the dependent variable might be explained by a straight line, but there are usually random changes that cannot be explained by the line. The problem is how do you fit a good predictive line to the data to minimize the error.

One method is visually fitting a line to a graph of data. This involves drawing a straight line through the data so that the distance between the data points and the line is minimized. This method may be improved with the knowledge concerning a mathematically calculated line of best fit. Any straight line of best fit must pass through the average of the X values

$(\overline{X})$

and the average of the Y values

$(\overline{Y})$[1].

Visually fitting a line is a three step process.

Step 1. Graph the known data.

Step 2. Find the point representing the average of the X values and the average of the Y values.

Step 3. Draw a line through

$$(\overline{X}, \overline{Y})$$

and the data so that it minimizes the distance between the line and the data points. A clear plastic ruler is useful since it permits you to see all data points at all times.

Example: Given the data in table 3-2, visually sets a line of best fit.

Table 3-2
Data for Fitting Line

X	Y
5	14
7.5	15
8	19
12	21
12.5	25
15	26

Step 1. Plot the data as in figure 3-1.

---

[1]The mathematical method of fitting a straight line to a set of data is known as least squares best fit. While this technique is beyond the scope of this text, values of A and B may be found by solving a set of simultaneous equations.

$$\Sigma Y = NA + B\Sigma X$$
$$\Sigma XY = A\Sigma X + B\Sigma X^2$$

where N = the number of data points
Σ = sum of values

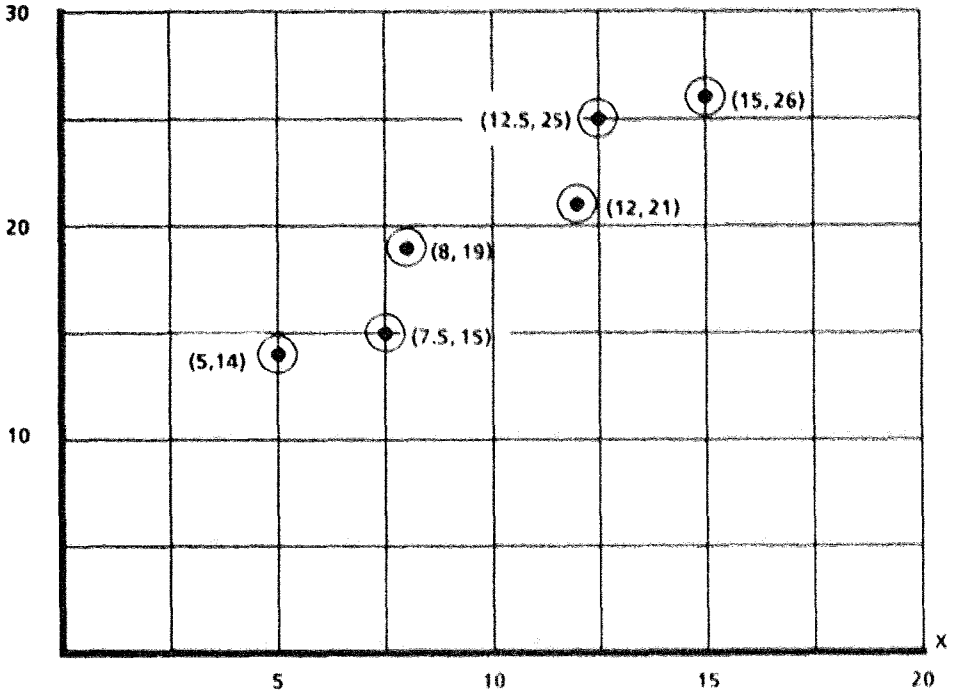


Figure 3-1. Graphing table 3-2 data.

Step 2. Find and plot

$$(\overline{X}, \overline{Y}).$$

$$\overline{X} = \frac{5+7.5+8+12+12.5+15}{6} = 10$$

$$\overline{Y} = \frac{14+15+19+21+25+26}{6} = 20$$

Step 3. Fit a line through

$$(\overline{X}, \overline{Y})$$

as in figure 3-2.

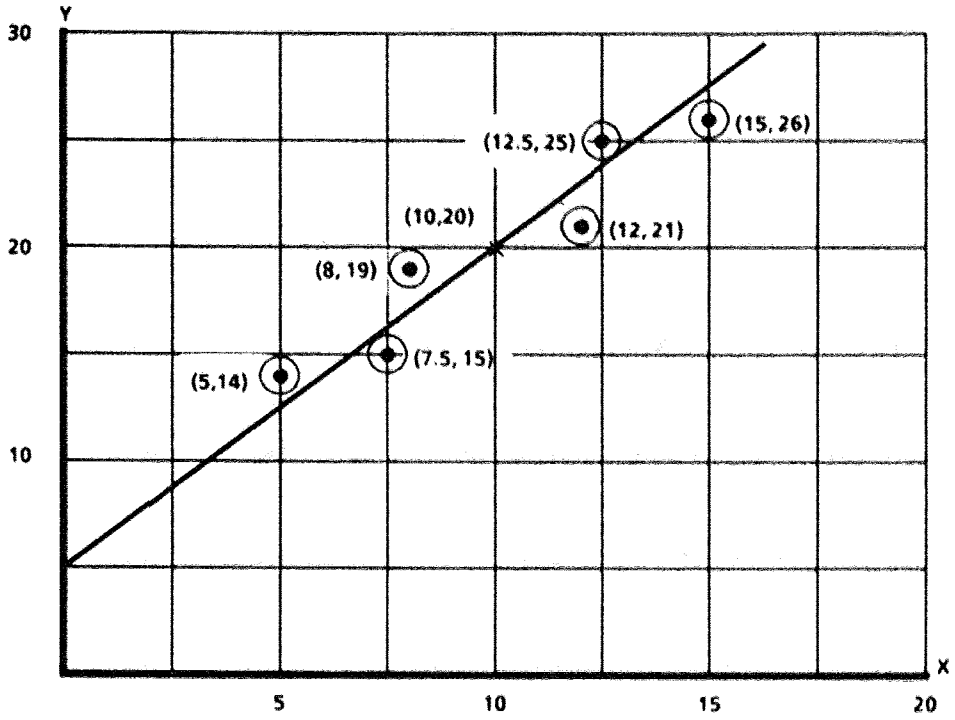


Figure 3-2. Line of best fit.

Predictions could now be made, using figure 3-2, or an equation may be developed, using any two points on the line. In this case, we might use the known

$$(\overline{X}, \overline{Y})$$

of (10, 20) and another value from the line (6, 14).

$$B = \frac{Y_2 - Y_1}{X_2 - X_1}$$

$$B = \frac{20 - 14}{10 - 6} = \frac{6}{4}$$

$$B = 1.5$$

Substitute in the general equation using (10, 20) for A.

$$A = Y - BX$$
$$A = 20 - (1.5)(10)$$
$$A = 5$$

The equation is then $Y = 5 + 1.5X$.

Exercises (036):

1. A line of best fit through a set of data minimizes the distance between the points on a graph and line. What point must a visually fitted line of best fit for the following data go through?

X	Y
100	105
110	120
93	99
120	109
107	107

2. Given the data in the previous question, what would be your prediction of a value for Y at the point X = 115?

3.6 Straight Line Limitations

037. *State the limitations of a straight line in the analysis of cost and pricing* data.

Later in this course, applications of straight line analysis are demonstrated. The straight line is a basic tool for many cost and price analysis situations; however, its application must be tempered by the user's judgment. Some matters that require considerations are comparability of data and confidence of projection.

Comparability of Data. When collecting data for analysis, a major consideration is the comparability of data. Units should be capable of equitable comparison. For example, the dollar has decreased in value over a period of years. Therefore, it is not valid to say that a person earning $5 an hour in 1972 has the same purchasing power as a person who earned $5 an hour in 1962. Data must be comparable for valid analysis.

Confidence of Projection. Any two points determine a straight line. However, in an acquisition situation, the use of only two data points to draw a conclusion can be erroneous, with the actual result much higher or much lower than that projected. The greater the number of data points reflecting a trend, the greater the confidence that can be placed in trend line prediction.

Even with a large number of data points, there is a possibility of error in a trend projection. The data points of figure 3-3 are connected by a solid line; however, on either side of the known data are curved lines. These lines indicate the possible error of an estimate developed, using the line. Near the center of the data, the possibility of error would be small. As we move beyond the known data, the chance of error becomes increasingly larger. The lines can be developed statistically, but such analysis is beyond the scope of this course. However, knowledge of the potential error of projection is important in analysis. You should feel more comfortable predicting the dependent variable costs based on the independent variable quantity between the extremities of the known data. As the independent variable becomes much greater or less than the observed maximum or minimum quantities respectively, the validity of the prediction of dependent variable becomes less reliable.

The straight line (Y = A + BX) is a powerful tool in the analysis of cost and pricing data related to many acquisition situations. However, the "real world" demands that more than a mechanical operation be employed because of factors such as defining the problem, deciding what data to collect, and then analyzing it as the appropriate data pertains to the current situation. Analysis of cost and pricing data can be somewhat ambiguous in nature. The remainder of this text discuses some uses of the straight line, difficulties in its use, and your ability to use the tool effectively. The most

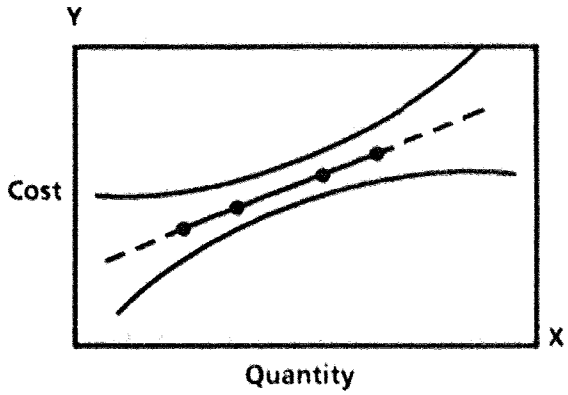


Figure 3-3. Confidence band on prediction for straight line analysis.

important ingredient in any analysis is the analyst, since the analyst is the only person capable of applying thought and judgment to the solution of a complex problem.

Exercise (037):

1. What are two important considerations in the application of straight line analysis to cost and pricing data?

3.7 Comparison Techniques

038. Name the techniques commonly used to facilitate price of cost comparison.

Both price analysis and cost analysis involve comparisons. When competitive prices are being compared, the process is relatively simple. You have bids or offers for the same purchase description during the same period of time under the same conditions. When you compare current prices with past quotes or contract prices or with prices for similar but not identical items, the problem becomes more complex. Quantities, delivery schedules, FOB points, and other factors in the acquisition situation may also complicate the process.

Common techniques used to facilitate price or cost comparison include indexes, cost estimating relationships, and learning curves.

Exercise (038):

1. What techniques are used to facilitate price or cost comparison?

3-8. Index Numbers

039. State the purpose and characteristics of index numbers, and list the steps in the construction of a simple price index.

One of the variables that the analyst must contend with in comparing current quotes with historical cost or price data is the changing value of the dollar over a period of time. Price index numbers provide the analyst with a technique to analyze the effect of the changing value of the dollar on price. Price index numbers indicate historical price changes with respect to time that can be used to analyze, compare, and predict prices for a specific product or service in a different time frame.

There are a number of reasons for using index numbers instead of prices themselves to provide for comparison. One reason is to reduce the comparison to terms of a percentage increase or decrease, thus rendering price changes for high priced items comparable to price changes for low priced items. Another reason is to provide for comparing price changes of aggregates of different items, such as aggregative price changes for apples and oranges or plywood and nails. A third reason is to provide a vehicle for collecting samples of price changes for different items and using the collected samples to represent price changes for an entire population of items.

Purpose of Price Index Numbers. The buyer can use price index numbers for three general purposes: (1) to deflate or inflate prices for comparison analysis; (2) to project price or cost escalation in contractual documents; and (3) to inflate and deflate costs to facilitate trend analysis.

Price index numbers are used in cost or price analysis to compare the proposed cost of an item with the cost of the same or a similar item procured in past years. Here, the index numbers are used to adjust prices for inflation that has occurred over a period of time so the comparison can be made in constant year dollars. Contract price escalation clauses usually call for some kind of after-the-fact pricing action, adjusting the price paid to reflect actual price levels at the time of contract performance. These clauses usually use index numbers to measure changes in price levels. Index numbers are also used to facilitate trend or time series analysis of individual cost elements by eliminating or reducing the effects of inflation so that the analysis can be made in constant dollars.

Characteristics of Index Numbers. Index numbers may be defined as ratios, usually expressed in percentages, indicating changes in values, quantities, or prices. Typically, the changes are measured over time, each period price being compared with the corresponding figure from some selected base period. Simple index numbers deal with single commodities, such as plywood, steel, or grain. More commonly though, index numbers are aggregates of a number of different commodities, products, or services. For such index numbers, each item in the aggregation is weighted to represent a commodity, product, or service in proportion to its amount in a particular end item, industry, or geographical area.

It is important to identify the type of index number you are working with and use that type of index number consistently throughout the analysis. Naturally, when you are in the business of analyzing prices, you will be mostly concerned with price index numbers. However, there are also quantity and value indexes.

Price index numbers represent changes in the prices of items, commodities, or industries over a period of time. An example of a price index is the *Producer Prices and Price Indexes* (Bureau of Labor Statistics) that gives the changes in the average wholesale price of commodities and products sold in the United States over a given period of time.

Quantity index numbers represent the change in the amount of a commodity or product output over a period of time. The Federal Reserve Board compiles a quantity index called the *Index of Industrial Production* that measures physical volume of factory production in the United States from one year to the next.

A value index combines changes in both price and quantity over time. Value indexes may be considered to be the product of a price index and a quantity index. A commonly used value index is the Index of Retail Sales, published in the *Federal Reserve Bulletin*, which reflects the changes in both prices and quantities of items sold by retail sales outlets across the United States.

Price Index Construction. Price index numbers indicate price changes for some specific commodity, product, or service over a period of time. As historical indicators, index numbers become more accurate if they are constructed, using actual prices paid for a particular commodity, product, or

service rather than using the more general aggregative index published by agencies such as the Bureau of Labor Statistics.

Price index numbers are price relatives, usually expressed as percentages. As price relatives, they relate prices paid in one time period to prices paid in some base time period. To provide comparability, a series of index numbers representing some commodity, product, or service is usually constructed using the same base period, thus reflecting a percentage increase or decrease in prices relative to that base period.

Base period. *The selection of a base period is usually an arbitrary process.* With a short series of data, say five to ten years, the analyst often chooses the first (earliest) year as the base year. Under ideal conditions, it is best to choose as a base year one in which prices are not changing erratically. Finding such a year is difficult when hundreds of items are included in an aggregative index number. So, again, you may be led to an arbitrary choice of a base year.

The U.S. Department of Labor's Bureau of Labor Statistics (BLS), a widely recognized constructor and publisher of general index numbers, currently uses a base year of 1967 for most of its index numbers. Prior to that, the base year was 1957. The BLS will probably update its index numbers to a new base year of 1977.

Index data. In constructing price index numbers, it is important to express a price in dollars per measure of quantity (for example, $/#, $/person, or $/feet). You should not express the price in terms of dollars per period, such as is found in accounting data. Accounting data must be edited to dollars per measure of quantity before they can be used in price index number construction.

Simple price index construction. A simple price index involves a single commodity or service over time. There are four steps to be followed in constructing a simple price index.

1. Collect data. For each index period, collect average price data for the product, commodity, or service. *For example, assume the average yearly prices of ¾ inch thick,* 4 feet by 8 feet, grade AC interior, sanded plywood per 1,000 square feet were:

Year	1967	1968	1969	1970	1971
Price	$84.12	$90.84	$95.06	$101.97	$107.32

2. Select base year. Select a base year appropriate for the data available. In this case we will use 1967.

3. Calculate price relative. Calculate a time series price relative for each year by dividing each yearly average price by the base year price.

4. Convert to index. Convert to an index number or percentage by multiplying each price relative by 100. Normally, we round indexes to the nearest tenth.

Year	1967	1968	1969	1970	1971
Index No.	100.00	108.0	113.0	121.2	127.6

Aggregative price index construction. Seldom will a single simple index number suffice for pricing purposes. *Most items purchased are made up of many different rates over a* period of time. Therefore, we must construct composite index numbers that reflect aggregative changes in the prices of the components, assemblies, and types of labor that make up an item. This need has been satisfied by the development of a number of different methods for constructing aggregative indexes. A

discussion of these methods is beyond the scope of this text. However, there are a number of good texts that discuss construction of index numbers if you desire to pursue the subject.

Exercises (039):

1. What is the purpose of price index numbers?

2. What is the definition of price index numbers?

3. How would you construct a simple price index?

040. Select or construct an appropriate index series, adjust for inflation, and compare price levels to determine if the price of a particular product or service is fair and reasonable.

Previously Constructed Price Indexes. Often you will not have enough data or time to construct needed index numbers. Many sources exist for previously constructed price index numbers that are general in scope but may be used to approximate price changes of a particular product or service.

Probably the best known and most frequently used source of price index numbers if the *Producer Prices and Price Indexes* published monthly by the U.S. Department of Labor Statistics (BLS). Economic indicators can also be found in the BLS publication entitled *Monthly Labor Review*, as well as other similar publications.

The producer price indexes are a series of price indexes of specific commodities and products. Each series is successively arranged in homogeneous categories of items and commodities to form a general aggregation of wholesale prices for all U.S. production. Accordingly, you may choose an index that best fits a specific product from the indexes of many different commodities or services and many different levels of aggregation.

Another widely used source of price index numbers is the *Survey of Current Business, National Income Issue*, which is published each July by the U.S. Department of Commerce, Bureau of Economic Analysis. A series of "Gross National Product Implicit Price Deflators" are included in this publication.

A source of data useful for constructing labor price index numbers is the BLS periodical, *Employment and Earnings*, which sets forth average wage rates segregated by skill and geographical categories. These rates are useful in tailoring an index to fit a specific product or company. Another source of wage data useful to the price analyst as an economic indicator is the annual *National Survey of Professional Administrative, Technical and Clerical Pay*, a BLS publication. This survey is useful as a source of data concerning indirect labor pay rate changes.

The *Economic Report of the President*, an annual publication of the executive branch, sets forth extensive summaries of economic indicators. This publication is useful for evaluating long-range trends of data.

These sources are only a sample of the many index number and economic data series available to the buyer. Remember when using them that a general index series must be used carefully since it usually will not exactly fit the cost pattern of the product or service being analyzed. Sources of error include the fact that the data is not from a specific contractor, and it usually represents national or regional averages. Another source of error stems from the fact that the sample of items that make up an index probably will not fit a specific product or contractor effort. Nevertheless, preconstructed

index numbers offer a practical alternative to the costly and time-consuming task of building index number series from basic cost data.

How to Use Index Numbers. Index numbers indicate the percentage change in price with respect to the base year only. The index we constructed in table 3-3 for 1971 of 127.6 indicates that the average price of plywood went up 27.6 percent with respect to 1967. It does not indicate that prices rose 6.4 percent (127.6-121.2) between 1970 and 1971. To calculate the percentage increases in price for 1971 with respect to 1970, you divide the 1970 index into the 1971 index, multiply the dividend by 100, and subtract 100.00. In this case, the price level rose 5.3 percent

$$\left(\frac{127.6}{121.2}\right)$$

between 1970 and 1971.

This information can be used to inflate or deflate prices to allow for general price level changes. Consider the problem of analyzing a contractor's proposed price of $22,500 for a turret lathe to be delivered in 1972. A procurement history file reveals that the same machine tool was purchased in 1969 at a price of $18,500. The task is to determine if the 1972 proposed price is fair and reasonable.

Select index. To determine if the price is fair and reasonable, we would first select or construct an appropriate index series. The Machinery and Equipment Subindex of the Producer Price Industrial Commodities Index (BLS) might be selected as a reasonable indicator of price movement for a turret lathe. We could extract the data from a publication, such as the 1972 issue of the *Economic Report of the President.*

Year	Machinery & Equipment Index
1967	100.0
1968	103.2
1969	106.5
1970	111.4
1971	115.5
1972	120.0

Adjust for inflation. After we have selected an index, we can adjust prices to common dollar value level. In this case, we might adjust the historical 1969 price to the 1972 dollar value level. We alternatively might adjust the current price to the 1969 dollar value level. It really makes no difference as long as we get both prices to comparable dollar value levels. To make the adjustment, we simply find the percentage of dollar value change between the periods and multiply that change by the price in the period. This can be shown in the following information.

$$\frac{\text{Projection Period Index}}{\text{Price Data Period Index}} \times \text{Price Data} = \text{Comparable Projection Period Price}$$

1. To adjust the 1969 price to 1972 dollars, this could be written as follows:

$$\frac{\text{1972 Index}}{\text{1969 Index}} \times \text{1969 Price} = \text{Comparable 1972 Price}$$

$$\frac{120.0}{106.5} \times \$18{,}500 = 1.12676 \times \$18{,}500 = \$20{,}845 = \text{Comparable 1972 Price}$$

2. To adjust the 1972 quoted price to 1969 dollars, we could do the following:

$$\frac{1969\ Index}{1972\ Index} x\ 1972\ Quoted\ Price = \frac{Comparable\ 1969}{Quoted\ Price}$$

$$\frac{106.5}{120.0} x\ \$22,500$$

.8875 x $22,500 = $19,968.75 = Comparable *1969* Quoted Price

Compare price levels. Once the adjustment for inflation is made, we can compare the quoted and historical prices in comparable dollar values. If we want to compare using 1972 dollar values, we must compare the 1969 historical prices adjusted to 1972 price levels with the unadjusted 1972 price quote. The quoted price is $22,500, but the adjusted historical price is only $20,845. The quoted price is $1,655 (7.9 percent) higher than what we would expect it to be, based on the available indexes and the historical price.

If we would have made the comparison at 1969 dollar levels, we would have used the unadjusted historical price and the 1972 quote adjusted to 1969 dollar levels. The price quote would be $19,968.75 in 1969 dollars, and the historical price is $18,500. The quoted price is still 7.9 percent higher than what we would expect. The actual dollar difference, however, is less meaningful than the difference we found in 1972 dollars.

Based on the 7.9 percent difference between the historical price and quoted price, we would probably question the reasonableness of the price quoted. We would probably require more information to assume the price is unreasonable, but this difference would raise a warning flag.

Exercises (040):

1. The Army paid $8,000 for a truck in 19X0. They are currently evaluating 19X1 quotes for this truck. For comparison purposes, adjust the price of the truck to constant 19X1 dollars, using the price index series of 107.4 for 19X0 and 111.9 for 19X1.

2. Given the following index numbers for product Y:

Year	Index
19X2	96.3
19X3	100.0
19X4	109.2
19X5	106.0
19X6	113.6
19X7	111.3

   a. What was the percentage change between 19X2 and 19X3?

   b. If product Y cost $500 in 19X5, what would you estimate its cost to be in 19X7?

3. Using the index numbers in question 2, if product X cost $400 in 19X6, what should it cost in 19X7?

041 Solve problems on the forecasting of index numbers.

Forecasting Index Numbers. Forecasting index numbers may be either a short-range of long-range problem. To this point, the discussions have been centered on index numbers as a measure of history. Both the specially constructed price index numbers or the previously constructed price index numbers indicate changes of price in times past. The business of Government contract pricing is concerned with predicting or forecasting prices in the future. Accordingly, the buyer needs to be able to forecast index numbers as well as construct them from the appropriate literature.

The forecasting problem can be divided into two categories: Short range (up to two years) and long range (two to ten years). Generally speaking, for long-range forecasts, you should use a trend analysis technique to build a model of the historical economic data changeover time. The time-honored practice in Government acquisition to best fit a straight line trend model through the historical data may not always be adequate for long-term projection. Changes in the rate of change of the economy in recent years indicate that the straight line is not always a good general trend indicator. The straight line trend forecast (based on indications from the 1960s) has consistently underestimated the trend of the 1970s. Accordingly, any model for the long-range forecasting must be able to adjust to changing trends. It is also important to obtain as much as possible to examine for trend changes.

For short-range forecasting, however, simple time series models, such as the straight line, are still reasonably accurate. There are at least two ways of using a straight line for forecasting in the short term. It may make good sense in short-range forecasting to put more weight on the most recent years of data. One method does this subjectively by simply ignoring the early years of data, graphically fitting a straight line through the most recent data, such as the last two years, and extending that straight line into future years for the forecast.

On the other hand, the last two years may be atypical. In such a case, it might be more logical to use a trend line including other recent yearly data. The difference in projections can be seen in table 3-4 and figure 3-4.

Table 3-4
Index Forecasting

Year	Index
1971	105.0
1972	107.0
1973	110.0
1974	115.5
1975	119.0
1976	120.0

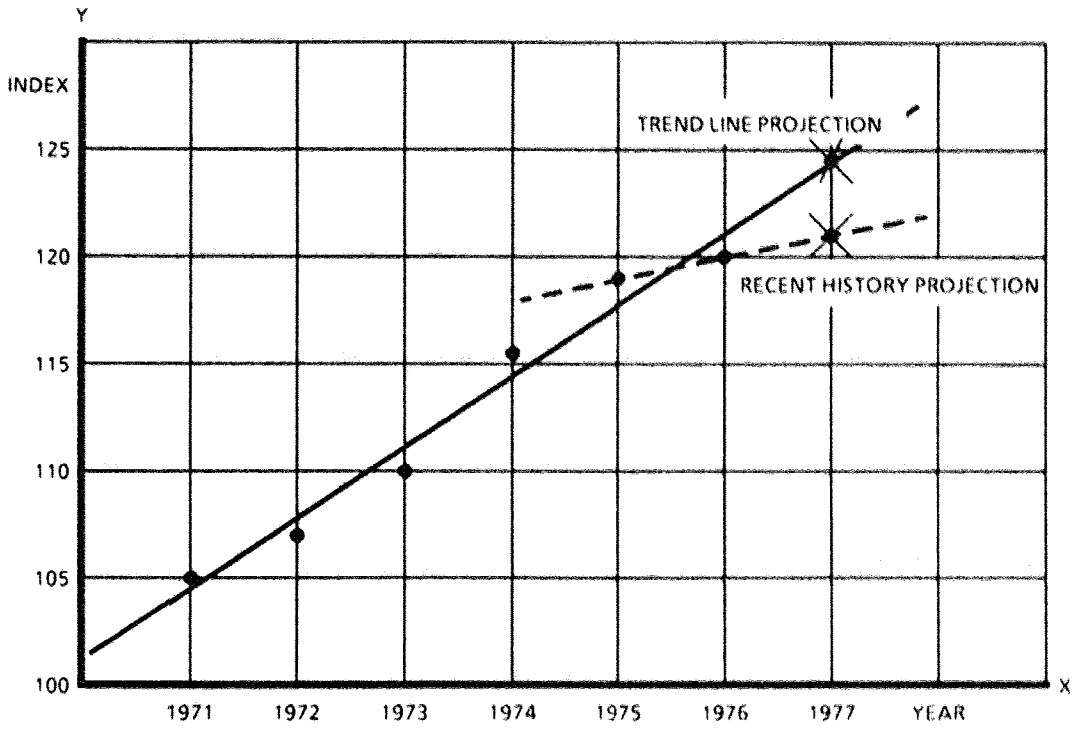


Figure 3-4. Index forecasting.

A trend line through the set of data (solid line) would project an index of 124.4 for 1977. (Remember that the best fit line must go through

$\overline{X}$,

1973.5 and

$\overline{Y}$,

112.75.) Using only the last two years, we would project an index of 121.0. The index we use would be determined by our evaluation of the current economic trend. Has something changed in the economy that would lead us to expect the trend to change? Is the 1976 a continuation of the historical trend? Depending upon this evaluation, the appropriate index might be 121.0, 124.4, or some index in between. The quality of analysis depends on your judgment.

The proper use of the straight line depends on your knowledge of current economic trends. Probably the most important single rule to remember about forecasting is that no one can predict an economic turning point. Get as much data as possible and look for trends and changes in trends. Consider these changes in making projections. Some techniques, such as moving averages and exponential smoothing, may assist you in prediction but are beyond the scope of this text. Information on these techniques may be found in a basic forecasting text.

A few comments are in order here to highlight possible sources of error in our use of indexes. (1) The approach assumes constant quality and quantity; that is, the contracting agency is buying essentially the same item in essentially the same quantities as purchased before. (2) It assumes that the general index is made up of samples of production of many different kinds of machines and equipment produced by different contractors located throughout the country. (3) It assumes that the past will forecast the future. These assumptions might be wrong. Any forecasting technique is subject to error as no one can forecast an economic turning point.

Nevertheless, the index number approach to price analysis gives the buyer another tool for comparison. It can be used to check prices predicted by other methods of analysis. The index number approach can also be used as a basis for price negotiation when the buyer is lacking other substantive price data.

Exercises (041):

1. The wholesale price index for item X, over a six-year period, reads as follows:

Year	*Index*
19X2	101.25
19X3	104.50
19X4	109.25
19X5	114.00
19X6	116.00
19X7	Unknown

   Using a linear trend with all data, estimate the index for 19X7.

2. Using only the most recent data (last two years) on item X from question 1, estimate the index for 19X7.

3. With the data used in questions 1 and 2, which answer provides the best estimate for the index in 19X7?

3.9 Cost Estimating Relationship (CERs)

042. Develop cost estimating relationships (CERs) and use CERs to estimate costs.

A relationship between cost and an item or service characteristic variable can be a valuable tool in assisting a buyer in obtaining a fair and reasonable price. If an independent characteristic (driver) that meaningfully relates to cost or prices can be found, a cost estimating relationship useful in the negotiation process is available. These cost estimating relationships (CERs) may be simple in nature, such as a linear function, or they may be represented by much more complex functions, such as cubic, exponential, and so forth. Here only linear CERs will be considered.

If at any time you make an observation indicating that cost varies in a predictable manner with a physical or performance characteristic, there is a basis to test to see whether or not a CER exists. The characteristic or characteristics selected are usually not the only ones that are driving costs, but the movement of cost has been found to be related to changes in these characteristics. By using models that relate changes in cost to changes in these characteristics, and defining these characteristics in the new item, we can predict the cost of the new item.

How To Develop a CER. Authorities on developing CERs differ on the number of steps required to establish a CER. In general the methodology follows these basic steps:

1. Designate and define the dependent variable (cost dollars, hours, and so forth.)

The buyer or estimator must determine what item he wants to estimate, using a CER, and at what level he wants the estimate. Does he want to estimate cost directly, or dos he want to estimate labor hours and then estimate cost from the hours? Does he want to estimate the cost of the weapon directly or develop an estimate from the estimates of the costs of a variety of components? The better the definition of the dependent variable, the easier it will be to gather comparable data for development of the CER.

2. Select item characteristics to be tested for estimating the dependent variable.

In selecting item performance or physical characteristics to be tested as independent estimating variables, the buyer or estimator should draw on personal experience, the experience of others, and published sources of information. It is especially important for the estimator to consult experts experienced with new technology when he desires to use the CER under development to predict costs of equipment currently beyond the state of the art.

In selecting the independent variable, several factors should be considered.

a. Parameters should be quantitatively measurable. Parameters, such as maintainability, are difficult to use in estimating because they are difficult to measure quantitatively.

b. Data availability is also important. If historical data cannot be obtained, it will be impossible to analyze and use as a predictive tool. Alas, data on the independent variable must be available to use as an estimating tool. For example, an independent variable, such as physical dimensions or parts count, would be of little value during the conceptual phase of a system development when these characteristics are unknown.

c. Performance characteristics generally provide the best independent estimating variables because they are known earlier in development than design characteristics. Design

characteristics that are limiting performance characteristics, such as weight and size, may provide good estimating parameters.

3. Collect data concerning the relationship between the dependent and independent variables.

The collection of data is often the most difficult and time-consuming step in establishing a CER. It is essential that all data be checked and double checked to insure that it is relevant, comparable, and relatively free of unusual costs.

4. Explore the relationship between the dependent and independent variables.

This phase of establishing a CER can involve a variety of analytical techniques from simple graphic analysis to computer analysis. The purpose here is simply to determine the degree of relationship between the independent and dependent variables. A high correlation (relationship) between a potential independent variable and the dependent variable usually indicates that the independent variable will be a good predictive tool.

5. Determine the relationship that best predicts the dependent variable.

After exploring a variety of relationships, we must select the one that best describes the data. In graphing, this would be the independent variable that best predicts the values of the dependent variable. Mathematically, we could determine this by use of least squares best fit.

6. Document your findings.

Documentation of the CER should permit the estimator, buyer, or analyst to trace the steps involved in developing the relationship. This should involve the parameters tested, the data gathered, sources of data, time period of the data, and any adjustments made to the data.

Example of a CER. For example, suppose a contract action relates to purchasing houses. During the analysis of proposed prices for a newly designed house, the historical data for the home purchase cost may be examined. Using this data, we can demonstrate the procedure for developing a CER.

1. Designate and define the dependent variable. In this case we will attempt to directly estimate the cost of a new house.

2. Select item characteristics to be tested for estimating the dependent variable. A variety of home characteristics could be used to estimate cost. These include such characteristics as square feet of living area, exterior wall surface area, number of baths, and others.

3. Collect data concerning the relationship between the dependent and independent variable.

House Model	Unit Cost	Baths	Sq. ft. Living Area	Sq. ft. Exterior Wall Surface
Burger	66,500	2.5	2,800	2,170
Metro	65,000	2.0	2,700	2,250
Suburban	68,000	3.0	2,860	2,190
Executive	60,500	2.0	2,440	1,990
Ambassador	57,000	2.0	1,600	1,400
New Home		2.5	2,600	2,100

4. Explore the relationship between the dependent and independent variables. As stated earlier, analysis of the relationship between the item characteristic and the dependent variable may be done, using a variety of techniques. Here we will use graphical analysis, figure 3-6 through 3-7.

5. Determine the relationship that best predicts the dependent variable. Figure 3-5 graphically depicts the relationship between the number of baths in the house and the price of the house. From the graph there appears to be a relationship between the number of baths and house price. The relationship, however, does not appear to be a good estimating tool, since three houses with a nearly $8,000 price difference (12 percent of the price of the most expensive house) have the same number of baths.

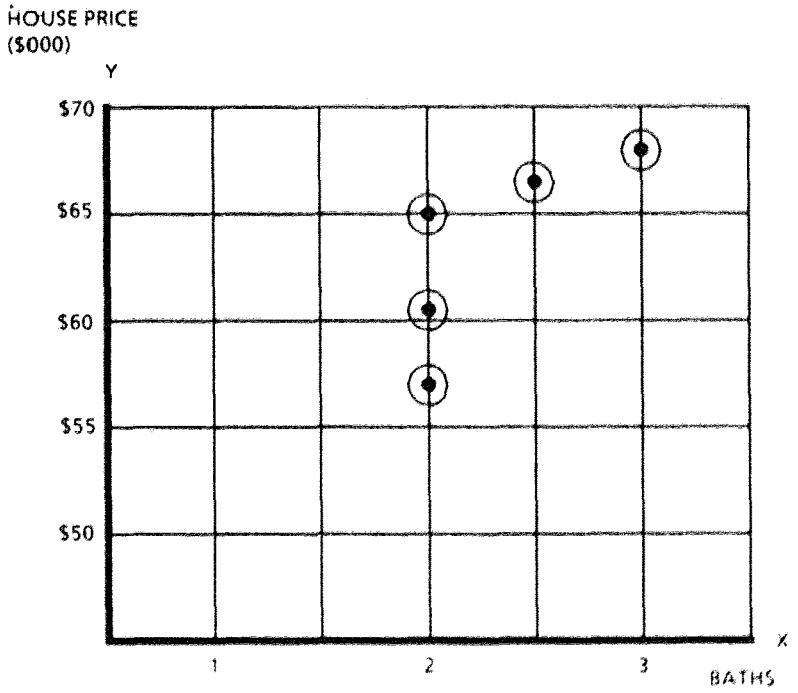


Figure 3-5. Relating price to number of baths.

Figure 3-6 graphically relates square feet of living area to price. In this graph there appears to be a strong linear relationship between house price and living area.

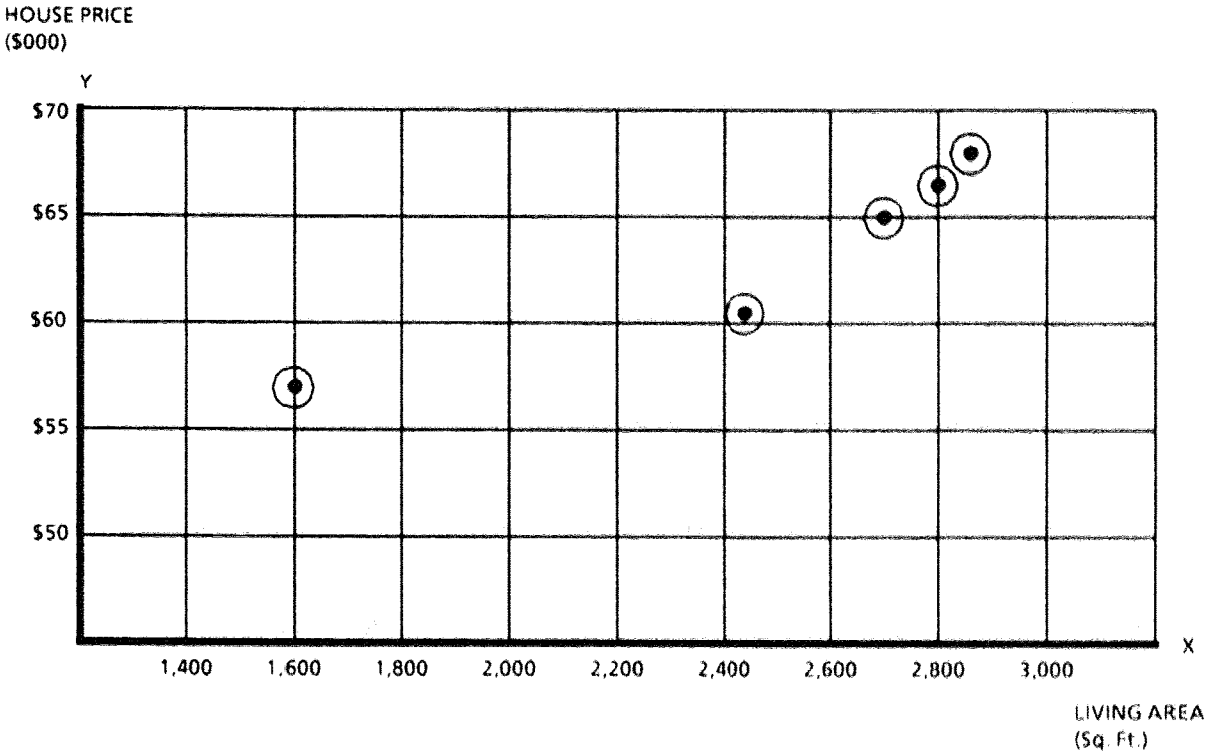


Figure 3-6. Relating price to living area.

Figure 3-7 graphically depicts the relationship between price and exterior wall surface area. Again, there appears to be a linear relationship between house price and independent variable.

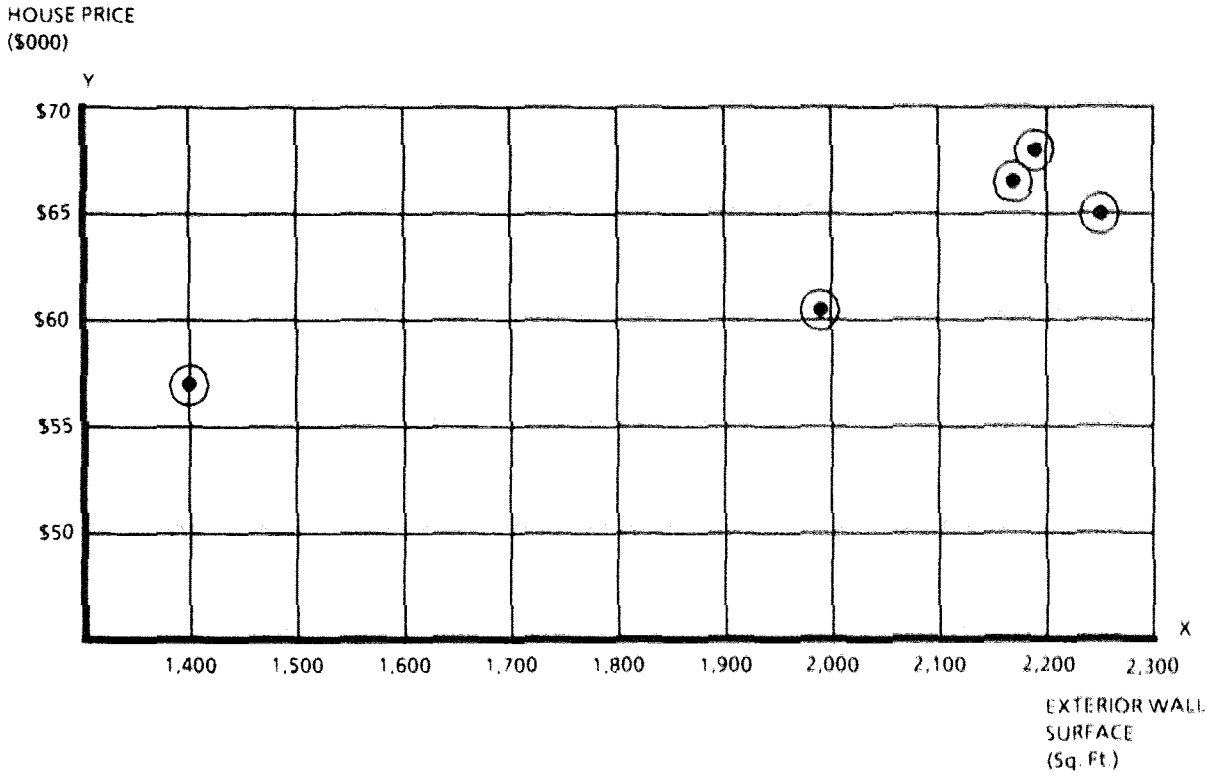


Figure 3-7. Relating price to exterior wall surface area.

Based on this graphic analysis, it appears that square feet of living area and exterior wall surface have the most potential for development of a cost estimating relationship. We may develop a "best-fit" graphic relationship by drawing a line through the average of the X values and the average of the Y values

$$(\overline{X}, \overline{Y})$$

and minimizing the distance between the data points an the line. (See figure 3-8 and figure 3-9).

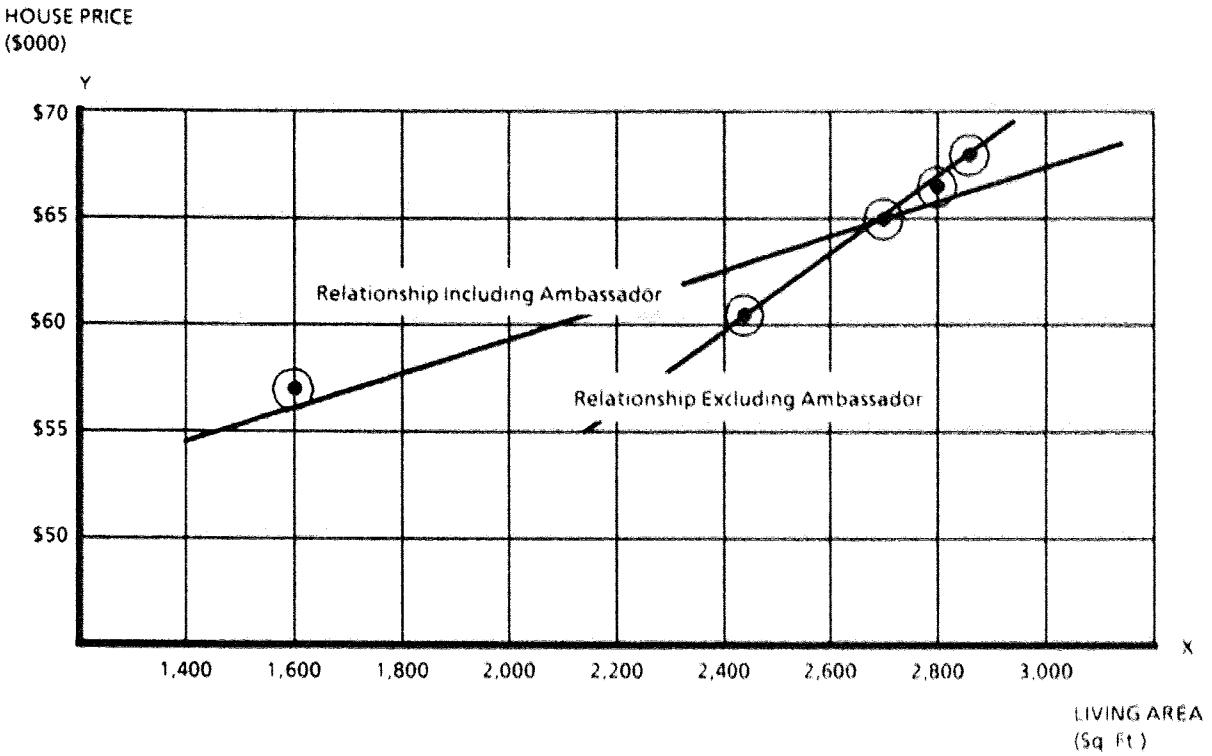


Figure 3-8. Linear relationship/living area.

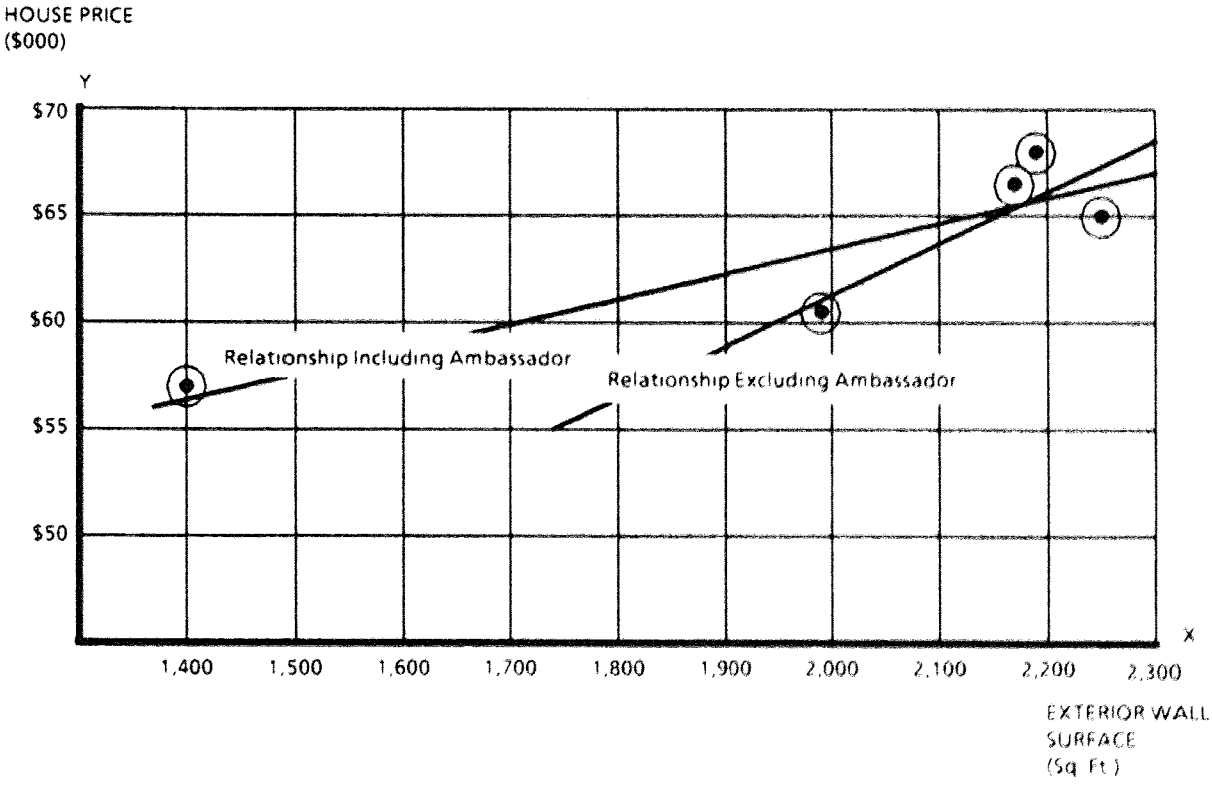


Figure 3-9. Linear relationship price/exterior wall surface area..

Viewing both of these relationships, we might question whether the Ambassador model data should be included in developing our CER. In developing a CER, you need not use all available data if all data is not comparable. However, you should not eliminate data just to get a better-looking relationship. In this case we find that the Ambassador's size is substantially different from the other houses for which we have data and the house for which we are estimating price. This substantial difference in size might logically affect relative construction costs. The trend relationship in figure 3-8 and figure 3-9, using the data for the four other houses, would be substantially different than relationships using the Ambassador data. Based on this information, you might decide not to consider the Ambassador data in CER development.

If you eliminate the Ambassador data, you find that the fit of a straight line relationship of price to the exterior wall surface is improved. For the relationship of price to square feet of living area, you find a close relationship, almost a straight line. If you had to choose one relationship, you would probably select this one over the relationship involving exterior wall surface because there is so little variance about the trend line.

If the analysis of these relationships did not reveal a useful predictive relationship, you might consider combining two or more of the relationships already discussed or exploring new relationships. However, since the relationship between living area and price is so close, we may reasonably use it for our CER.

In documenting our findings, we can relate the process involved in selecting living area for price estimation. We may then present the graph developed as an estimating tool. We might also convert the graphic relationship to a mathematical one. This may be done by simply finding two points on our graph, figure 3-10, and developing straight line equation.[1]

[1]The least squares best fit equation is: Cost = $17,907 + $17.4419 (sq ft).

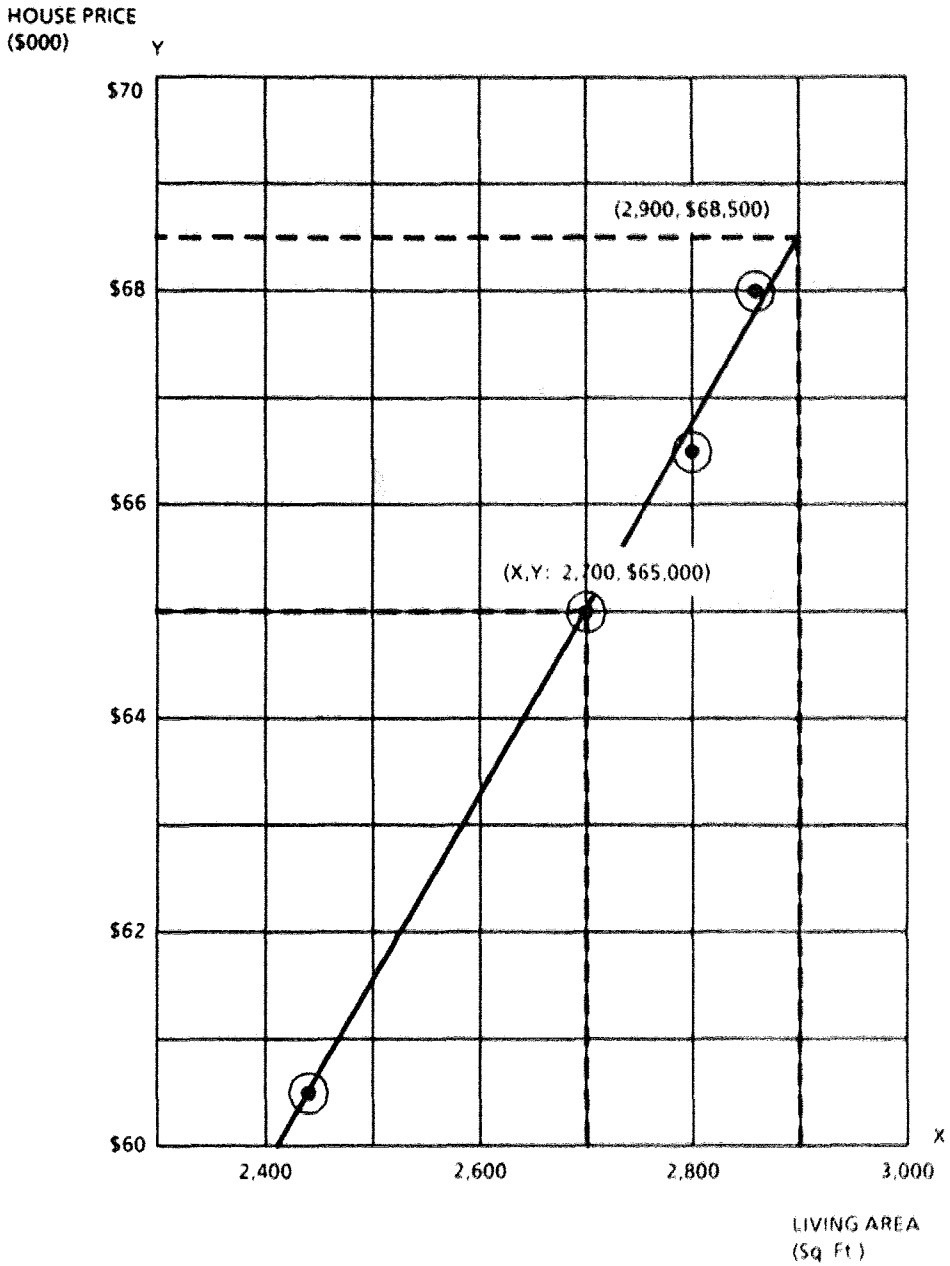


Figure 3-10. CER Development

We may use 2,700 square feet and $65,000 in price

$$(\overline{X}, \overline{Y})$$

as one point. For the other, we might read the Y value at 2,500 square feet, $61,500.

To develop a straight line equation, $Y = A + BX$, we would first have to find B.

$$\text{Remember, } B = \frac{Y_1 - Y_2}{X_1 - X_2}$$

$$\text{Therefore, } B = \frac{\$65,000 - \$61,500}{2,700 - 2,500}$$

$$B = \frac{\$3,500}{200}$$

$$B = \$17.50$$

Substituting this value of B with a known set of values of X and Y into the equation $Y = A + BX$, we find

$\$65,000 = A + \$17.50\,(2,700)$
$\$65,000 = A + \$47,250$
$\$17,750 = A$

Thus, our cost estimating relationship (CER) would be:

Y = $17,750 + $17.50 (sq ft living area)

Four our new 2,600 square-foot house, we would estimate:

Y = $17,750 + $17.50 (2,600)
Y = $17,750 + $45,500
Y = $63,250 estimated price

CER Application. A variety of relationships may be used in estimating costs. They include straight line relationships, simple ratios, and multiple variable relationships.

Total cost/price. One or more of the CER types discussed above can be used to predict costs and prices for a wide variety of products. (See table 3-5.)

Table 3-5
CER Types

Product	Independent Variable
Construction	Floor space, roof surface area, wall surface
Gears	Net weight, percent of scrap, inches of teeth cut, hardness, envelope
Trucks	Empty weight, gross weight, horsepower, number of driving axles, loaded cruising speed
Passenger car	Curb weight, wheel base, passenger space, horsepower
Turbine engine	Dry weight, maximum thrust, cruise thrust, specific fuel consumption, by-pass ratio, inlet temperature
Reciprocating engine	Dry weight, piston displacement, compression ratio, horsepower
Sheet metal	Net weight, percent of scrap, number of holes drilled, number of rivets placed, inches of welding, volume of envelope
Aircraft	Empty weight, speed, useful load, wing area, power, landing speed
Diesel locomotive	Horsepower, weight, cruising speed, maximum load on standard grade at standard speed

Cost elements. In addition to CER use in estimating total cost and prices, they may be used to estimate and evaluate individual elements of cost. CERs, for example, are frequently used to estimate labor hours. Tooling costs may be related to production, production labor hours, or some

other factor of production. Other direct costs may be directly related to the labor effort involved in the program.

CERs, like most other tools of cost analysis, must be used with buyer judgment. Judgment is required to evaluate the historical relationships in the light of new technology, new design, and other similar factors. Therefore, a knowledge of the factors involved in CER development is essential to proper application of the CER. Blind use of any tool can lead to disaster.

Exercises (042):

1. How are cost estimating relationships (CERs) used in predicting costs?

2. How should you develop a CER?

3. An estimating relationship of cost to weight is expressed by the equation, total cost = $1,700 + $50 (W), where W = weight in pounds. Using this equation, estimate the total cost of a product weighing 74 pounds.

4. The buyer of a small radio has the following cost estimating relationship data on hand from previous acquisitions of similar items:

Cost to Government in lots of 100 in current year dollars	No. of Transistors
$6,500	6
$7,000	7
$8,000	9
$9,000	11
$9,500	12

What would you consider a fair and reasonable price for a 10-transistor radio that is based solely on this data?

5. Suppose you were asked to select the physical characteristics that provides the best independent variable for a CER development from the following data:

Part Number	Price	Pounds Weight	Pounds Capacity	Number of Teeth
XR452	$400	1,000	600	200
XR460	$450	1,200	700	250
XR465	$600	1,100	1,000	500
XR480	$550	1,100	900	450
XR485	$500	1,250	800	600
XR500	-----	1,100	825	450

Which would you pick? Why?

6. In a contractor's proposal for new half-ton pickup trucks, the following information was submitted to support the subcontract price for a 330 horsepower engine:

Engine Horsepower	Price Per Unit
202	$1,209.00
289	$1,600.50
300	$1,650.00
350	$1,875.00
400	$2,100.00

The contractor's proposal included $1,850 for the engine. Based on the trend of the above data, the price is apparently _____.

3-10. Direct Labor Hour Analysis

043. Identify the essential considerations in an analysis of labor cost estimates.

In analyzing labor cost estimates, we must carefully review the labor hours and wages estimated for the job. If indirect expenses are allocated on the basis of labor hours, or labor cost, this review is especially important. If direct labor hours or wages are overestimated or underestimated, overhead amounts will be similarly affected, and the error will be multiplied accordingly. Direct labor costs plus labor overheads are usually a large part of the total cost estimate and frequently represent a substantial segment of the costs that are directly controllable by the contractor. For these reasons, the basis for contractor labor estimates must be completely documented.

In reviewing the hours and wages proposed, it is important we recognize that there are patterns in the incidence of various types of labor. At the start of the program or contract, there may be a heavy input of design and production engineering effort. As these efforts peak, and then decrease, tooling and setup effort increase. After tooling and setup efforts peak, machining and assembly labor become predominant. At the end of the contract effort, practically all work is being done by assembly and final test labor. In evaluating direct labor hours, you must determine if the estimate is based on proper planning and if it contemplates the sound use of labor and reasonable expectations of efficiency. These determinations will affect your evaluation of both hours and wages proposed.

Although subject to some differences in practice, direct manufacturing is labor that produces a change in the raw material, can be readily identified with the product, and will be large enough to merit identification and measurement. Most labor hours in the factory labor estimate are fabrication and assembly hours estimated for constructing the end product. However, quality control labor may be a significant part of some factory labor estimates.

Next we will consider how to estimate the number of hours by looking at the learning curve. Then we will discuss wage rate estimating techniques.

Exercise (043):

1. What determinations must you make in evaluating direct labor hours?

3-11. Experience or Learning Curve

044. Define the learning curve.

The *experience or learning curve is a quantitative technique* used to predict resource requirements in a process with recurring operations. As a pricing tool, this technique belongs to the comparison family of estimating approaches, since it depends on a comparison of historical costs to future costs through trend projection. The learning curve theory has been used successfully to predict direct labor hours, units of material required, as well as the dollar cost of subcontracted items.

Historically, the term "learner's curve" is based on the observation that individuals performing repetitive tasks exhibit a rate of improvement due to increased manual dexterity. The mental and muscular adjustments made by an individual from the time he performs his task for the first time to the time he has repeated it a number of times result in a reduction in the time required for each repetition of a uniform unit of work. Psychologists, teachers, personnel directors, manpower planners, and others have used this principle for a long time. When this improvement factor is subjected to further refinements of observation and analysis, causes of improvement are readily apparent. Dexterity on the part of individual workers is only one of the reasons for improvement in the usage of labor hours per unit of production.

Changes in the worker's environment, changes in morale, changes in the flow process, work simplification, engineering changes, and changes in work setup, all may contribute to improvement (or contribute to disimprovement), but such changes are nearly always induced by management functions. Thus, not only the cost effects of changing manual dexterity but also those of a broad group of factors that might be called management innovations (and the *interactions among manual* dexterity and the various management innovations) are measured and predicted by the learning curve. It is for this reason that the term "learning curve" is a misnomer. Several other suggested terms more nearly describe the actual meaning. These include improvement curve, cost or time reduction curve, or experience curve. In a study, S. A. Billon has suggested that the term "time reduction curve" is the most descriptive. However, the term "learning curve" (or learner's curve) has become so widely used that it is imperative to use it here. But when using it, you must understand that all complexities of causal relationships are embodied in its meaning. In essence, it represents the learning of the firm and is not specifically isolated to the learning of individuals.

Since World War II, the learning curve concept has been used by Government agencies to aid in pricing of selected Government contracts. Its application has been most conspicuous in airframe production where conditions were most favorable for its use. More recently, the learning curve has been used as a price analysis tool in such production industries as electronics systems, machine tools, shipbuilding, missile systems, and depot level maintenance of equipment.

Exercise (044):

1. What is the experience or learning curve?

3-12. *Experience Curve Characteristics*

045. List four factors relating to cost behavior that follow a learning curve trend.

As was mentioned previously, the experience or learning curve theory was developed from observations of cost behavior as a function of sequential aircraft produced. Certain factors associated

with the airframe industry seem to be necessary to that cost behavior and accordingly are mentioned here.

The first is the building of a sizeable, complex end item that requires large numbers of direct labor hours. The many individual tasks associated with these hours provide myriad opportunities to learn. A second factor is production in which nonmechanized assembly operations are predominant. If the operations were mechanized or machine paced as are many fabrication operations, the learning process would be inhibited. Another factor, which certainly influences learning, is a continuous process with constant pressure to reduce labor hours. If production breaks were common or long, the accrued learning would be dispersed through reassignment of workers or even forgetfulness. A fourth factor is the element of constant change in the product. The many engineering changes that are characteristic of a "state of the art" weapon seem to contribute to the overall process of improvement that was observed. One other observation worthy of note here concerns major engineering changes or model changes. Airframe production is characterized by short model/series production runs. With each change in model, the learning curve phenomena tends to repeat itself. That is, when a production program is completed for a particular airframe model and a new production is set up for a similar but new model, it cannot be expected that the first unit of the new model will continue where the old model left off. Rather, it can be expected that the labor hours to be used for the first unit of the new model will behave as unit one of a new production run and learning will begin anew.

It should be emphasized from the outset that while the learning curve is essentially a trend concept, it is not a time-series trend form. Rather, the independent variable is the number of opportunities to earn, while the dependent variable is cost input per constant unit of production. At first, this independent-dependent variable relationship may seem obscure. At best, it is not likely to seem quite as straightforward as a simple cost per unit time-series. Yet the reader is cautioned to study this relationship, for it is one of the key concepts that makes the learning curve a useful device for measuring and predicting change in production cost input.

Exercise (045):

1. List four factors necessary for a cost behavior that follows a learning curve trend.

3-13. Unit Curve Theory

046. State the unit curve theory, and express it in equation form.

A study has validated a learning curve cost model that is known as the "unit curve" or the "Boeing" theory. This theory can be stated as follows: "As the total quantity of units produced doubles, the cost per unit decreases by some constant percentage." The constant percentage by which the costs of doubled quantities decrease is called the rate of learning. The term "slope" in the learning curve analysis is the difference between 100 percent and the rate of learning. If rate of learning is 20 percent, the learning curve slope is 80 percent (100 percent – 20 percent). The slope is discussed at length in the following paragraphs.

Learning Curve Equation. The unit curve theory can be expressed in equation or model form as:

$$Y = AX^B$$

Where, Y represents the unit cost (usually expressed in hours) of the x^{th} unit;

X is the unit number.

A is the coefficient (constant) that represents the theoretical cost (also usually expressed in hours) of the first unit;

B is a coefficient (constant) that is related to the slope and the rate of change of the learning curve. It can be calculated from the relationship

$$B = \frac{\text{logarithm of the "slope"}}{\text{logarithm 2}}$$

The slope must be expressed in decimal form rather than percentage form.

Exercises (046):

1. What is the learning curve equation?

2. Describe the unit learning curve cost behavior.

047. Demonstrate a knowledge of plotting and interpreting a graph on arithmetic graph paper.

Graphing Learning. To illustrate the unit curve concept, assume that the first unit cost 100,000 labor hours to produce. If a curve with an 80 percent slope is assumed, the second unit would require 80,000 labor hours, the fourth 64,000, and so forth. In tabular form, the arrangement would appear as shown in table 3-6.

Table 3-6
Unit Curve Concept

Units Produced	Labor Hours Per Unit at Indicated Unit Number	Difference in Labor Hours Per Unit at Doubled Quantities	Rate of Change (%)	Slope of Curve (%)
1	100,000			
2	80,000	20,000	20	80
4	64,000	16,000	20	80
8	51,200	12,800	20	80
16	40,960	10,240	20	80
32	32,768	8,192	20	80

Obviously, the difference or amount of labor hour reduction is not constant. Rather, it declines by a continually diminishing amount as the quantities are doubled. But the rate of change or decline is found to be a constant percentage of the prior cost because the decline in the base figure is proportionate to the decline in the amount of change.

A labor hour graph of this data curve drawn on ordinary graph paper (rectangular coordinates) becomes a hyperbolic line as shown in figure 3-11. The nonlinear appearance of figure 3-11 pictures the relationship between two variables, units produced in sequence (X) and labor hours per unit (Y). This relationship is expressed in terms of an arithmetic graph in which equal spaces represent equal amounts of difference. When thinking of numbers in terms of their absolute values, the graphical picture presents an accurate description. But they do not depict a rate of change or decline as needed in the learning curve. Rectangular coordinates assign the same spacing to the difference of one unit between two large numbers as they do for the difference of one unit between two small numbers.

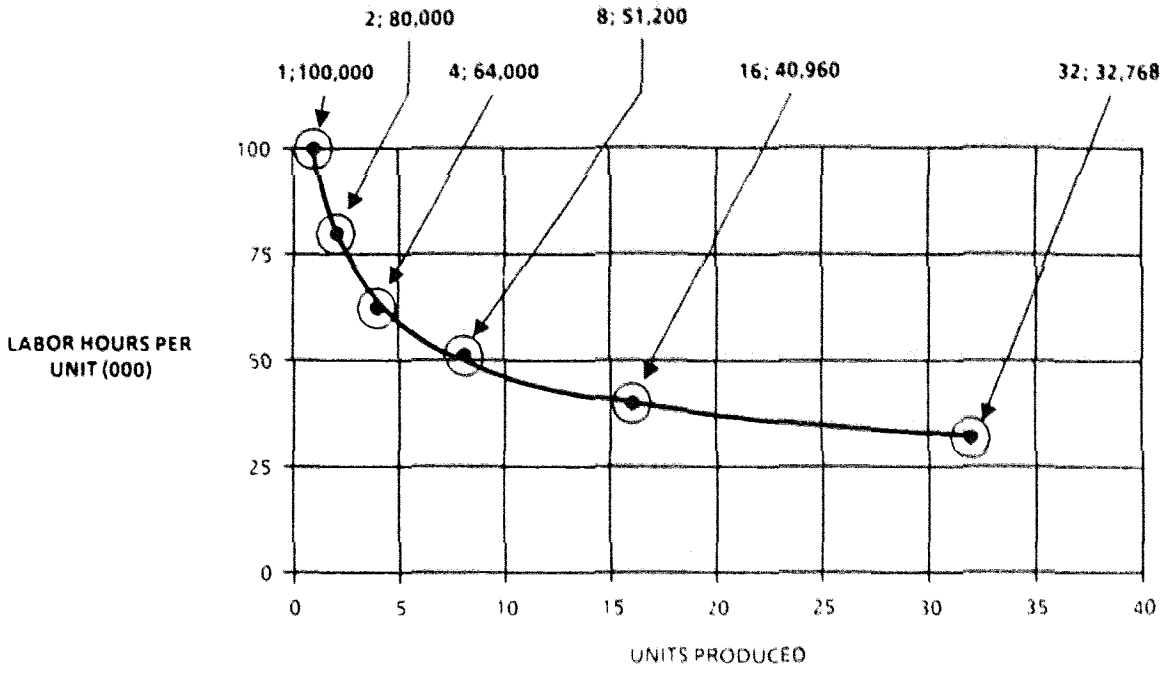


Figure 3-11. An 80 percent experience curve drawn on arithmetic graph paper.

For example, the change from 100 to 101 is a difference of one, whereas the change from 1 to 2 is also a difference of one. Relatively speaking, the first difference is a 1 percent change in values, while the latter is 100 percent change in values. What is needed is a measure of rate of change rather than a measure of amount of change. Such a measurement would show the relative importance of changes regardless of where the changes occurred on the number scale. For example, figure 3-12 shows that the distance between 4 and 8 on the horizontal scale is the same as the distance between 28 and 32. This is because the difference between both sets is 4. Relatively speaking, however, the distance between 4 and 8 should be the same as between 16 and 32 because both represent a 100 percent change. If the distances are not equal, the changes in labor hours occurring in the first set will appear to be more important because the numbers are spaced further apart even though the relative change may be the same.

When labor hour figures that conform to the learning process are plotted on log-log paper against the units of production to which they apply, the points thus produced lie on a straight line called the learning curve. Note that there is no anomaly in that it is called a curve despite its being a straight line. In mathematical terminology a straight line is a particular case of a curve, having a curvature of zero. Figure 3-12 shows the data of table 3-8 plotted on log-log paper. As previously indicated, data that conforms to the theory of the learning curve (the cost of doubled quantities decreased by some constant percentage) forms a straight line when plotted on log-log paper. Not only can the analyst estimate future production costs by extending the straight line, he can dispense with mathematical models that are sometimes difficult to solve. With careful attention to detail, the graphical approach to learning curve analysis will yield estimates as satisfactory as estimates derived through mathematical or computer assisted estimates. Accordingly, it is of value to the analyst to understand the mechanics of using log-log paper.

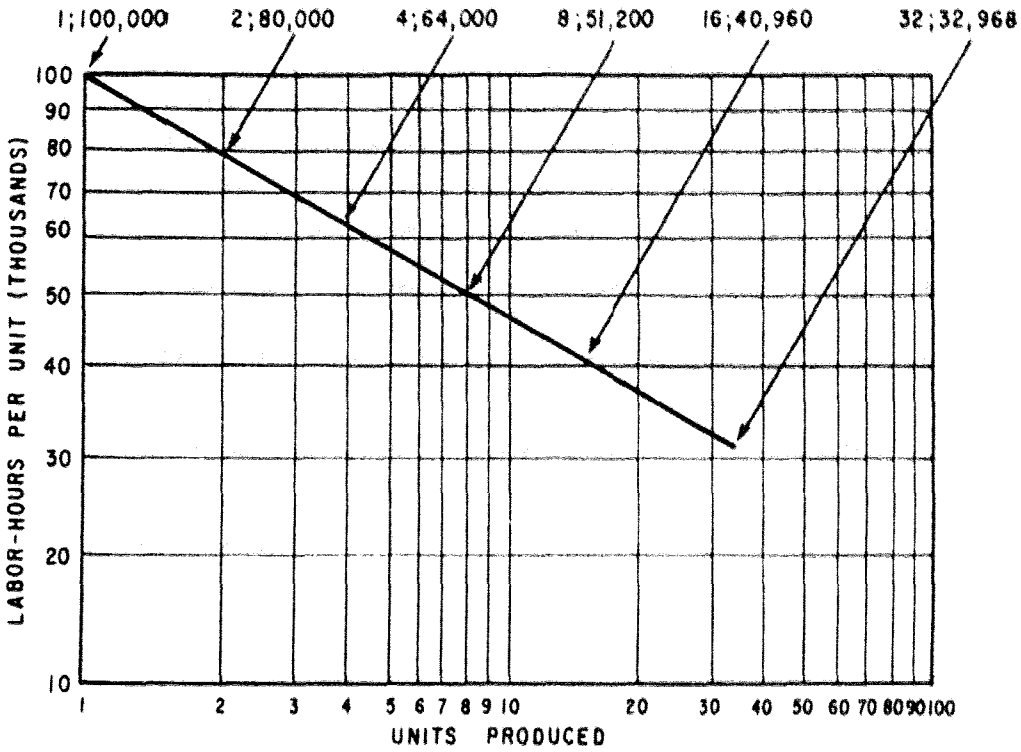


Figure 3-12. An 80 percent experience curve drawn on log-log paper.

Exercise (047):

1. Prepare a graph on arithmetic graph paper plotting the following data (unit numbers are plotted along the X axis). (Graph paper is in the back of this volume.)

Unit Number	Labor Hours Per Unit
5	1,000
10	800
20	640
40	512
80	409 6
160	327 7

a. Plot the relationships.

b. Connect the plot points.

c. Estimate from the graph the labor hours for unit 3.

d. Estimate from the graph the labor hours for unit 200.

3-14. Mechanics of Log-log Paper

048. Demonstrate a knowledge of plotting and interpreting data on log-log paper.

One form of graph paper marked so that number values are expressed in terms of equal relative differences on both vertical and horizontal scales is called log-log paper and is illustrated in figure 3-12. Log-log paper is so constructed that the distances between numbers on the horizontal scale are equal for equal percentage changes. The distance, for example, between 1 and 2 is the same as between 4 and 8; also, the distance between 3 and 4 is the same as between 60 and 80. In each set of distances, the differences in numbers represent a 100 percent and a 33⅓ percent increase, respectively. The vertical scale has the same characteristics.

A straight line on log-log paper indicates that the rate of change between two variables is constant. Any two lines that are parallel on the same piece of log-log paper indicate equal rates of change for the two relationships, regardless of size of numbers.

Several characteristics should be observed about log-log paper. First, there are no zeros. Values approach zero but never achieve it. Second, this type of graph paper is drawn in terms of cycles. The first line, either vertical or horizontal, must be labeled 1 or 10, or any integral power of 10. It is essential to observe that the first line values cannot be a number such as 5 or 6.

Each cycle has a definite starting point when designating values. But, if the first cycle starts with 1, the next cycle must start with 10, and the third cycle would start with 100. If the first line is 10, the first line of subsequent cycles would have values of 100 and 1,000. That is, a cycle need not always start with 1, but may start with .01 or 0.1 or 1.0 or 10.0 or 100.0, etc. However, once an absolute value is assigned to a point on an axis, either horizontal or vertical, all other locations on the same axis have a fixed absolute value so that comparable locations in each successive cycle (to the right on the horizontal axis or above on the vertical axis) have an absolute value exactly ten times as great as in the preceding cycle.

In all graphs, the horizontal axis is conventionally called the X axis, and the vertical axis is called the Y axis. For our purposes, sequentially produced units will always be plotted on the X axis; labor hours, cost, pounds of material, or whatever quantity varies as production proceeds will be plotted on the Y axis.

On the X axis, the first vertical line on the left cycle represents the first unit produced. The heavy vertical line on the right side of this cycle will then represent the tenth unit produced, the heavy vertical line on the right side of the second cycle the 100th unit produced, and the heavy vertical line on the right side of the third cycle the 1,000th. It is advisable to mark these figures on the margin of the log-log paper before starting to plot points.

On the Y axis, the scale varies from problem to problem. It is still important to locate the scale before beginning to plot points; otherwise, it is easy to make errors in plotting or reading figures.

To determine the scale to be used, first decide what is the largest figure to plot or read on the Y axis. This figure would probably be the theoretical cost of the first unit. Suppose this is 60,000 hours. Next, determine what is the next integral power of ten above this figure. An integral power of ten is ten multiplied or divided by itself a number of times. It is usually expressed as a 1 preceded or followed by a number of zeros. One itself is also an integral power of ten; ten divided by itself once.

The next integral power above 60,000 is 100,000 which is ten multiplied by itself four times. This value is given to the horizontal line at the top of the upper cycle on the Y axis. The horizontal line at the top of the lower cycle must then represent 10,000 of the same units, and the line at the

bottom of the lower cycle represents 1,000. A labor hour figure of 60,000 would plainly relate to an item of considerable size, like a medium-sized aircraft. If the item being produced were something quite small, like an electronic component, then the largest labor hour figure (first unit cost) to be plotted might only be .6 of the labor hour. The next integral power of 10 above .6 is 1. The value to be given to the horizontal line at the top of the upper cycle would then be 1 labor hour, and that to the horizontal line at the bottom of the lower cycle .01 of the labor hour.

The accuracy of the results obtained from graphs depends greatly on the degree of refinement of the plotting technique. A sharp pencil should always be used. Points plotted on the paper should be as small as possible, lines as narrow as possible. When the smallest possible point has been marked on the paper, it may easily be lost sight of or confused with a blemish in the paper. To avoid this, it may be identified by surrounding it with a small ring. Circles, triangles, and squares are also used to identify points that belong to different sets of data. Great care should be exercised in drawing a line. If it is supposed to go through a point, it should pass exactly through it, not merely be close to it.

The data points discussed in the example of table 3-6 were chosen to form a perfect straight line when plotted on log-log paper. That is, a straight line passes exactly through each of the points. When plotting real production data on log-log paper, the data points will seldom all fall in a perfect straight line. In this situation, the analyst must "best fit" a straight line through the data points. The object of this best fit approach is to discern the trend of the data that will include both the location and the slope of the line. The usual approach is to attempt to locate a straight line on the log-log paper so that the sum of the distances of each of the data points from the line is as small as possible. If one data point is a significant distance away from the best fit line, further analysis into the cause of the deviation is indicated. If this analysis so indicates, adjustment or elimination of the errant data point might be in order.

Exercise (048):

1. Now, plot the data, given in exercise 047, question 1, on log-log paper. What the labor hour values by units 3 and 200? (Log-log paper is in the back of this volume.)

3-15. Measuring the Slope of the Curve

049 Using the ratio method, demonstrate how to measure the slope of a learning curve drawn on log-log paper.

The term "slope" as used for learning curves is a mathematical misnomer. It cannot be related to the definition of slope in a straight line on rectangular coordinates. Because of this misnomer, we must define the term "slope" for learning curve discussions.

In the definition of the learning curve, it was stated that "as the total quantity of units produced doubles, the cost per unit decreases by some constant percentage." The slope of a learning curve is equal to 100 minus that constant percentage decrease (100 – rate of learning). Using the ratio method, the slope can be calculated directly by dividing the unit cost Y_1 at some quantity X_1 into the unit cost Y_2 at twice the quantity X_2 and multiplying the resulting ratio by 100. Slope = $100(Y_2X_2/Y_1X_1)$. Therefore, one way to measure the slope of a learning curve drawn on log-log paper is to read a Y value at any quantity of X, read a Y value at any quantity two times X, divide the second value by the first and multiply by 100. For example, if the number of hours (from the graph) to make unit number 5 is 70 an the number of hours (from the graph) to make unit number 10 is 50, the slope of the learning curve is $100(Y_{10}/Y_5) = 100(50/70) = 71.4$ percent.

The analyst needs to know the slope of the learning curve for a number of reasons. One is to facilitate communication among analysts, as it is part of the language of the learning curve theory.

The steeper the slope (lower the percent), the more rapidly the resource requirements (hours) will decline as production increases. Accordingly, the slope of the learning curve is usually an issue in a negotiation. The slope of the learning curve is also needed to project follow-on costs, using either the learning tables or computational assistance of a computer. Another need for a slope is that for many production situations; a given slope may be established as a standard based on reliable historical experience. Learning curves developed from actual experience on current production can then be compared against this standard slope to determine whether the improvement on a particular contract is or is not reasonable.

Exercise (049):

1. Using the ratio method, measure the slope of the curve in exercise 048, question 1. What is the slope of the curve?

3-16. Extending the Line

050. In terms of the learning curve theory, demonstrate a knowledge of predicting the costs of future units of production.

The primary purpose for developing the learning curve as a cost/price analysis tool is to permit the analyst to predict the cost of future production. The prediction is based on the assumption (not always true) that the future will behave as the past. In terms of the learning curve theory, this assumption means that the cost (hours) of doubled quantities will continue to decrease by some constant percentage. Prediction can most easily be accomplished by drawing a straight line through the historical observed data on log-log paper and extending that straight line through some future quantity to be produced. The predicted cost per unit to produce any particular unit is read on the Y axis horizontally even with the point where the learning line and a vertical line drawn at the specified quantity intersect.

For example, suppose the first unit had a value of 3,000 hours per unit; the second, a value of 2,400 hours; the fourth, a value of 1,920 hours; and the eighth, a value of 1,536 hours. By connecting the points (when plotted on log-log paper), you will observe a straight line with an 80 percent slope. (see fig. 3-13.) If the line were extended sufficiently far beyond the eighth unit, you could estimate the value for the one hundredth unit. (The extended line should reveal a value of approximately 680 hours for unit number 100.)

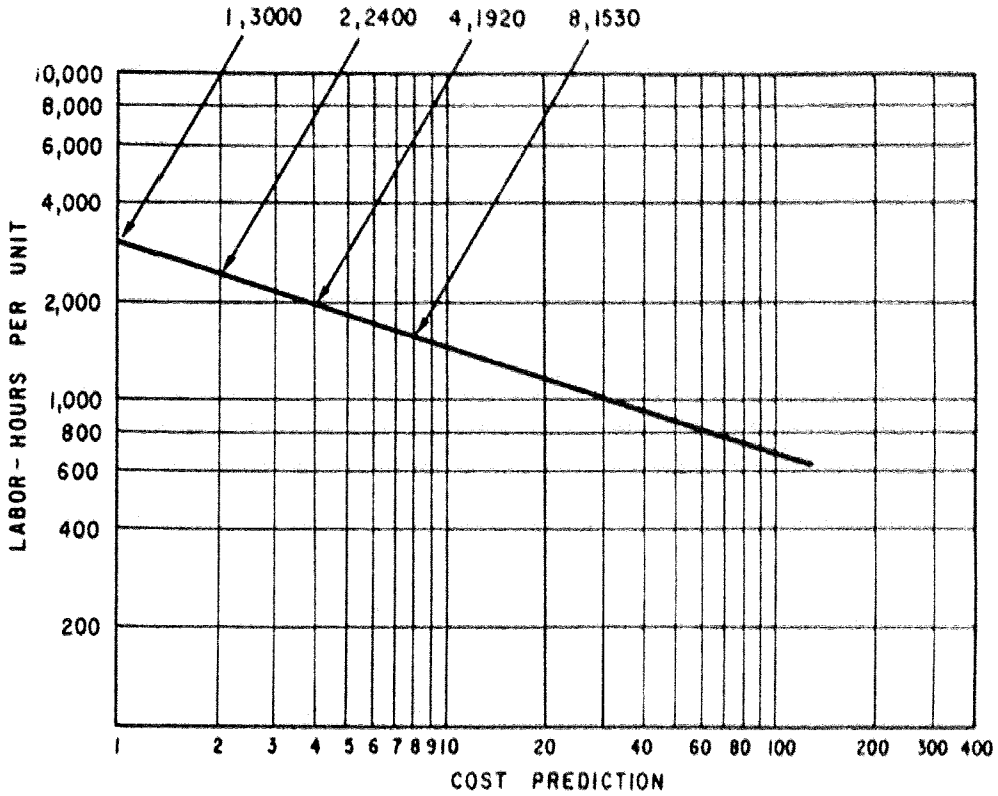


Figure 3-13. Cost Prediction.

The learning line can also be extended backward, especially if the theoretical value of the first unit is needed. For further practice and to illustrate the concept, plot on the log-log paper of figure 3-13 the following cost values (Y) for corresponding unit numbers (X).

Unit Number	Labor Hours Per Unit
10	2,500
20	1,900
50	1,325

This data, when plotted and connected, forms a straight line as does the data from the previous example. However, in this example, there is an opportunity to extend the line in either direction. When extending the line to the left, the first unit value should read approximately 6,200 labor hours, and when extending it to the right, the reading at the one hundred fiftieth unit should be approximately 860 labor hours. This is also confirmed by the ratio \$1,900/\$2,500 or 76 percent. These dollar figures are the given cost values at the quantities 20 and 10.

As with any method of projecting the future, the theory of the learning curve falls short of perfection. Such a simple model of the real world cannot hope to cover all pricing situations. However, the method of extending straight lines on log-log paper, as described, proves a reasonable approach to predicting the future if the historical data falls on a straight line trend. Conversely, the

further away historical data points lie from the selected trend line, the less confidence the analyst can place in his prediction.

Exercises (050):

1. Connect by line the following sets of values on log-log paper.

Unit Number	Labor Hours/Unit
3	84
30	60
100	50

   a. Project to unit 1 and read the labor hour value.

   b. Project to unit 250 and read the labor hour value.

2. Using the theory of the unit learning curve, calculate the cost in hours of the 40th unit if the cost of the 10th unit is 3,200 hours and the slope of the learning curve is 75 percent.

3. Draw two near learning curves with a slope of 85 percent. In curve A, let unit 7 have a value of 200 labor hours. In curve B, let unit 1 have a value of 3200 hours. Which line will produce a higher unit value for unit 20? Why?

4. Given a 70, 80, and 90 percent slope with a first unit value of 950 labor hours, which curve would require the lowest amount of labor hours for 500 units of production? Why?

051. Calculate the unit values of lot plot points, the representative values of each lot, and the average and total value of projected lots of production.

The use of the learning curve is dependent on the methods of recording costs that companies employ. An accounting or statistical record system must be devised by a company so that data is available for learning curve purposes. Otherwise, it may be impossible to construct a learning curve. Costs, such as labor hours per unit or dollars per unit, must be identified with the unit of product. It is preferable to use labor hours rather than dollars since the latter contain an additional variable, the effect of inflation or deflation (wage-rate changes), which the former does not contain. In any event, the record system must have definite cut-off points for such costs, permitting identification of the costs with the units involved. Most companies use a lot-release system, whereby costs are accumulated on a job order in which the number of units completed are specified and costs are cut-off at the completion of the number of units. The continuous process method, as distinguished from the job order system, also yields costs identified with end-item units. In this case, however, the costs are usually equated with equivalent units rather than actual units.

Since the job order system is commonly used, the unit cost is not the actual cost per unit in the lot. This means that when lots are plotted on graph paper, the unit value corresponding with the average cost value must be found. In nearly all cases, this unit value (X) is the median unit within the lot that should be given the average value. Thus, for each succeeding lot as the program progresses, the midpoint of each lot is taken as the plot point for the quantity (X). For example, if a lot is made up of units 91 through 100 of a given contract, the unit value of the plot point would be 95. The calculation is based on the cumulated number of units in all preceding lots plus one-half the

number in the log under consideration.

$$(90 + \frac{10}{2} = 95)$$

Since it is characteristics for the early units in the first lot to decline rapidly arithmetically speaking, there may be some distortion when locating the representative value at the midpoint of the first lot. This holds true especially when the first lot contains 10 or more units. This distortion is compensated for by a rule-of-thumb which states that when the first lot contains ten or more units, one-third the lot size should be chosen as the unit value estimate of the first lot point. Conversely, when the first lot contains less than 10 units, one-half of the lot size should be chosen as the unit value for the first lot plot point. It is an arbitrary rule and applies to the first lot only, but it approaches the true midpoint more nearly than the other arbitrary rule of taking half the lot size in every case. True lot plot points can be calculated from a rather complicated formula, but in most instances the rule-of-thumb is sufficiently accurate.

For a contract of 150 units in which the predetermined lot sizes are 3, 7, 10, 10, 20, 50, 50, the unit value plot points for the lots are calculated as in table 3-7.

Table 3-7
Calculation of Lot Plot Points

Lot No.	Lot Size	Cumulative Units	Lot Midpoint	Lot Plot Point
1	3	3	1.5	1.5
2	7	10	3.5	6.5
3	10	20	5	15
4	10	30	5	25
5	20	50	10	40
6	50	100	25	75
7	50	150	25	125

Unit values of lot plot points for quantities yet to be produced can also be calculated. For example, consider the lot data of table 3-8. Assume a contractor had labor hour information only for the first three lots and wished to estimate the labor hours required to produce lot 4 of 40 units. The cumulative number of units for the first three lots is 30, and the lot plot point for the unknown or prospective lot is:

$$30 + \frac{40}{2} = 50$$

The assumption here is that the unit cost of unit 50 is the same as the average cost of units 31 through 70.

Now assume 6,800 labor hours for lot No. 2 and 3,500 labor hours for lot No. 3 as table 3-8 indicates. Plot the average lot labor hour data (Y) at the corresponding lot plot points (X) on log-log paper and fit a learning line. Extend the learning line through unit number 50 (the lot plot point for the lot No. 4). On the Y axis read the lot average cost of lot No. 4 as approximately 2,700 labor hours at the lot plot point of 50 units. The cost for lot No. 4 can then be estimated by taking the product of 2,700 hours per unit and 40 units that is equal to 108,000 hours.

Table 3-8
Lot Experience Data

Lot No.	Lot Size	Cumulative Units	Lot Midpoint	Lot Plot Point	Lot Average Cost	Lot Total Cost
1	6	6	3	3	$6,800	$40,800
2	9	15	4.5	10.5	4,500	40,500
3	15	30	7.5	22.5	3,500	52,500
4	40	70	20	50		

Exercises (051):

1. The Jackson-Pollock Company had the following history on item Y. What are the plot points for each of the four lots?

Lot #	Lot Size	Cumulative Units	Lot Midpoint	Lot Plot Point	Total of Labor Hours	Avg of Labor Hours
1	8	8			2,080.8	
2	16	24			2,404.8	
3	26	50			2,808	
4	32	82			2,736	

2. Given the data of the Jackson-Pollock Company, what are the average labor hours for each lot?

3. The Jackson-Pollock Company proposed to produce a fifth lot of 80 units for the Government. What average and total values would you expect for the fifth lot? (Develop the answer by plotting the data on log-log paper.)

3-17. Factors Affecting Wage Rates

052. Demonstrate how to insure that the contractor's estimated wage rates are those that will actually be paid and that they are fair and reasonable.

Once you have determined the labor hours necessary, you must consider the wage rate. The method a contractor uses to project wage rates should be developed and applied consistently. Any special approach devised for a given, individual estimate should be examined with considerable care. Ordinarily, labor rate information will be provided by the auditor. However, you must know what factors were considered in deriving that information.

Four general factors have a significant impact on labor rates. These variations in geographical locations, skill levels, time period of the contract, and conditions in the contractor's work force. The task of the analyst is to insure that estimated wage rates are those that will actually be paid and that they are fair and reasonable.

Variations in Geographical Locations. Wage rates for the same work vary widely with geographical location. This variation results from the supply and demand position in relation to a particular trade, the strength of the particular trade organization, the cost of living in the area, and

other similar factors. It is important, therefore, to insure that the wage rate stated in the proposal is the one that applies in the location in which the work will actually be done.

Information on wage rates paid to different trades in different locations is published by the Bureau of Labor Statistics and by various state and local agencies. The first action of the buyer should be to compare the wage rates proposed by the contractor with those given in the published tables. Differences should be explained and justified by the contractor, or the rates should be adjusted.

Variations in Skills. Both the nature and degree of the skill required have an important bearing on the wage rate. Generally, as the degree of skill required increases, the period of training is longer and the wage rate is higher. This consideration applies particularly to trades involving similar work but varying degrees of skill, such as mechanic, fitter, and toolmaker; however, when the trades are dissimilar, other factors enter into the relative level of wages paid, such as supply and demand in that particular trade, relative strength of the labor organizations, danger, and exposure to weather.

A proposed wage rate should not be agreed to unless it is consistent with the value of the contract effort involved. If the work is routine assembly that could be done satisfactorily by mechanics, a wage rate for a higher skill level (fitters) is not appropriate. This is important in relation to the actual sum paid as wages. However, it is even more important when we consider the applied indirect costs that may multiply the direct costs several times.

It is evident that considerations of this sort require the buyer to have a considerable knowledge and appreciation of the methods of production that the contractor plans to use and the nature of contractor facilities and equipment. At an early stage in the analysis, the buyer should set out to acquire this knowledge. The question of whether a particular operation calls for the work of individuals with particular skills is one on which the buyer may often need advice from a specialist, such as the industrial engineer. In addition to the in-house specialists, a Defense Contract Administration Services (DCAS) office may provide technical specialists, and the Defense Contract Audit Agency (DCAA) may provide audit assistance to help determine required skills and costs.

The performance of a contract frequently entails the employment of persons in numerous skills that receive varying wage rates. Several methods may be used to propose the required variety of wage rates. These include proposing wage rates for specific individuals, for labor categories, or for departmental or plantwide average rates.

Individual wage rates. Individual wage rates may be used when the project requires extraordinary skills that in turn demand extraordinary wages. In this method, the company identifies which individuals will be assigned to the project, estimates the number of hours each individual will work, and applies the individual's wage rate to the estimated hours to compute the estimated cost to the project. Even though singling out expensive personnel may be a fair method of estimating cost, the approach is acceptable only if the company uses the individual rate method on all other Government business, including business where the required skills and wages may be lower than average.

Labor category rates. Use of rates developed by labor category is found primarily in estimating engineering labor requirements. This rate classification system is generally used by engineering-oriented operations to reflect the significant variations in capabilities and responsibilities among the various levels of expertise from draftsman to program or project manager. Such a classification system is necessary because of the wide variations in labor rates by the various categories and because each project usually requires a particular combination of engineering expertise rather than a pro rata share of all levels.

Departmental rates. Departmental rates may be used by organizations with significantly different processes or operations that require varying degrees of skill, where wage rates vary widely between departments, and where the manufacture of all products does not require that work be done in every department. To be a valid method of estimating contract labor cost, work done within each department should require effort from the various skills in proportion to the manpower available in that department.

Plantwide rates. Plantwide rates are usually used by organizations producing a limited number of products that pass through all or most departments during manufacture. If each department of the activity contributes to every job, roughly in the same proportion as the number of personnel in each department, an average wage rate for the plant might then be applied fairly to the total labor hours.

It is important that departmental and plantwide average rates not be derived simply by averaging the wage rates of the various labor categories. To determine an overall average, the various labor categories must be weighted by the number of individuals to which they apply.

As an example of what can happen, consider the data in table 3-9. A simple average wage rate could be derived by adding the rates for the four labor categories and dividing by four.

$$\$8.00 + \$4.00 + \$4.60 + \$5.00 = \$21.60$$

$$\$21.60/4 = \$5.40 \text{ Average wage rate}$$

Table 3-9
Weighted Average Wage Rate

Labor Category	Force Employed	Wage Rate $ Per Hour	Weighted Wage Rate
Senior fabrication	100	$8.00	$ 800
Fabrication	200	4.00	800
Assembly	400	4.60	1,840
Quality control	300	5.00	1,500
Total force employed	1,000		
Total of force X rate			$4,940
Weighted average wage rate	$4,940/1,000 = $4.94		

The $5.40 wage rate gives no consideration to the number of individuals employed in each class of labor. If we look at the data, we can see that the same number of people are not employed in all labor categories. Yet in our simple average labor rate, Senior Fabrication with 100 employees was given the same consideration as Assembly with 400 employees. If everyone in the plant worked one

hour, the labor cost would be $4,940. This figure divided by the number of employees, 1,000, yields an average labor rate of $4.94. The $4.94 figure is $.46 below the simple average of $5.40.

In analyzing labor costs for a Government contract, we are concerned with the mix of labor to be employed on the contract. If the labor mix is in the exact proportion as the number of employees, then the use of the $4.94 wage rate is acceptable. However, if the distribution of labor in the contract differs, then we must calculate the weighted wage rate using the number of hours in our contract as shown in table 3-10.

Table 3-10
Weighted Average Wage Rate

Labor Category	Number of Hours for Contract	Wage Rate $ Per Hour	Weighted Wage Rate
Senior fabrication	50	$8.00	$ 400
Fabrication	175	4.00	700
Assembly	125	4.60	575
Quality control	100	5.00	500
Total hours	450		
Total labor costs			$2,175
Weighted average wage rate	$2,175/450 = $4.83		

Variation with Time. It is a familiar fact that wage rates do not stay at the same level over a period of time. In recent years, they have been increasing. This movement of rate with respect to time can be divided into two parts. One part is an adjustment to reflect increased productivity and what the employees regard as their fair share of the resulting increase in profits. The second part is cost of living increase that endeavors to counter the effects of inflation on the purchasing power of the employee's income.

This wage rate movement over time may be accentuated by conditions of contracts between employers and the unions representing the employees. When an employer makes a Government contract proposal, labor contracts with the unions may have long or short periods to run before they become subject to renegotiation. If the work under the Government contract can be completed before they are renegotiated, the contractor knows what wage rates he will have to pay. On many Government contracts, however, the work is likely to go on for several years. Also, there is a good chance that some or all of the labor contracts will expire before the contract has been completed.

If labor contracts are renegotiated during the period of the Government contract, it is likely that wage rates will be increased, and this may substantially affect Government contract costs. The contractor, therefore, has no option but to use his best judgment to project from the current wage rates to an estimate of the future wage rates and consequently include these additional anticipated costs in his proposal. From the Government side, the buyer has no option but to attempt similar projections to determine whether the wage rates that the contractor estimates are fair and reasonable.

Exercises (052):

1. Our contract requires the following types of labor:

Senior Design Engineer	1,000 hours
Design Engineer	3,000 hours
Tool and Die Maker	500 hours
Machinist	5,000 hours

The contractor develops and proposes a composite contract labor rate considering the effort for each contract. For this contract the rate proposed is $11 per hour. DCAA has provided us with the following information:

Title	Rate	Number of Employees
Chief Engineer	$17	1
Senior Design Engineer	$13	4
Design Engineer	$11	20
Chief Manufacturing	$12	1
Supervision Mfg Operator	$10	2
Machinist	$ 9	10
Tool and Die Maker	$11	2

Based on the data given, would you say that the contractor has overstated or understated the proposed labor rate? If so, by what amount was it overstated or understated?

2. The following departmental labor rate data is available:

Department	Number of Employees	Department Average
Engineering	50	$10.00
Fabrication	200	5.00
Assembly	200	4.50
Test	100	4.00

Your analysis of the cost proposal indicates that the "Tinker" contract effort includes engineering, assembly, fabrication, and test labor in the same proportions as the distribution of manpower for those departments. The contractor develops and proposes a composite contract labor rate considering the effort for each contract. What would be the appropriate weighted average labor rate to apply for a contract using these categories of labor?

3-18. Projecting Wage Rates

053. Demonstrate a knowledge of projecting wage rates by forecasting the average manufacturing labor rate of production, the midpoint of labor effort, the wage rate at the midpoint, and total labor costs.

There is no perfect method of arriving at a correct wage figure under uncertain circumstances. With the contractor's organization, such things as changes in skill levels due to retirements and increases or reductions in total force levels can affect wage projections. External forces, such as unexpected changes in the economic climate, changes in Government policy, or turn of events in international affairs, may completely alter the basis of the projections.

In attempting to estimate the level of wage rates at some future time, the first thing to do is to look at historical information on wage rates in recent months and years. If they have been following a clearly defined trend and there is no evident reason to expect them to depart from that trend in the future, it would be difficult to criticize a decision to assume that the same trend will be followed, at least in the reasonably near future.

Method of Forecasting. One method of determining whether such a trend exists is to graph the figures on rectangular coordinates. Actual wage rates may be plotted on the Y axis, against corresponding months elapsed on the X axis. If all points fall quite close to a straight line that is acceptable to both the Government and the contractor, then future rates may be forecast simply by extending the straight line into the future. The trend is defined by the slope of the line.

This straight line approach provides a reasonable vehicle for projecting future labor rates over periods of two years or less. As with any graphical or analytical technique, the approach can be broken down into some general steps. An example of the approach is included here for illustrative purposes. Consider the need to forecast a manufacturing labor rate for use in estimating direct labor costs in December 19X7. The first step is to gather the most recent historical labor rate data. Assume that the data of table 3-11 represents the monthly plantwide average manufacturing labor rates. The second step is to examine and edit the data if needed. For example, some labor rate time series may reflect a sudden increase due to a negotiated pay raise that is unrelated to a change in cost of living. In such a case, you might want to subtract the step increase from rates subsequent to the jump to facilitate analysis of the underlying trend. No such editing is necessary on the sample data given. The third step is to plot the edited data on rectangular coordinates. Figure 3-14 depicts this step. The fourth step is to best fit a straight line through the data. Earlier we stated that the line of best fit must pass through the point with coordinates at the mean of the X values and the mean of the Y values

$$(\overline{X}, \overline{Y}).$$

The mean of the X values can be calculated by summing the month numbers and dividing by the number of months, that is

$$(1+2+3+4+5+6)/6 = \frac{21}{6} = 3.5$$

The mean of the Y values is calculated by summing the rates and dividing by the number of rates, that is:

$$(4.26+4.27+4.29+4.30+4.30+4.31)/6 = \frac{25.73}{6} = \$4.2883$$

Thus, the best fit line must pass through the point (3.5, $4.29). The line of best fit can now be located by fitting a straight line through (3.5, $4.29) such that the overall sum of the distances from the line to the data points is visually minimized. Figure 3-14 shows such a line.

Table 3-11
Monthly Plantwide Average Manufacturing Labor Rate

Month	Month No. (X)	Rate (Y)
May	1	$4.26
Jun	2	4.27
Jul	3	4.29
Aug	4	4.30
Sep	5	4.30
Oct	6	4.31

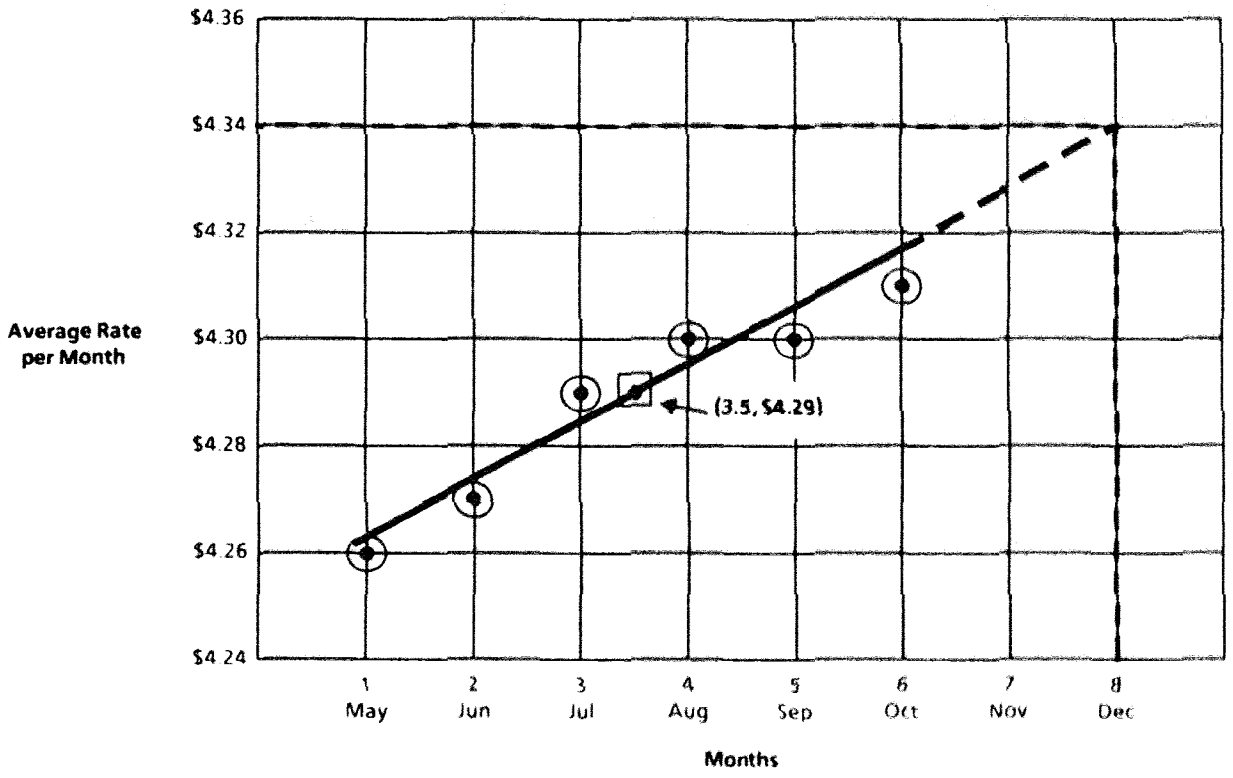


Figure 3-14. Historical labor or rate data.

The fifth step is to forecast the December labor rate by moving vertically from December (month 8) on the X axis to the trend line. At the point on the trend line directly above month 8, move left horizontally to the Y axis and read $4.34. Thus, the forecast rate for the December contract is $4.34.

Forecasting a single rate for a single month can be accomplished relatively easily, using this graphic method. If several labor categories are involved and the contract extends over several months, more computation would be required.

Midpoint of Effort. Time-consuming calculations would be required to determine a wage rate for each month of a contract, multiply that rate by the effort in that month, and add all the monthly labor costs. To save time, an estimate of the cost of direct labor is often extended by multiplying the estimated number of labor hours by a single representative wage rate. To do this, we must determine

the point in time at which to select that representative wage rate. This point in time is important because characteristically the labor rates change with the passage of time.

To use this method, we require a labor-loading schedule. A labor-loading schedule reflects the time sequence of labor hour (day) expenditure. It is estimated by the contractor who considers such factors as the date of award, the production lead time, the delivery schedule, the unit labor hour requirements, and the availability of personnel, equipment, and facilities. A contractor must estimate some sort of labor-loading schedule if his proposal is to make sense, even though the schedule may not be in great detail. The proper point in time at which to determine and apply an average labor rate is the weighted mean time of performance (weighted by the labor-loading schedule), assuming labor rates are projected on a straight line or nearly straight line basis.

Two assumptions are normally made to simplify implementation of this method. The first assumption is that all months are of equal length, 30 days. This eliminates concern over the labor rate changes over shorter months, such as February, and longer months, such as July. The second assumption concerns the scheduling of manpower in a given month. Since information is rarely given concerning scheduling during a month, we normally assume that hours are worked uniformly throughout the month. So the middle of the month is the appropriate point for labor rate application for that month. Because wage rates are assumed to be increasing uniformly throughout the month, the appropriate wage rate to use at the middle of the month is the monthly average wage rate. Consider the direct manufacturing labor-loading schedule proposed by the contractor indicated in table 3-12. The data of table 3-12 is plotted on the rectangular coordinate system of figure 3-14. The labor-loading schedule is obviously symmetrical; that is, the buildup of hours is the mirror image of the phase down. Just as obviously, the labor rate time application point is the middle of August. (Normally, the middle of the month is considered appropriate for rate application.) You would select the average manufacturing labor rate from the straight line that corresponds to the middle of August to extend the manufacturing labor cost. This August 15 rate would be multiplied by the total (2,300) hours. It is important to remember that this approach assumes that rates are projected on a straight line basis. From this illustrative data, you can develop a general approach for calculating the weighted mean time (WMT) or midpoint of effort. Step 1 is to assign consecutive month numbers to each month in which labor hours are expended. The data set of table 3-12 reflects this step. This approach implicitly assigns a month number to the point in time corresponding to the middle of the month.

Table 3-12
Direct Manufacturing Labor-Loading Schedule

Month	May	Jun	Jul	Aug	Sep	Oct	Nov
Contract delivery schedule		10	20	30	30	30	15
Labor-loading schedule (hr)	200	300	400	500	400	300	200
Month no.	1	2	3	4	5	6	7

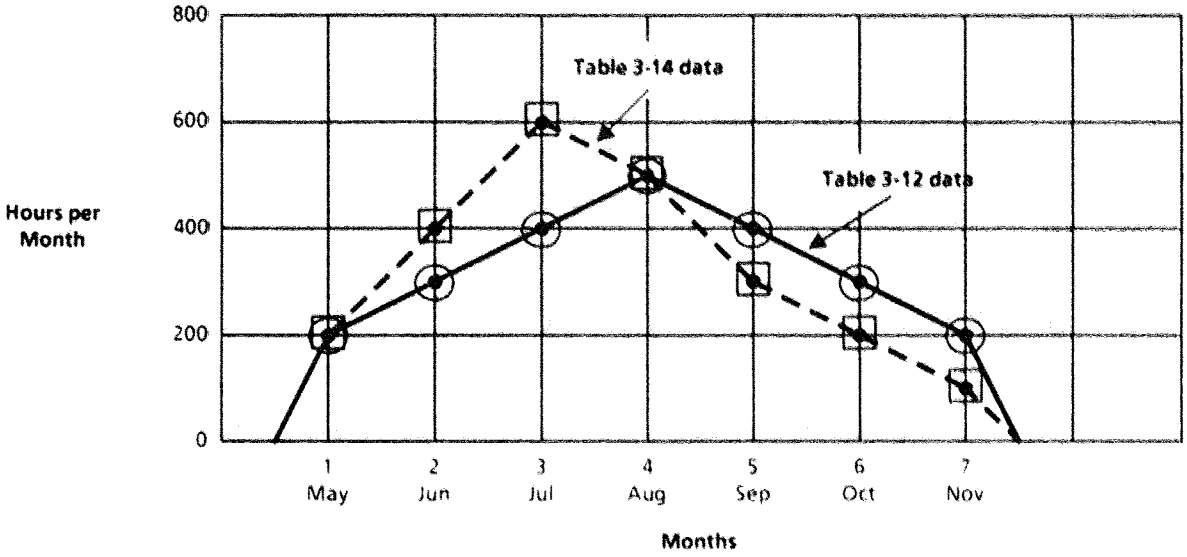


Figure 3-15. Labor-loading schedule.

For example, the point for month two corresponds to June 15. Step 2 is to multiply each month number by the scheduled labor hours for the corresponding month. Step 3 is to add both the scheduled labor hours and the products of Step 2. These are 2,300 and 9,200 respectively, as shown in table 3-13. The final step is to calculate the weighted mean time of performance, or midpoint of effort (weighted by monthly hour expenditures) by dividing the sum of the products by the sum of hours (9,200/2,300 = 4.0). The number 4.0 was the number assigned to the middle of August as previously noted.

Table 3-13
Weighted Mean Time Midpoint of Effort

Month	Month No.	X Labor Hours	= Weighted Hours
May	1	X 200	= 200
Jun	2	X 300	= 600
Jul	3	X 400	= 1,200
Aug	4	X 500	= 2,000
Sep	5	X 400	= 2,000
Oct	6	X 300	= 1,800
Nov	7	X 200	= 1,400
		2,300	9,200
Midpoint of effort = 9,200/2,300 = 4.0 = 15 August			

Seldom will the contractor's labor-loading schedule be symmetrical. More commonly, the schedule will represent a compromise between the factors previously mentioned, such as labor availability and delivery schedule. Accordingly, the labor-loading schedule is likely to be skewed right or left that may significantly affect the proper labor rate application point.

Let us consider a different direct manufacturing labor-loading schedule, but the same contract delivery schedule. This new schedule is set forth in table 3-14 and is also plotted on figure 3-15 to show the difference in labor scheduling.

Table 3-14
Direct Manufacturing Labor-loading Schedule

Month	May	Jun	Jul	Aug	Sep	Oct	Nov
Contract delivery schedule		10	20	30	30	30	15
Labor-loading schedule (hrs)	200	400	600	500	300	200	100
Month no.	1	2	3	4	5	6	7

Table 3-15
Weighted Mean Time Pricing Point

Month	Month No.	X Labor Hours	= Weighted Hours
May	1	X 200	= 200
Jun	2	X 400	= 800
Jul	3	X 600	= 1,800
Aug	4	X 500	= 2,000
Sep	5	X 300	= 1,500
Oct	6	X 200	= 1,200
Nov	7	X 100	= 700
		2,300	8,200
Midpoint of effort = 8,200/2,300 = 3.56			

This data shows that more labor hours will be expended in the first half of the contract period than in the last half of the contract period. Using the same steps as before, the weighted mean time pricing point is calculated in table 3-15. The weighted mean time of 3.56 corresponds to a time point of 2 August. This estimate was made in the following manner. As previously discussed, the number 3 represents the fifteenth day of the third month, in this case July. The .56 indicates that the contract midpoint of effort is that portion of a month later than the fifteenth. Since each month is assumed to have 30 days, we may multiply .56 by 30 to determine the number of days after the fifteenth.

$$.56 \times 30 = 16.8 \text{ or } 17 \text{ days}$$

Seventeen days after 15 July is 2 August (assuming again that all months have 30 days.)

While this difference of approximately one-half of a month may not seem significant in a period of rapidly rising or falling average wage rates, labor rate changes can significantly change forecasted total labor costs. In this case, our contract requires an estimated 2,300 labor hours. Suppose the projected weighted average wage rate for July is $4.35 and for August $4.50. The appropriate wage rate would be:

Month	Monthly Hourly Wage
Jul	$4.35
Aug	$4.50

$4.50 – $4.35 = $.15 per hour difference
.56 X .15 = $.084 increase from 15 July to 2 August
$4.35 + $.084 = $4.434 or $4.43 wage rate of 2 August

The $4.43 wage rate would result in a contract cost of $184, or nearly 2 percent higher than the $4.35 rate.

Exercises (053):

1. Average manufacturing labor rates for the months of April, May, June, July, and August of 19X3 were $7.82, $7.86, $7.96, $8.04, and $8.10, respectively. Forecast the average manufacturing labor rate of production during the months of November and December 19X3, assuming that an equal number of labor hours will be expended in each month and that a linear time series trend line is the best predictor of the future rate.

2. The following direct manufacturing labor-loading and delivery schedules have been furnished for a contract awarded 1 October 19X4:

Month	Oct	Nov	Dec	Jan	Feb	Mar
Contract Delivery Schedule			20	20	40	60
Labor Hours	20	160	165	180	235	340

Using the above figures, on what date does the midpoint (weighted mean time price point) of labor effort fall?

3. The Brown Company produced the following labor hours and wage rate costs:

Month	Labor Hours	Wage Rate
Jan	1,000	$10.00
Feb	400	10.10
Mar	100	10.20
Apr	300	10.30
May	100	10.40
Jun	100	10.50

   a. What is the midpoint (weighted mean date) of labor effort for the contract?

   b. What would be the wage rate at the midpoint?

   c. Using the wage rate at midpoint and the proposed hours for the contract, what would be the labor cost?

   d. What labor cost would you estimate by multiplying the monthly wage rate by the hours for the month and totaling the monthly figures for the contract?

Appendix E

SOURCES OF PRICING INFORMATION

APPENDIX E

SOURCES OF PRICING INFORMATION

This appendix contains an annotated list of price information sources, divided among three broad categories: (1) industrial, (2) governmental, and (3) other.

The listing is by no means complete. For instance, there are over 50 trade journals that publish or maintain pricing information. Many of the most frequently used journals are available in both Government and public libraries. There are highly specialized governmental statistical publications besides those listed, and there are many associations beyond those identified here that may have information useful in special circumstances.

Many of the sources identified in the appendix are primary comparison sources. These sources are weekly or daily price lists for a given commodity or industry. They are compiled through contact with wholesalers or reliance on commodity exchanges (spot prices) and price lists. Because the prices listed are often subject to various trade discounts depending on quantity or type of customer, make certain that the list pertains to the specific item in question and that the price is adjusted for any applicable trade discounts.

Several commodity or industry sources are useful in trend analysis and therefore come under the secondary comparison data category. The remainder of the sources fall into the category of data for auxiliary analyses. Among this group are publications of the Departments of Commerce and Labor that are available through the Government Printing Office. These periodicals are most valuable as indicators of past and future trends; the prices are *averages*, not direct quotations.

Surveys are another source of information for both public and private sectors. Surveys are one of the best measures of changes in industry prices or trends of activities. Although factors such as the political environment, seasonal adjustments, weather, and labor conditions must be taken into account, available business surveys often reveal points of change before activity indexes do. Included here is a reference to the surveys published by the National Association of Purchasing Management (NAPM). In addition, many local NAPM chapters produce surveys on a local level.

COMMODITY AND INDUSTRIAL SOURCES

1. CHEMICALS

a. Chemical Marketing Reporter

This weekly publication offers three sources for price information -- market indexes, current prices of chemicals and related materials, and the week's price changes. The *Chemical Marketing Reporter* (CMR) provides a market index number that reflects the price derived from 10 to 23 representative firms and the quantity each firm produced for its particular industry.

The CMR newspaper also reports on the supply and demand, pricing, and marketing trends of various commodities.

Address: Chemical Marketing Reporter
Subscription Department
100 Church Street
New York, NY 10007
(212) 732-9820

b. Chemical Industry Update (North American Report)

Address: Predicasts, Inc.
11001 Cedar Avenue
Cleveland, OH 44106
(800) 321-6388

2. LUMBER

Random Lengths Lumber and Plywood Market Report Service

This service is published weekly and supplies specific prices on more than 1,000 softwood lumber, structural panel, and other wood product items.

The price guides are in easy-to-read formats with footnotes detailing the geographical areas to which the price applies and, in some cases, other pricing information.

Address: Random Lengths Publications, Inc.
P. O. Box 867
Eugene, OR 97440-0867
(503) 686-9925

3. METALS AND MINERALS

a. The Black Diamond

This magazine is published every other month rather than monthly because the spot prices on solid fuels vary only slightly within any calendar year. The prices for the coal industry are broken down by region and type of coal.

Articles discuss the supply of iron ore, coal, and grain, developments in both the private and public sectors, and increased supply, layoffs, and costly EPA regulations. Articles of this type contain pricing information that can help in assessing the market.

Address: The Black Diamond
343 S. Dearborn St., Room 608
Chicago, IL 60604

b. Iron Age

This weekly publication provides price information on steel, ores, primary metals, and ferrous and nonferrous scrap. The editors of *Iron Age* gather their price information every Monday by calling representative dealers and scrap producers in the various geographic regions.

Address: Iron Age
Chilton Company
Radnor, PA 19089
(215) 964-4312

c. Metals Week

This newsletter provides three main sources of price information: daily prices and the weekly average, weekly prices, and monthly prices. A fourth indicator is the metals week price indexes for base metals, precious metals, and for nonferrous composite. This index graphically displays trends over the past two years.

Address: Metals Week
Attn: Marguerite Stanford
1221 Avenue of the Americas
New York, NY 10020
(212) 512-6126

4. OFFICE SPACE

Black's Office Space Guide

This guide is published six times a year. It contains leasing information for office space for over 1,200 sites in a given region. The guide features articles on a variety of topics, including negotiating a lease, what to look for from cleaning services, and additional tenant costs.

Black's Guide is published for the following regions: New York, Philadelphia, Baltimore/Washington, Atlanta, and Houston.

Address: Black's Guide
P.O. Box 2090
Red Bank, NJ 07701
(201) 842-6060

5. PAPER PRODUCTS

Pulp and Paper Week

This weekly periodical covers prices, production statistics, economics, and technology concerning the paper industry. It lists prices for products in the four categories of paper and paperboard products. Second, the newspaper contains a separate listing of monthly producer price indexes for paper and board products. For trend analysis, these prices are compared with year-ago levels. Third, the prices of current wastepaper products are listed for 12 grades in the New York City, Chicago, Atlanta, and San Francisco-Los Angeles regions.

Pulp and Paper Week receives price data from private and Government sources. These sources vary monthly but all are reputable and known to the industry. Some examples are: the American Paper Institute, National Association of Recycling Industries, Department of Commerce, and American Pulpwood Association.

Address: Pulp & Paper
500 Howard Street
San Francisco, CA 94105
(415) 379-1881

6. PETROLEUM AND GAS

a. Platt's Oilgram Price Report: An International Daily Oil/Gas Price and Marketing Newsletter

This newsletter first informs the reader of the day's developments in the oil market, generally by geography or by corporation. The prices for the various products in the oil market are then listed specifying the source – e.g., Venezuela, Iran, Africa, Gulf, Kuwait, etc., whether waterborne or pipeline, and whether spot price or official list price.

The prices printed in the Oilgram newsletter are actual sale prices, quotations, general offers, and posted prices. The editors receive the data directly from refineries, pipeline terminal operators, and tanker terminal operators for crude oil and products lawfully produced and transported. The prices represent current sales and shipments of each business day.

Address: Platt's Oilgram Price Report
1221 Avenue of the Americas
New York, NY 10020
(212) 512-3016

b. American Paint & Coatings Journal

This weekly publication contains several sources of pricing information. In addition to a regular feature entitled "Paint, raw material price indexes," the Journal includes a section on "The Markets" which analyzes supply and demand as well as expected price increases for various products. The Journal also reports on developments in the paint industry, such as computer networks and new products, and includes a column entitled "Financial Front" which gives a general statement on the financial status of major firms in this field.

Address: American Paint & Coatings Journal
Editorial and Subscription Offices
2911 Washington Ave.
St. Louis, MO 63103
(314) 534-0301

c. American Gas Association Monthly

Address: American Gas Association
1515 Wilson Boulevard
Arlington, VA 22209
(703) 841-8400

d. Weekly Statistical Bulletin

Address: American Petroleum Institute
Division of Statistics
1220 L Street, N.W.
Washington, DC 20005
(202) 682-8525

e. CRA Petroleum Economics Monthly

Address: Charles River Associates, Inc.
John Hancock Tower
200 Clarendon Street
Boston, MA 02116
(617) 266-0500

7. SANITATION AND BUILDING MAINTENANCE

a. Waste Age

This monthly publication covers developments in the solid waste management industry. The topical areas covered include municipal, maintenance, collection, and hauling.

Address: National Solid Waste Management Association
1730 Rhode Island Avenue, N.W., Suite 512
Washington, DC 20036
(202) 659-4613

b. Clean Talk

Address: Writers Publisher Service
1512 Western Avenue
Seattle, WA 98101
(206) 789-2531

c. Building Services Contractor

Address: MacNair-Dorland Co.
101 W. 31st Street
New York, NY 10001
(212) 279-4455

d. Building Services Contractors Association

Address: 301 Maple Avenue, W., Suite 525
Vienna, VA 22180

e. Cleaning Management

Address: Harris Communications
Box 2068
Glendale, CA 91209
(213) 244-1176

f. National Waste News

Address: Newport Publications
4001 Westerly Place
Box W
Newport Beach, CA 92663

g. Professional Sanitation Management

Address: Environmental Management Association
1019 Highland Avenue
Largo, FL 33540
(813) 586-5710

h. Sanitary Maintenance

Address: Trade Press Publishing Co.
2100 W. Florist Avenue
Box 694
Milwaukee, WI 53201
(414) 228-7701

8. TEXTILE INDUSTRIES AND FABRICS

a. Textile Business Outlook. International textile forecasts.

b. Textile Pricing Outlook. Textile petrochemicals, raw materials, fibers, yarns, fabrics, end uses: price forecasts.

Address (a and b both): Statistkon Corp
81 Peach Tree Drive
Box 246
Norwich, NY 11732

GOVERNMENTAL SOURCES

1. AGRICULTURE, DEPARTMENT OF

a. Agriculture Price Reports. Monthly and annual. Commodity prices.

b. Agricultural Statistics. Annual. Commodity prices.

2. BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM

Address: 20th Street and Constitution Avenue, N.W.
Washington, DC 20551

a. Federal Reserve Bulletin. Monthly. Includes economic indexes and data on business; commodity prices; construction, housing, and real estate; economic indexes; labor; manufactures; and retail and wholesale trade.

b. Federal Reserve Banks. Monthly review published by each bank with special reference to its own Federal Reserve District. Economic indexes.

c. Capacity Utilization: Manufacturing and Materials. Monthly.

d. Industrial Production. Monthly.

3. BUREAU OF THE CENSUS, DEPARTMENT OF COMMERCE

In most cases, separate reports of the most recent censuses are available for each state, subject, industry, etc. Complete information on publications of all the censuses and current surveys conducted by the Bureau of the Census appears in the Bureau of the Census Catalog, published annually and available from the Superintendent of Documents.

a. Current Business Reports. Includes a series of three reports listed below.) Subscription price: Domestic – **$37.00** a year; Foreign – **$46.25** a year **[6 issues plus 1 annual]**.

Single copies may be purchased from Customer Services (Publications), Bureau of the Census, Washington, DC 20233.

(1) *Advance Monthly Retail Sales.* Estimated monthly retail sales for the United States; estimated monthly retail sales by kind of business for the United States; percent change in estimated monthly retail sales by kind of business for the United States; estimated monthly retail sales of Group II Companies by kind of business for the United States; and estimated monthly retail sales by selected kinds of business for specified areas and cities.

(2) *Monthly Retail Trade.* Estimated dollar sales volume of all retail stores and those of organizations operating 11 or more retail stores. United States by kind-of-business, current month with comparisons for previous months. Estimated monthly sales of stores of organizations operating 1 to 10 retail stores. Census regions by kind-of-business, for the same periods. Estimated weekly sales during current month of retail grocery stores operated by organizations with 11 or more retail stores, United States. Percentage changes (previous month) in sales, all kinds of business combined, for stores of organizations operating 1 to 10 retail stores, by selected standard metropolitan areas.

(3) *Retail Sales*, Annual Report. Estimates of sales of all retail stores and those of organizations operating 11 or more retail stores, United States and Census regions, by kind-of-business. year-end merchandise inventories, sales-inventory ratios, and accounts receivable balances held by all retail stores and those of organizations operating 11 or more retail stores, by kind-of-business, United States.

b. Current Business Reports. Monthly wholesale trade, sales, and inventories. Subscription price: Domestic – **$18.00** a year; Foreign – **$22.50** a year. Single copy price: Domestic – $1.75 a copy; Foreign – $2.19 a copy.

Contains wholesaler's sales and inventories, by kinds of business and geographic divisions.

c. Current Industrial Reports: Present statistics on total United States shipment, production, or consumption of the following products based on a survey of manufacturers.

(1) *Aluminum Ingot and Mill Products (M33-2).* (Monthly, Preliminary Summary and Summary Issues.) Subscription price: Domestic – **$18.00** a year; Foreign – **$22.50** a year. Single copy price: Domestic – $1.75 a copy; Foreign – $2.20 a copy. Preliminary Summary Issue: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary Issue: Domestic – $2.25 a copy; Foreign – $2.85 a copy.

(2) *Backlog of Orders for Aerospace Companies (MQ37D)* (Quarterly and Summary Issue); *Aircraft Propellers (MA37E)* (Summary Issue); *New Complete Aircraft and Aircraft Engines (M37G)* (Monthly and Summary Issue). Subscription price: Domestic – **$23.00** a year; Foreign – **$28.75** a year. Single copy price: Quarterly Issues: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary Issue: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary Issue: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Monthly Issue: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary Issue: Domestic – $2.25 a copy; Foreign – $2.85 a copy.

(3) *Clay Construction Products (M32D).* (Monthly and Summary Issue.) Subscription price: Domestic – **$20.00** a year; Foreign – **$25.00** a year. Single copy price: Domestic – $1.50 a copy. Foreign – $1.88 a copy. Summary issue: Domestic – $4.00 a copy; Foreign – $5.00 a copy.

(4) *Closures for Containers (M34H).* (Monthly and Summary Issue.) Subscription price: Domestic – **$16.00** a year; Foreign – **$20.00** a year. Single copy price: *Domestic – $1.50 a copy; Foreign – $1.90 a copy.* Summary Issue: Domestic – $2.25 a copy; Foreign – $2.85 a copy.

(5) *Construction Machinery.* (*MQ-35D* Quarterly.) (*MA-35D* Summary Issue.) Subscription price: Domestic – **$9.00** a year; Foreign – **$11.25** a year. Single copy price: Domestic – $2.00 a copy; Foreign – $2.50 a copy. Summary Issue: Domestic – $3.00 a copy; Foreign – $3.75 a copy.

(6) *Copper Controlled Materials (ITA-9008).* (Quarterly and Summary Issue.) Subscription price: Domestic – **$11.00 a year; Foreign – $13.75** a year. Single copy price: Domestic – $2.50 a copy; Foreign – $3.13 a copy. Summary Issue: Domestic – $2.50 a copy. Foreign – $3.13 a copy.

(7) *Electric Lamps (MQ-36B)* (Quarterly and Summary issue.); *Electric Lamps (M-36D).* (Monthly.) Subscription price: Domestic – **$22.00** a year; Foreign – **$27.50** a year. Single copy price: Quarterly Issue: Domestic – $2.00 a copy; Foreign – $2.50 a copy. Summary Issue: Domestic – $2.50 a copy;

Foreign – $3.15 a copy. Monthly issue: Domestic – $1.50 a copy; Foreign – $1.90 a copy.

(8) *Fats and Oils: Oilseed Crushings (M20J), and Production, Consumption and Stocks (M20K).* (Monthly and Summary Issue.) Subscription price: Domestic – **$37.00** a year; Foreign – **$46.25** a year. Single copy price for both subtitles: Domestic – $2.00; Foreign – $2.50. Summary Issue for both subtitles: Domestic – $2.25; Foreign – $2.85.

(9) *Finished Fabrics Production, Inventories, and Unfilled Orders (M22A).* (Monthly.) Subscription price: Domestic – **$15.00** a year; Foreign – **$18.75** a year. Single copy price: Domestic – $1.50 a copy; Foreign – $1.90 a copy.

(10) *Flat Glass (MQ-32A).* (Quarterly and Summary Issue.) Subscription price: Domestic – **$7.50** a year; Foreign – **$9.40** a year. Single copy price: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary issue: Domestic – $1.75 a copy; Foreign – $2.20 a copy.

(11) *Flour Milling Products (M20A).* (Monthly and Summary Issue.) Subscription price: Domestic – **$16.00** a year; Foreign – **$20.00** a year. Single copy price: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary Issue: Domestic – $1.75 a copy; Foreign – $2.20 a copy.

(12) *Fluorescent Lamp Ballasts (MQ-36C).* (Quarterly and Summary Issue.) Subscription price: Domestic – **$7.50** a year; Foreign – **$9.40** a year. Single copy price: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary issue: Domestic – $1.75 a copy; Foreign – $2.20 a copy.

(13) *Footwear (M31A).* (Monthly and Summary Issue.) Subscription price: Domestic – **$16.00** a year; Foreign – **$20.00** a year. Single copy price: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary Issue: Domestic – $2.25 a copy; Foreign – $2.85 a copy.

(14) *Glass Containers (M32G); (MA-32G).* (Monthly and Summary Issue.) Subscription price: Domestic – **$17.00** a year; Foreign – **$21.25** a year. Single copy price: Domestic – $1.75 a copy; Foreign – $2.20 a copy. Summary Issue: Domestic – $2.50 a copy; Foreign – $3.15 a copy.

(15) *Industrial Gases (M28C); (MA-28C).* (Monthly and Summary Issue.) Subscription price: Domestic – **$16.00** a year; Foreign – **$20.00** a year. Single copy price: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary issue: Domestic – $2.00 a copy; Foreign – $2.50 a copy.

(16) *Inorganic Chemicals (M28A); (MA-28A).* (Monthly and Summary Issue.) Subscription price: Domestic – **$16.00** a year; Foreign – **$20.00** a year. Single copy price: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary Issue: Domestic – $3.50 a copy; Foreign – $4.40 a copy.

(17) *Inorganic Fertilizer Materials and Related Products (M28B).* (Monthly and Summary Issue.) Subscription price: Domestic – **$17.00** a year; Foreign – **$21.25** a year. Single copy price: Domestic – $1.75 a copy; Foreign – $2.20 a copy. Summary Issue: Domestic – $1.75 a copy; Foreign – $2.20 a copy.

(18) *Iron and Steel Castings (M33A).* (Monthly and Summary Issue.) Subscription price: Domestic – **$16.00** a year; Foreign – **$20.00** a year. Single copy price: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary Issue: Domestic – $2.50 a copy; Foreign – $3.15 a copy.

(19) *Inventories of Steel Mill Shapes (M33-3).* (Monthly and Summary Issue.) Subscription price: Domestic – **$16.00** a year; Foreign – **$20.00** a year. Single copy price: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary Issue: Domestic – $1.75 a copy; Foreign – $2.20 a copy.

(20) *Manufacturers' Shipments, Inventories, and Orders and United States Department of Commerce News-Advance Report on Durable Goods Manufacturers' Shipments and Orders (M3-1).* (Monthly and Advance Summary Issue.) Subscription price: Domestic – **$28.00** a year; Foreign – **$35.00** a year. Single copy price: Domestic – $1.75 a copy; Foreign – $2.20 a copy. Advance Summary Issue: Domestic – $1.50 a copy; Foreign – $1.90 a copy.

(21) *Metalworking Machinery (MQ-35W).* (Quarterly and Summary Issue.) Subscription price: Domestic – **$9.00** a year; Foreign – **$11.25** a year. Single copy price: Domestic – $2.25 a copy; Foreign – $2.85 a copy. Summary Issue: Domestic – $3.25 a copy; Foreign – $4.10 a copy.

(22) *Nonferrous Castings (M33E).* (Monthly and Summary Issue.) Subscription price: Domestic – **$16.00** a year; Foreign – **$20.00** a year. Single copy price: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary Issue: Domestic – $2.00 a copy; Foreign – $2.50 a copy.

(23) *Paint, Varnish, and Lacquer (M28F); (MA-28F).* (Monthly and Summary Issue.) Subscription price: Domestic – **$16.00** a year; Foreign – **$20.00** a year. Single copy price: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary Issue: Domestic – $1.50 a copy; Foreign – $1.90 a copy.

(24) *Plumbing Fixtures (MQ-34-E).* (Quarterly and Summary Issue.) Subscription price: Domestic – **$8.00** a year; Foreign – **$10.00** a year. Single copy price: Domestic – $1.75 a copy; Foreign – $2.20 a copy. Summary Issue: Domestic – $2.00 a copy; Foreign – $2.50 a copy.

(25) *Refractories (MQ32C); (MA-32C).* (Quarterly and Summary Issue.) Subscription price: Domestic – **$8.00** a year; Foreign – **$10.00** a year. Single copy price: Domestic – $1.75 a copy; Foreign – $1.90 a copy. Summary Issue: Domestic – $2.50 a copy; Foreign – $3.15 a copy.

(26) *Steel Shipping Drums and Pails (MQ-34K).* (Quarterly and Summary Issue.) Subscription price: Domestic – **$7.50** a year; Foreign – **$9.40** a year. Single copy price: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary Issue: Domestic – $1.75 a copy; Foreign – $2.20 a copy.

(27) *Titanium Mill Products: Ingots and Castings (ITA-991).* (Monthly and Summary Issue.) Subscription price: Domestic – **$16.00** a year; Foreign – **$20.00** a year. Single copy price: Domestic – $1.50 a copy; Foreign – $1.90 a copy. Summary Issue: Domestic – $1.50 a copy; Foreign – $1.90 a copy.

d. Statistical Abstract of the United States. Annual. *Guide to data sources.*

4. BUREAU OF ECONOMIC ANALYSIS, DEPARTMENT OF COMMERCE

a. Business Conditions Digest. (Monthly.) Subscription price: Domestic – **$44.00** a year, Foreign – **$55.00** a year. Single copy price: Domestic – $4.00 a copy; Foreign – $5.00 a copy.

Prepared in the Statistical Indicators Division of the Bureau of Economic Analysis. The Digest presents almost 500 economic indicators in a form convenient for analysts with different approaches to the study of current business conditions and prospects (e.g., the national income model, the leading indicators, and anticipations and intentions), as well as for analysts who use combinations of these approaches.

b. Survey of Current Business. (Monthly.) Subscription price: Domestic – **$50.00** a year (priority), **$30.00** a year (nonpriority); Foreign – **$37.50** a year; Foreign airmail distribution available upon request – **$37.50** plus additional cost based upon International Postal Zone. Single copy price: Domestic – $4.75 a copy; Foreign – $5.95 a copy.

This publication provides general information on trends in industry, the business situation outlook, and other items pertinent to the business world. The periodical will provide an overview of the market in which you are operating. It furnishes economic indexes and data on business; construction, housing, and real estate; manufactures; national income and wealth; retail and wholesale trade; and transportation.

5. BUREAU OF LABOR STATISTICS, DEPARTMENT OF LABOR

a. Consumer Price Index Detailed Report. (Monthly.) Subscription price: Domestic – **$25.00** a year; Foreign – **$31.25** a year. Single copy price: Domestic – $4.00 a copy; Foreign – $5.00 a copy.

The Consumer Price Index (CPI) is published by BLS in a news release between the 20th and 25th of the month following the reference month. The release includes a narrative summary and an analysis of major price changes. The information is also published in the *Monthly Labor Review* and in greater detail in the *CPI Detailed Report*. The CPI is based on prices from a fixed mix of goods selected from the following categories: food, clothing, shelter and fuels, transportation, medical services, and other goods and services used in day-to-day living. It may have limited application because it is the converse of the PPI; that is, retail rather than wholesale prices are represented.

b. Current Wage Developments. (Monthly.) Subscription price: Domestic – **$21.00** a year; Foreign – **$26.25** a year. Single copy price: Domestic – $4.50 a copy; Foreign – $5.65 a copy.

Wage and benefit changes resulting from collective bargaining settlements and unilateral management decisions, statistical summaries, and special reports on wage trends.

c. Handbook of Labor Statistics. Annual.

d. Monthly Labor Review. Subscription price: Domestic – **$24.00** a year; Foreign – **$30.00** a year. Single copy price: Domestic – $4.00 a copy; Foreign – $5.00 a copy.

Articles on labor force, wages, prices, productivity, economic growth, and occupational injuries and illnesses. Regular features include a review of developments in industrial relations, book reviews, and current labor statistics.

e. Producer Prices and Price Indexes. (Monthly and annual supplement.) Subscription price: Domestic – **$29.00** a year; Foreign – **$36.25** a year. Single copy price: Domestic – $4.25 a copy; Foreign – $5.31 a copy. Annual Supplement: Domestic – $4.75 a copy; Foreign – $5.94 a copy.

The Producer Price Index (PPI), formerly the Wholesale Price Index, is compiled and issued monthly. The index is first available to the public through a news release, usually in the second week of the month following any specific month. Then a report entitled *Producer Prices and Price Indexes* is issued to give comprehensive coverage on all components of the PPI.

The PPI is a comprehensive report on price movements at the primary market level, arranged by stage of processing and commodity. Supplement contains changes in the relative importance of components of the indexes, revisions in coverage, and annual averages. The *PPI* includes all commodities sold in the primary markets of the United States through commercial transactions. Retail transactions are not included. Civilian Government purchases are included, but military products are excluded.

Data are gathered through a confidential questionnaire. The prices represent the first transaction price, f.o.b. production or central marketing point. In the case or raw materials, subsequent transactions of the semifinished and finished goods are also included in the index.

The following is a simplified formula used to compute the PPI from the data collected:

$$I_i = \frac{\left(\sum QaP_i\right)}{\left(\sum QaP_o\right)} \times 100$$

where I_i is the index price on a given date

P_o is the price of a commodity in the comparison period

P_i is the current price

Qa represents the quantity shipped during the weight-base period

Note: Σ means multiply the numbers inside the parentheses and add all the sums of each multiplication.

The PPI Report also gives general pricing information.

f. Area Wage Surveys. (70 surveys throughout the year.) Subscription price: Domestic – **$88.00** a year ; Foreign – **$110.00** a year; single surveys vary in price.

These bulletins report on earnings in 70 major metropolitan areas for occupations common to a wide variety of establishments. Coverage includes office clerical, professional and

technical, maintenance, custodial, and material movement occupations. Information on employee benefits is provided for about one-third of the areas each year.

6. BUREAU OF MINES, DEPARTMENT OF INTERIOR

a. Mineral Commodity Summaries. Annual.

b. Mineral Industry Surveys. Publications available from Bureau of Mines, Publication Distribution Branch, 4800 Forbes Avenue, Pittsburgh, PA 15213. Surveys of molybdenum, copper, gold and silver, iron, zinc, fluorspar, and sodium compounds are examples.

c. Minerals and Materials. Bimonthly. Publication available from the U.S. Department of Interior, Bureau of Mines, 2401 E Street, N.W., Washington, DC 20241.

7. COMMERCE, DEPARTMENT OF

Guide to the 1982 Economic Censuses and Related Statistics

The guide provides an overview of economic censuses taken in years ending in "2" and "7" – i.e., every five years. The 1982 censuses cover retail and wholesale trade, service industries, transportation, and economic activity in Puerto Rico and other outlying areas under the jurisdiction of the United States.

The censuses provide information to government, business, industry, and academics, and for general public use. For example, the Federal Reserve Board uses the data from the Current Industrial Reports in producing its monthly index of industrial production. The Department of Labor uses census statistics in its measurement of productivity and as weights for the Producer Price Index.

8. COUNCIL OF ECONOMIC ADVISORS

a. Economic Report of the President. Annual.

9. ENERGY INFORMATION ADMINISTRATION, DEPARTMENT OF ENERGY

a. Coal Production. Annual.

b. Electric Power Monthly. Subscription price: Domestic – **$32.00** a year; Foreign – **$40.00** a year. Single copy price: Domestic – $3.00 a copy; Foreign – $3.75 a copy.

Presents monthly summaries of electric utility statistics on net operation, net energy for load, peak load and net capability, fuel consumption, fuel stocks, fuel deliveries, and prices.

c. Electric Power Quarterly. Subscription price: Domestic – **$22.00** a year; Foreign – **$27.50** a year. Single copy price: Domestic – $6.00 a copy; Foreign – $7.50 a copy.

Provides comprehensive information on the electric utility industry's cost, quantity and quality of fossil fuel receipts, net generations, fuel consumption, and fuel stocks.

d. Natural Gas Monthly. (Monthly.) Subscription price: Domestic – **$56.00** a year; Foreign – **$70.00** a year. Single copy price: Domestic – $5.00 a copy; Foreign – $6.25 a copy.

Provides monthly and annual State, and national data on production, storage, imports, exports, and consumption of natural gas. Also contains selected data on major interstate pipeline companies and on filings with the Federal Energy Regulatory Commission.

e. Petroleum Marketing Monthly. (Monthly.) Subscription price: Domestic – **$47.00** a year; Foreign – **$58.75** a year. Single copy price: Domestic – $4.25 a copy; Foreign – $5.32 a copy.

Provides current information and statistical data about a variety of petroleum products, including motor gasoline, distillants residuals, jet fuel, kerosene, and propane.

f. Petroleum Supply Monthly. (Monthly.) Subscription price: Domestic – **$46.00** a year; Foreign – **$57.50** a year. Single copy price: Domestic – $3.75 a copy; Foreign – $4.70 a copy.

Consisting chiefly of tables and statistics, this publication also provides articles to help the reader understand and interpret the petroleum statistics.

g. Quarterly Coal Report. Subscription price: Domestic – **$17.00** a year; Foreign – **$21.25** a year. Single copy price: Domestic – $4.75 a year; Foreign – $5.94 a copy.

Written for a wide audience – including Congress, Federal, and State agencies, the coal industry, and the general public – the quarterly report provides comprehensive information about coal production, exports, imports, receipts, consumption, and stocks in the United States.

h. Weekly Coal Production. Subscription price: Domestic – **$69.00** a year; Foreign – **$86.25** a year; single copies vary in price.

Gives data on United States production of bituminous, lignite, and anthracite coals.

10. SMALL BUSINESS ADMINISTRATION

a. Annual Report

11. CONGRESS

a. Economic Indicators. (Monthly.) Subscription price: Domestic – **$27.00** a year; Foreign – **$33.75** a year. Single copy price: Domestic – $2.50 a copy; Foreign – $3.13 a copy.

Gives pertinent economic information on prices, wages, production, business activity, purchasing power, credit, money, and Federal finance.

OTHER SOURCES

1. AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA
   a. Aerospace Economic Indicators. Quarterly.
   b. Average Hourly and Weekly Earnings in the Aerospace Industry. Monthly.
   c. Average Weekly Hours and Overtime Hours in the Aerospace Industry. Monthly.
   d. Employment in the Aerospace Industry. Monthly.
2. AMERICAN GAS ASSOCIATION
   a. Gas Facts. Annual.
   b. Quarterly Report on Gas Industry Operations
3. AMERICAN IRON AND STEEL INSTITUTE
   a. Annual Statistical Report
4. AMERICAN METAL MARKET
   a. Metal Statistics. Annual.
5. COMMODITY RESEARCH BUREAU, INC.
   a. Commodity Yearbook. Annual.
   b. Commodity Yearbook Statistical Abstract Service. Quarterly (3 editions annually).
6. THE CONFERENCE BOARD
   a. The Conference Board Statistical Bulletin. Monthly.
7. EDISON ELECTRIC INSTITUTE
   a. Statistical Yearbook of the Electric Utility Industry. Annual.
8. ELECTRONIC INDUSTRIES ASSOCIATION
   a. Electronic Market Data Book. Annual
   b. Electronic Market Trends. Monthly.
9. THE INDEPENDENT PETROLEUM ASSOCIATION OF AMERICA
   a. U.S. Wholesale Prices of Crude Oil and Principal Products. Monthly.

10. MORGAN GUARANTY TRUST COMPANY OF NEW YORK

a. The Morgan Guaranty Survey. Monthly. (Wholesale price index.)

11. PENNWELL PUBLISHING CO.

a. The Oil and Gas Journal. Weekly.

12. REPORT ON BUSINESS

The National Association of Purchasing Management (NAPM) publishes a monthly report compiled from survey questionnaire of a committee of 250 purchasing managers from various geographic regions representing companies in 21 different industries in 40 states. The *Report on Business* graphically depicts general increases and decreases in price based on the data received. Further, specific commodities in short supply or showing significant changes during the month are discussed. A third feature of the *Report* is the Commodity Reports, in which subcategories of products, such as paper and packaging containers, are discussed in terms of supply and demand and price changes.

13. THE WALL STREET JOURNAL

The Wall Street Journal's Commodities section contains daily price information on items in the following categories: grains and feeds, foods, fats and oils, fibers and textiles, metals, miscellaneous (hides, newspapers, and rubber), precious metals, and oil. The prices are quoted for the day, for the previous day, and for one year ago. Further detail concerning bid or asked price, dealer or wholesale, f.o.b., and the region from which the price was quoted is provided by notations.

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