

PRICING DECISION

Introduction:

This chapter discusses the role that product costs play in setting sales prices. For most companies operating in competitive markets, as well as for unregulated monopolies (such as a pharmaceutical company that has a drug under patent with no close substitutes), the most important factor in setting the profit-maximizing sales price is the elasticity of demand (the sales demand as a function of price). The elasticity of demand is affected by such factors as competitors' prices, consumers' preferences, and the availability of substitute goods. Ignoring the elasticity of demand, and setting the sales price based on cost of production (such as full cost plus 30%) is generally a really bad idea.

Nevertheless, production costs do play a supporting role in setting prices generally, and for a relatively small number of products and markets, production costs play the lead role.

Short-Run Pricing Decisions:

Occasionally, a company faces a sales opportunity for which the only relevant costs and revenues are the incremental costs and revenues for that one transaction. In this situation, accurate information about marginal costs are important, because the company should be willing to set the sales price at any amount in excess of marginal cost (marginal production cost plus any marginal non-manufacturing costs such as distribution and marketing costs). Typically, marginal production costs consist of all variable production costs.

These opportunities probably occur relatively infrequently (certainly less often, for example, than one might infer from Eliyahu Goldratt's popular business novel *The Goal*). Among the conditions that are typically required for the optimal sales price to depend *only* on the variable costs of the one transaction the company now faces are: (1) excess production capacity (so that the sales order does not displace existing orders); (2) a one-time customer (since the price the customer is willing to pay in the future might depend on the price the customer pays today); and (3) a customer not in the company's normal sales channels (because if other customers learn that the company has given another customer a price break, they are likely to demand similar concessions).

Intermediate-Run Pricing Decisions:

Over the course of several months to a year or two, costs associated with many fixed assets are unavoidable, but the company can make meaningful decisions about product prices, production levels and product mix. For these decisions, microeconomics provides analytical tools for jointly determining the optimal sales price and production level to maximize profits. The solution to this problem depends on the elasticity of demand and also on variable production costs (marginal production cost, in the terminology of economics).

Long-Run Pricing Decisions:

In the long-run, all fixed costs become relevant costs. Factories and warehouses can be built, rebuilt, purchased or sold. Salaried employees can be hired, fired, reassigned, or given incentives to resign or retire. Long-term leases and other contracts come up for renewal. In the long-run, the company's revenues must exceed its costs, if it is to survive. Therefore, the management accounting system should provide managers information about whether sales prices for products are sufficiently in excess of their full cost of production to cover non-manufacturing costs and still provide the company a reasonable rate of return. Management should consider dropping products that are unable to cover their full costs (manufacturing costs plus non-manufacturing costs), unless there are extenuating circumstances such as a product that serves as a "loss leader" (e.g., sell the inkjet printer at or near cost, and make high profit margins on sales of ink cartridges). The timing for eliminating unprofitable products might depend on when the costs of fixed assets associated with those products can be avoided.

Pricing Decisions when the Demand Function is Unknown:

For new products, the demand function is often unpredictable. Also, important macro-economic, political and technological changes can create significant uncertainty about the demand function. In these situations, the sales price might be based on cost of production. As

better information about the demand function becomes known over time, this information should then be incorporated into pricing decisions.

Regulated Monopolies:

Natural monopolies that provide essential services are usually regulated. Traditionally, utility companies that provide electricity, natural gas and telephone service have been natural monopolies in their local service areas. When these services are provided by a for-profit company, as opposed to a municipality or cooperative, a regulatory agency determines the rates that the company is allowed to charge customers, in order to cover its costs and earn a reasonable return on its investment. Hence, rate-setting requires the determination of the utility company's cost of providing the service. In effect, sales prices for the utility company are based on its costs.

In the telecommunications industry, changes in technology have created competition that did not exist before. For example, one can easily purchase cellular phone service from one of a number of providers, and entirely avoid the company that provides local land-line telephone service. Changes in laws and technology permit customers to purchase long distance telephone service from any of a number of providers. Attempts have been made to deregulate the electric and natural gas markets, although the results have been mixed with respect to consumer welfare. When an industry that was previously a natural monopoly becomes a competitive market, regulatory rate-setting is no longer necessary.

Cost-Plus Contracts:

In a few specialized markets, sales prices are often based on cost. The U.S. Defense Department frequently contracts with companies for the design and manufacture of military equipment using cost-plus contracts: the contractor receives reimbursement for production costs plus a negotiated profit. Cost-plus contracts are useful when it is difficult for the manufacturer to predict production costs, when product specifications may have to change after the contract is signed, or when there is only one logical supplier. Military equipment with long design and

production lead-times, such as complex weapons systems and aircraft, often meet one or more of these criteria.

An important purpose of cost-plus contracts is to transfer risk from the seller to the buyer. For example, given the uncertainty surrounding the cost of building the next-generation Navy submarine, it is possible that no company capable of undertaking the project would be willing to do so, if the company were required to commit to a price beforehand. A significant cost overrun could bankrupt the company. Conversely, if the contracted price significantly exceeded actual cost, the large profits that would be earned by the defense contractor could cause the military considerable political embarrassment. Cost-plus contracts avoid both issues by ensuring that the defense contractor earns a reasonable profit.

Medicare, which was discussed earlier, is another government program that originally used a cost-plus reimbursement scheme. Another example is Federal support of scientific research. National Science Foundation grants usually allow grant money to be used to cover the direct costs of the research as well as a share of institutional overhead. The indirect cost reimbursement rate is based on estimates of the indirect costs of the grant recipient. In other words, the indirect cost reimbursement rate is institution-specific. When the researcher is employed by a university, which is often the case, these indirect costs can include general and administrative expenses that sometimes appear far removed from the researcher and department that receives the grant.

In the entertainment industry, actors and writers sometimes sign contracts that provide them a percentage of the profits from a movie or television show. These contracts are not cost-plus contracts, but they do incorporate cost in the determination of the amount to be received by the actor or writer. Risk sharing in this situation does not apply so much to uncertainty about the cost of production, as to uncertainty about revenue. These contracts allow the actor or writer to share in the upside potential of the project.

Disputes under Cost-Plus Contracts:

There are fairly complex guidelines for how government contractors can allocate overhead. These rules have been promulgated by the Cost Accounting Standards Board. Within these guidelines, contractors that are working on a mix of cost-plus contracts and traditional fixed fee contracts have incentives to allocate as much overhead as possible to the cost-plus contracts and away from fixed fee contracts. The fixed fee contracts could represent sales to government agencies or to commercial enterprises. To the extent that overhead is allocated to the cost-plus contracts, the contractor will be reimbursed for those overhead costs. Headlines sometimes report apparently excessive charges under cost-plus contracts, such as \$500 toilet seats for military airplanes. Usually, these amounts reflect the allocation of large amounts of overhead, including research and design, to a relatively small production run and they are not improper.

On the other hand, contractors also have incentives to shift **direct** costs from fixed fee contracts to cost-plus contracts, and this type of cost-shifting constitutes fraud. Several cases have arisen over the past few decades in which defense contractors have been accused of this practice, as well as other practices involving the improper treatment of overhead.

In the 1990s, Stanford University came under public scrutiny for allegedly including in its indirect cost pool, for the purpose of determining reimbursement rates on Federal grants, the cost of depreciation on a yacht that had been donated to the University, and the cost of expensive linen at the University President's house. The inclusion of these costs was apparently not a concerted effort to increase the reimbursement rate. In point of fact, however, Stanford had one of the highest reimbursement rates of any university in the nation, and Stanford put on seminars, attended by personnel from other universities, on how to maximize reimbursement under Federal grants. At one point, University President Donald Kennedy remarked "I expect our controllers to do their best on behalf of the university." There were Congressional hearings, and the scandal prompted Kennedy to resign.

There have been so many public allegations over the years by actors and writers that film and television studios overstate costs, and thus significantly reduce or completely eliminate the incentive component of the actor's or writer's contract, that it is difficult to understand why artists continue to sign these contracts. Stan Lee, creator of Spiderman, sued Marvel in 2002, claiming that his contract entitled him to 10% of Marvel's profits whenever his characters were used in film or television. The lawsuit asserted that the first Spiderman movie had grossed more

than \$400 million, that Marvel had reported millions of dollars in earnings from the movie, but that Lee had not received a penny. Marvel issued a statement that Stan Lee was well-compensated for his contributions to the industry, and that Marvel was in compliance with its contract with Lee, which probably meant that there were no “profits” from the movie as “profits” are defined in the company’s contract with Lee.

Actors and writers would be on surer ground signing contracts based on a percentage of revenues, which are less susceptible to manipulation than profits.

Intra-Company Sales:

The cost of production is often used as the basis for setting the sales price for internal sales of product that sometimes occur from one part of a company to another part of the same company. These internal sales are called transfers, and the topic is referred to as transfer pricing. Chapter 23 discusses transfer pricing. Most companies that use a cost-based transfer price include an allocation of fixed costs in the determination of cost.

The role of cost in the legal resolution of disputes over pricing:

For the most part, aside from the exceptions noted above, most companies conducting business in the U.S. are free to charge whatever they want for their products. There are, however, laws that prevent certain types of price discrimination and predatory pricing practices. Price discrimination consists of charging different customers different amounts for the same product. Predatory pricing consists of charging low prices in an attempt to drive a competitor out of business (or out of the local market).

The Sherman Act of 1890 prohibits companies from monopolizing trade, conspiring in restraint of trade, or engaging in predatory pricing. The Clayton Act of 1914 elaborated on the Sherman Act, and made price discrimination illegal. The concern at that time was that manufacturers were granting lower prices to large customers, and the purpose of the Clayton Act was to encourage competition among retailers by allowing small retailers to buy merchandise at the

same price as large retailers. In effect, the concern that Congress was addressing at the beginning of the last century mirrors the concern of many people today about the proliferation of large, national retail chains like Wal-Mart at the expense of small, locally-owned “Main Street” stores.

The Clayton Act was amended by the Robinson-Patman Act in 1936. This Act delineates three defenses against a charge of price discrimination. The first defense is that the manufacturer is allowed to offer volume discounts. This defense gives large retailers a great advantage. The second defense is that price can reflect differences in manufacturing costs, which might arise, for example, from different product specifications by different customers. The third defense is that manufacturers are allowed to meet competitors’ prices, even if doing so results in charging lower prices in one geographic market (where the competitor has a presence) than in other locations.

The resolution of disputes that arise under these laws usually involves a determination of the manufacturer’s costs. However, the Congressional Acts identified above do not specify how cost is to be determined. Hence, this issue was left to the courts. Case law has resulted in a determination that marginal cost is to be used.

Considering the three defenses specified in the Robinson-Patman Act, the courts’ determination of how costs are to be calculated, and the fact that price discrimination applies only to manufacturing companies (not to service sector companies), it would seem very difficult for any plaintiff to prevail in a lawsuit alleging either price discrimination or predatory pricing. Recently, the Supreme Court defined predatory pricing as a situation in which a company sets prices below average variable cost, with plans to raise prices later to recover the temporary losses (*Brooke Group Ltd. vs. Brown & Williamson Tobacco Corp.*, 1993). The Supreme Court then interpreted economic theory as indicating that predatory pricing does not work. In effect, the Court appears to have asserted that predatory pricing cannot succeed, and that therefore, it is unreasonable to assert that any company would engage in it. In the subsequent 37 predatory pricing cases, the defendants prevailed. In 2001, a Federal judge threw out a high-profile legal action brought by the Justice Department against American Airlines that alleged predatory pricing in the Dallas/Fort Worth market.

Predatory pricing also applies to international trade. Anti-dumping laws preclude foreign companies from dumping product onto domestic markets, which refers to selling large quantities of product at unusually low prices. Such actions by foreign competitors can drive domestic industries out of business, and in fact, there are frequent accusations that this is the intent of dumping. U.S. anti-dumping laws stipulate that the import price into the U.S. cannot be lower than the cost of production. The World Trade Organization found that the number of cases brought under anti-dumping laws increased 35% from 1995 to 2000.

The Downward Demand Spiral:

If sales price is established based on cost of production, and if cost of production includes an allocation of fixed costs, then the cost-based price will be a decreasing function of sales volume. Thus, if sales volume increases, the per-unit sales price decreases; and if sales volume decreases, the per-unit sales price increases. If in addition, the demand function is decreasing in price, which normally would be the case, then this situation can result in something called the **downward demand spiral** (occasionally called the **death spiral**; we accountants are so dramatic).

Start with either a decrease in demand for the product, or an increase in fixed costs. The downward demand spiral refers to the reduction in demand that can occur if prices are raised to recover the higher fixed cost per unit of product, which in turn induces another price increase, because fixed costs must be recovered from a smaller customer base, which leads to another drop in demand, etc., etc.

The downward demand spiral does not occur often, and when it does, it probably occurs most frequently for “internal sales” by service departments. In this setting, service departments might view demand as relatively inelastic, when in fact, user departments might be surprisingly creative in finding either less costly external service providers, or alternative in-house solutions. For example, there is a story about a downward demand spiral that supposedly occurred in the typing pool of a high-tech company in the 1970s or 1980s. The typing pool charged out its services on a per-page basis at a time when managers were becoming increasingly proficient with desktop computers and word-processing software. As managers became more proficient with the technology, their demand for the typing pool decreased, which resulted in higher per-

page costs, which prompted more managers to avoid the typing pool, to the point where the cost-per-page was ridiculously high.

ALLOCATION OF SERVICE DEPARTMENT COSTS

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Introduction:

Many companies in all sectors of the economy, and not-for-profit and governmental organizations as well, allocate service department costs to “production” or user departments, and ultimately to the products and services that they provide. For example, hospitals use sophisticated methods for allocating costs of service departments such as Housekeeping, Patient Admissions, and Medical Records to patient wards and outpatient services, and then to individual patients. Historically, these allocations were important to hospitals because Medicare reimbursement was based on actual costs. To the extent that the hospital allocated service department costs to Medicare patients, Medicare covered these costs.

Companies that allocate service department costs do so for one or more of the following reasons:

1. To provide more accurate product cost information. Allocating service department costs to production departments, and then to products, recognizes that these services constitute an input in the production process.
2. To improve decisions about resource utilization. By imposing on division managers the cost of the service department resources that they use, division managers are encouraged to use these resources only to the extent that their benefit exceeds their cost.
3. To ration limited resources. When production departments have some discretion over their utilization of a service department resource, charging production departments for the resource usually results in less demand for it than if the resource were “free” to the production departments.

The motivation for the first reason, to provide more accurate product cost information, can be to improve decision-making within the organization, to improve the quality of external financial reporting, or to comply with contractual agreements in regulatory settings where cost-based pricing is used. As discussed above, Medicare was historically a cost-based reimbursement scheme. As another example, defense contractors that provide the U.S. military “big ticket” items such as airplanes and ships often operate under cost-plus contracts, under which they are reimbursed for their production costs plus a guaranteed profit. In such settings, the calculation of cost includes a reasonable allocation of overhead, including overhead from service departments.

The distinction between the second and third reasons is important in the context of fixed versus variable costs. In connection with the second reason, to improve decisions about resource utilization, from the company’s perspective, a division manager making a short-term decision about whether to utilize service department resources should incorporate into that decision the service department’s marginal costs, which are usually the variable costs. The manager should ignore the service department’s fixed costs if these costs will not be affected by the manager’s decision. This reasoning suggests that only the service department’s variable costs should be charged out.

However, in connection with the third reason, to ration a scarce resource, if the service department controls a fixed asset, and if demand for the asset exceeds capacity, charging users a fee for the asset allows the service department to balance demand with supply. The fee need not relate to the cost of obtaining the asset; rather, it is a mechanism for managing demand. Examples would be charging departments a “rental fee” for their use of vehicles from the motor pool, or for their use of a corporate conference facility.

Service department costs can be allocated based on actual rates or budgeted rates. Actual rates ensure that all service department costs are allocated. Budgeted rates provide service department managers incentives to control costs, and also provide user departments more accurate information about service department billing rates for planning purposes. In either case, service department costs should be allocated using an allocation base that reflects a cause-and-effect relationship, whenever possible. Here are some examples:

- Allocate building maintenance costs based on square footage;
- Allocate costs of the company airplane based on miles flown;
- Allocate costs of the data processing department based on CPU time.

In some cases, companies benefit from allocating fixed costs using a different allocation base than variable costs. For example, fixed costs might be allocated based on an estimate of long-term usage by the production departments.

Historically, there have been three alternative methods for allocating service department costs. These methods differ in the extent to which they account for the fact that service departments provide services to other service departments as well as to production departments:

The Direct Method:

The **direct method** is the most widely-used method. This method allocates each service department’s total costs directly to the production departments, and ignores the fact that service departments may also provide services to other service departments.

Example: Machining and Assembly are the only production departments that used the services of the Human Resources Department in March. Costs from Human Resources are allocated based on the number of new hires. Machining hired seven employees in March and Assembly hired three employees. Human Resources incurred total costs of \$93,000 in March.

Allocation of H.R. Department costs to Machining: $70\% \text{ of } \$93,000 = \$65,100$

Allocation of H.R. Department costs to Assembly: $30\% \text{ of } \$93,000 = \$27,900$

The characteristic feature of the direct method is that no information is necessary about whether any service departments utilized services of the Human Resources Department. It does not matter whether no other service department hired anybody, or whether three other service departments each hired five employees (implying that more than 50% of the hiring occurred in the service departments). Under the direct method, service department to service department services are ignored, and no costs are allocated from one service department to another.

The Step-Down Method:

The **step-down method** is also called the **sequential method**. This method allocates the costs of some service departments to other service departments, but once a service department's costs have been allocated, no subsequent costs are allocated back to it.

The choice of which department to start with is important. The sequence in which the service departments are allocated usually effects the ultimate allocation of costs to the production departments, in that some production departments gain and some lose when the sequence is changed. Hence, production department managers usually have preferences over the sequence. The most defensible sequence is to start with the service department that provides the highest percentage of its total services to other service departments, or the service department that provides services to the most number of service departments, or the service department with the highest costs, or some similar criterion.

Example: Human Resources (H.R.), Data Processing (D.P.), and Risk Management (R.M.) provide services to the Machining and Assembly production departments, and in some cases, the service departments also provide services to each other:

<u>Total Cost</u>	<u>Service</u>	<u>% of services provided by the service department listed at left to:</u>				
	<u>Dept</u>	<u>H.R.</u>	<u>D.P.</u>	<u>R.M.</u>	<u>Machining</u>	<u>Assembly</u>
\$ 80,000	H.R.	--	20%	10%	40%	30%
120,000	D.P.	8%	--	7%	30%	55%
<u>40,000</u>	R.M.	--	--	--	50%	50%
<u>\$240,000</u>						

The amounts in the far left column are the costs incurred by each service department. Any services that a department provides to itself are ignored, so the intersection of the row and column for each service department shows zero. The rows sum to 100%, so that all services provided by each service department are charged out.

The company decides to allocate the costs of Human Resources first, because it provides services to two other service departments, and provides a greater percentage of its services to other service departments. However, a case could be made to allocate Data Processing first, because it has greater total costs than either of the other two service departments. In any case, the company decides to allocate Data Processing second.

In the table below, the row for each service department allocates the total costs in that department (the original costs incurred by the department plus any costs allocated to it from the previous allocation of other service departments) to the production departments as well as to any service departments that have not yet been allocated.

	H.R.	D.P.	R.M.	Machining	Assembly
Costs prior to allocation	\$ 80,000	\$120,000	\$40,000	--	--
Allocation of H.R.	<u>(\$ 80,000)</u>	16,000	8,000	\$32,000	\$24,000
Allocation of D.P.		<u>(136,000)</u>	10,348	44,348	81,304
Allocation of R.M.			<u>(58,348)</u>	<u>29,174</u>	<u>29,174</u>
	<u>0</u>	<u>0</u>	<u>0</u>	<u>\$105,522</u>	<u>\$134,478</u>

After the first service department has been allocated, in order to derive the percentages to apply to the production departments and any remaining service departments, it is necessary to “normalize” these percentages so that they sum to 100%. For example, after H.R. has been allocated, no costs from D.P. can be allocated back to H.R. The percentages for the remaining service and production departments sum to 92% (7% + 30% + 55%), not 100%. Therefore, these percentages are normalized as follows:

Risk Management:	$7\% \div 92\%$	=	7.61%
Machining:	$30\% \div 92\%$	=	32.61%
Assembly:	$55\% \div 92\%$	=	<u>59.78%</u>
Total:			<u>100.00%</u>

For example, in the table above, 59.78% of \$136,000 (= \$81,304) is allocated to Assembly, not 55%.

The characteristic feature of the step-down method is that once the costs of a service department have been allocated, no costs are allocated back to that service department. As can be seen by adding \$105,522 and \$134,478, all \$240,000 incurred by the service departments are ultimately allocated to the two production departments. The intermediate allocations from service department to service department improve the accuracy of those final allocations.

The Reciprocal Method:

The **reciprocal method** is the most accurate of the three methods for allocating service department costs, because it recognizes reciprocal services among service departments. It is also the most complicated method, because it requires solving a set of simultaneous linear equations.

Using the data from the step-down method example, the simultaneous equations are:

$$\text{H.R.} = \$ 80,000 + (0.08 \times \text{D.P.})$$

$$\text{D.P.} = \$ 120,000 + (0.20 \times \text{H.R.})$$

$$\text{R.M.} = \$ 40,000 + (0.10 \times \text{H.R.}) + (0.07 \times \text{D.P.})$$

Where the variables H.R., D.P. and R.M. represent the total costs to allocate from each of these service departments. For example, Human Resources receives services from Data Processing, but not from Risk Management. 8% of the services that Data Processing provides, it provides to Human Resources. Therefore, the total costs allocated from Human Resources should include not only the \$80,000 incurred in that department, but also 8% of the costs incurred by Data Processing. Solving for the three unknowns (which can be performed using spreadsheet software):

$$\text{H.R.} = \$ 91,057$$

$$\text{D.P.} = \$ 138,211$$

$$\text{R.M.} = \$ 58,781$$

Hence, costs are allocated as follows:

	H.R.	D.P.	R.M.	Machining	Assembly
Costs prior to allocation	\$80,000	\$120,000	\$40,000	--	--
Allocation of H.R.	(\$91,057)	18,211	9,106	\$36,423	\$ 27,317
Allocation of D.P.	<u>11,057</u>	(138,211)	9,675	41,463	76,016
Allocation of R.M.			(58,781)	<u>29,390</u>	<u>29,390</u>
	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$107,276</u>	<u>\$132,723</u>

To illustrate the derivation of the amounts in this table, the \$36,423 that is allocated from Human Resources to Machining is 40% of H.R.'s total cost of \$91,057.

Summary of Service Department Cost Allocation Methods:

The direct method and step-down method have no advantages over the reciprocal method except for their simplicity, and the step-down method is sometimes not very simple. Nevertheless, the reciprocal method is not widely used. Given advances in computing power, the reciprocal method would seem to be accessible to many companies that are not using it. Presumably, these companies believe that the benefits obtained from more accurate service department cost allocations do not justify the costs required to implement the reciprocal method. In fact, many companies do not allocate service department costs at all, either because they do not think these allocations are beneficial, or because they do not believe that the benefits justify the costs.

