Determining The 'Plus' In Cost-Plus Pricing: A Time-Based Management Approach

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Abstract

This study focuses on methods for determining the contribution margin in cost-plus pricing (CPP). The key assumption is that, in manufacturing companies, the use of contribution margin per hour in pricing and profitability analyses provides stronger adherence to the goal of optimizing global earnings than the percentage contribution margin approach.

Three different methodological approaches were adopted in this study: (a) review of relevant literature for pricing, (b) action research (single case study in a manufacturing company aiming at understanding the environment complexity of pricing) and (c) critical reflections to shape a conceptual proposal.

Findings show that a pricing model based on the contribution margin per hour offers stronger adherence for optimizing global earnings if compared to contribution margin in percentage terms. The evidence from this study fills, therefore, an important void in the pricing literature.

Keywords

Pricing
Cost-Plus Pricing (CPP)
Contribution Margin
Cost Accounting
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Introduction

Product price planning is fundamental to compliance with strategic organizational guidelines and the achievement of business objectives. Tung et al. (1997) noted that the fastest and most effective way for a company to reach maximum profits is by being able to correctly establish its price. Rowley (1997) analysed the principles of price and pricing policy for the information marketplace observing that no one should think that the area of pricing, particularly of newer forms of information products and services, is stable or that there are any simple guidelines. Megliorini and Guerreiro (2004) studied Brazilian manufacturers of customized goods to assess the importance that managers attached to various competitive factors and found that the sales price was considered a very significant factor in attracting orders in this industry.

Price is an important variable in such critical dimensions such as increased profitability, enhanced market share, desired product image, and signalling of product quality. A considerable number of authors have suggested the importance of pricing for both profitability and long term survival of firms. Avlonitis and Indounas (2007) recall that pricing is a very important element in the marketing mix for it is the only one which produces revenue. All the other parts of the marketing mix are cost driven.

Since decades ago, many studies have investigated various aspects of price planning (Shipley, 1981; Ratnatunga, 1985; Ratnatunga, 1987; Jobber and Hooley, 1987; Ratnatunga, et. al., 1994). Shipley (1981) studied British manufacturing firms and a general finding was that pricing and profit objectives vary to a greater extent and more systematically with firm size than with number of competitors. A similar study was carried out by Jobber and Hooley (1987) who analysed the relative importance of various price objectives in British companies and demonstrated that concern for profit was the main motivating factor when establishing prices. The study did, however, show that price objectives varied according to the evolutionary stage of the market in which the companies were operating.

More recently, many studies under different perspectives - economics, marketing and cost accounting – presented in the literature review

section address the issue of pricing. For example, Ratnatunga, et. al., (1994) predicted the significant changes the technology cost-price relationship would bring about in the profitability of the telecommunications industry.

The basic premise of the present study is that management accounting can make an important contribution to the optimization of global earnings (Catelli et al., 2001). In making this contribution, management accounting areas should implement appropriate management systems to provide support to managers in their decision-making with respect to prices. In this regard, Lucas (2002) has noted that modern textbooks on management accounting promote the generation of cost information as being an important function of management accounting. Nagle and Holden (2003) have contended that the establishment of a set of pricing policies and procedures that are in accordance with business strategies requires a new connection between finance and marketing. Moreover, in industrial companies, the production area should also be taken into account when making this connection (Balakrishnan and Sivaramakrishnan, 2002). Göx (2001) starts by criticizing accounting textbooks and their approaches and moves to explore cost-based pricing, by analyzing dimensions of marginal costs and sunk capacity costs, with a clear concern about capacity planning under uncertainty, unveiling relevant implications to management accounting. Drury and Tayles (2006) observe that it is widely noted in the normative literature that cost information can play a key role in determining selling prices.

According to Guilding et al. (2005), companies can be classified as: (a) price-makers or (b) price-takers. Price-makers tend to be market leaders or companies with highly customized products or services. In these companies, managers who are responsible for price decisions are involved with price establishment on the basis of internal company data. In contrast, price-takers are usually smaller companies or companies that are competing with market leaders. In these companies, market forces essentially determine prices and responsible managers attempt to optimize production and sales using prices that are obtained from market references. Despite their differences, both price-makers and price-takers must address a fundamental question: What target margin should be utilized (by price-makers in price formation and by price-takers in price analysis) to optimize the company's overall results?

In making profitability judgments according to conventional theory, product cost and contribution margin should be determined by the variable costing method. The present study proposes that the use of the *contribution margin per hour* provides stronger adherence to projected company targets than does the use of the *percentage contribution margin*. The study tests this proposition by assessing the effectiveness of these two parameters (contribution margin per hour, CMpH and percentage contribution margin, PCM) in the context of price formation and price analysis in industrial companies. This question has not been previously addressed in any depth by previous studies.

To limit the scope of the study, we do not discuss questions such as the possible limitations of price-planning methodology based on the cost-plus method, nor explore other conceptual alternatives. The research method combines a review of the relevant literature followed by an action research approach in a Brazilian manufacturing company, followed by critical reflections. The study contributes to pricing theory by providing conceptual and practical insights to the establishment of a sound contribution margin.

Literature Review and Conceptual Framework

Neoclassical theory versus practice in price determination

In a study by Noreen and Burgstahler (1997), most managers reported that they established prices through a mark-up on total cost (with the mark-up factor reflecting desired profits), rather than adopting marginal costs in the context of demand-price elasticity. Noble and Gruca's (1999) study of American companies indicated that a majority (56%) of sampled companies used the cost-based pricing method, especially in situations when it was difficult to estimate demand. Various other studies have reported similar findings.

According to Drury et al. (1993), the cost-plus pricing method is not aligned with the recommendations of conceptual management

accounting textbooks, which are based on neoclassical economic theory. In this context, Lucas (2002) compared research supporting neoclassical pricing theory (the economists' view) with research supporting the cost-plus method (the accountants' view). Having noted that the latter has served as the practical rule to guide business pricing, Lucas (2002) presented various arguments that have been advanced by researchers in support of neoclassical theory, as well as arguments by other researchers who have criticized this approach.

According to Diamantopoulos and Mathews (1994), the first criticisms of neoclassical theory appeared as a result of a study by Hall and Hitch (1939), who had provided evidence that companies did not generally adhere to the marginalist principles of neoclassical economic theory—that is, they did not establish prices at the point where marginal income equalled marginal cost. Rather, they established the price by adding a margin to the total product cost. In this context, Lucas (2002) noted that, during 1940s and 1950s, economists had become involved in what became known as the marginalist controversy, which culminated in the establishment of powerful arguments to confront research findings that were adverse to the neoclassical model.

Economics researchers defended the neoclassical economic model using two arguments: (a) the idea of implicit marginalism; and (b) the instrumentalist view. According to the first of these, i.e. the idea of *implicit marginalism*, companies might not consciously think about establishing an equivalence between marginal income and marginal cost, but they act as if they were actually doing this. According to the second argument, i.e. the *instrumentalist* view, what really matters are results of decisions, rather than the decision-making process itself. According to this argument, it is likely that a company can discover, through experience, that cost-plus pricing using a particular margin (say 20%) generates its best economic result. This means that the company reaches the same result that it would have achieved if it had consciously established equivalence between marginal income and marginal cost to establish the sales price.

More recently, neoclassical economic theory has been criticized by accounting researchers who adopt the old institutional economics approach to explain stability and change phenomena in management accounting systems. The essence of institutional theory is that behaviour is guided by habits and customs. The habits of people and groups guide the so-called routines (procedures or rules of activity), which are manifested as institutions inside the company. In this context, Ahmed and Scapens (2000), who applied the ideas of institutional theory to explain the apparent irrationality of cost-and-price calculation procedures, have suggested that the institutional approach can provide a better explanation of accounting practice than neoclassical theory. The study of Lucas and Rafferty (2007) reports on the findings of two cases studies undertaken to examine the power of the old institutional economics framework to explain the gap between management accounting theory and practice, in the realm of costing for pricing.

The Marketing Approach

Throughout time, research on pricing has been developed under different approaches: (i) economics, (ii) costing and (iii) marketing. Ratnatunga (1985); Avlonitis and Indounas (2005), Collins and Parsa (2006) and Hinterhuber (2008) share the same ideas about the classification of alternative approaches to pricing: (i) cost-based pricing, (ii) competition-based pricing and (iii) customer value-based pricing. We can assume that competition-based pricing and customer value-based pricing are marketing approaches to pricing. The studies related to pricing under marketing approach are recent and according to Hinterhuber (2004) they are not as numerous as publications on other classical marketing instruments such as product, promotion and distribution.

Considering the marketing perspectives, Ratnatunga, et. al., (1994) looked at the marketing aspects of pricing in the global telecommunications industry and Avlonitis and Indounas (2005) explored the pricing objectives that service companies pursue along with the pricing methods they adopt in order to set their price. Collins and Parsa (2006) carried out a study related to pricing strategies in the lodging industry. Ingenbleek (2007) carried out a comprehensive study about value-informed pricing approach based on a revision of empirical studies. Hinterhuber (2008) developed a study with a sample of marketing managers about the obstacles for implementing

value-based pricing. Indounas (2008) investigated the relationship between pricing and ethics in two industrial service contexts – transportation and information technology and, in a subsequent study, Indounas (2009) investigated pricing practices in these same contexts.

The study of Carricano, Trinquecoste and Mondejar (2010) emphasizes the origins and development of the pricing function exploring how companies are getting organized for price management. The study of Piercy, Cravens and Lane (2010) puts emphasis on the following issues: making pricing strategic, determining the role of price in strategic positioning, challenges in raising prices and designing a value-based pricing strategy.

Indounas and Avlonitis (2011) carried out an investigation on the conditions that lead companies to the adoption of new industrial service-pricing strategies namely skimming pricing, penetration pricing and pricing similar to competitive prices.

Sharma and Iyer (2011) examine the applicability of various pricing frameworks and pricing practices in the context of two industries – business processes outsourcing and power generation equipments. The result of this study indicates that firms predominantly use traditional pricing strategies and new strategies for solution-based pricing are only just emerging.

The Cost-Plus Pricing Approach

Dolgui and Proth (2010) stated that the cost-plus method should be avoided since they ignore customers` behaviour as well as the parameters they use to build their own evaluation. Nevertheless, in the past two decades, numerous studies have provided evidence that the cost-plus method is a common product-pricing method in companies. These studies have included: Lazer (1957), Lanzillotti (1958), Eichner, (1973), Lere and Swanson (1979), Scapens et al. (1983), Govindarajan and Anthony (1983), Ratnatunga (1985); Hilton et al. (1988), Emore and Ness (1991), Bright et al. (1992); Hanson (1992), Drury et al. (1993), Noreen and Burgstahler (1997), Govender (2000), Balakrishnan and Sivaramakrishnan (2002), Banker and Hansen (2002), Lucas (2002), Guilding et al. (2005), Fabiani et al. (2005), Drury and Tayles (2006), Indounas (2006) and Thépot and Netzer (2008).

One of the most comprehensive of these studies was that of Fabiani et al. (2005), who conducted an in-depth analysis of pricing practices in more than 11,000 companies from nine countries in the euro-zone in 2003 and 2004. The study, which was sponsored by the European Central Bank, demonstrated that the most frequently used pricing method was based on mark-up (that is, cost-plus pricing). Indeed, 54% of the companies examined in the study had adopted at least some of their prices on the basis of mark-ups on costs. However, in highly competitive markets, the study found that price-takers preferred not to establish prices on the basis of costs and mark-ups.

In calculating prices using the cost-plus approach, the unit cost of products is first estimated, and all other elements (administrative costs, commercial/financial expenses, and profit) are included in the price through a percentage of costs or sales price. The dominant idea in the cost-based pricing approach is that the product cost is calculated by absorption costing. Other studies, including those of Lere and Saraph (1995), Lere (2000) and Cardinaels et al. (2004), have adopted a normative approach to defend the use of activity-based costing (ABC) as a price-planning tool. However, a literature review carried out by one of these authors failed to find any empirical studies that have demonstrated the efficacy of ABC in the price- formation process.[1] Guilding et al. (2005) have claimed that empirical studies have demonstrated that price-makers use the absorption-costing method more frequently than other methods.

According to Banker and Hansen (2002), the argument about whether fixed capacity costs should be included in product costing is one of the oldest debates in management accounting. These authors noted the classical arguments—that is, if managers establish prices using variable costs only as a marginal cost approach, they will generate low prices and high sales volumes; however, if prices are very low, companies will then fail to recover fixed costs and will lose money in the long term. On the other hand, if managers establish prices through

[1] Of course, one could have full absorption costing by allocating indirect costs using activity-based cost drivers.

total costs, each order will then cover a part of fixed costs. Nevertheless, high prices can reduce sales to the extent that companies lose money in the long term. According to Banker and Hansen (2002), this suggests that managers should be capable of choosing between the direct and total costing methods if they understood how product prices interact with client demands and how this affects the company's production capacity.

A related issue in pricing and costing studies is the relationship between price planning and installed capacity. Balakrishnan and Sivaramakrishnan (2002) defended the idea of a joint consideration of capacity and product price planning to clarify the role of total costing in these decisions. A study by Banker et al. (2002) developed an optimization model to analyze product costing and pricing decisions in the context of a dynamic information environment and the use of full production capacity in the long term. Bierley, Cowton and Drury (2006) observe that there has been criticism of the use of budgeted capacity as the denominator of overhead rates. The use of practical capacity and normal capacity is proposed to ensure that products are not under or overcosted.

Balanchandran, Li and Radhakrishnan (2007) developed a framework for measuring and reporting unused capacity, identifying the cost of unused capacity avoiding to hide it under the product cost.

Adopting a reductionist perspective, product price incorporates two elements: product cost and margin. Product cost can be calculated through total costing, absorption costing, or direct costing. Depending on the adopted costing method, the composition of the product cost and the desired margin varies (Table 1).

Table 1 can stimulate questions about the influence of costing methods on sales price determination. In this regard, Christensen and Demski (1997) have argued that it is inadequate to use total costs for decision-making about individual products profitability and the study of Guerreiro, Cornachione Junior and Soutes (2011) show that not only Brazilian companies, but companies around the world use predominantly the absorption costing method for management decisions. Noreen and Burgstahler (1997) developed a model to study the effect of pricing based on the cost-plus method. Their research demonstrated that, for a multiproduct firm with fixed costs, this pricing procedure put a restriction on the relationship between product prices, and that this can impede a company's efforts to obtain satisfactory profits, even when these are achievable. Balakrishnan and Sivaramakrishnan (2001) examined economic losses deriving from the use of the cost-plus method in tactical price decisions.

Price Setting Based On Percentage Contribution Margin

Conventional theory (Noreen and Burgstahler, 1997; Christensen and Demski, 1997; Groth, Byers and Simmons, 2000; Nagle and Holden, 2003) asserts that the variable costing method should be used. Indounas (2006), from a marketing perspective, emphasizes the concept of contribution margin approach for pricing and Ifandoudas and Gurd (2010) explore the relevance of Theory of Constraints for price decisions.

Table 1: Cost And Margin Composition

Costing Method	***Product Cost Composition***	***Margin Composition***
Total costing	Total costs + total expenses	Desired profit
Absorption costing	Total costs	Total expenses + desired profit
Variable costing	Variable costs and expenses	Fixed costs + fixed expenses + profit

When using this costing method in the price planning process, the following equation applies:

sp = vc + dm

where:
sp = sales price;
vc = product variable cost; and
dm = desired margin.

Moreover:

dm = fe + fc + dp

where:
fe = fixed expenses; fc = fixed costs; and
dp = the profit desired by stockholders.

In this equation to determine the unknown sales price, the central issue is to establish the desired margin. The product cost is made up only of variable costs, thus eliminating the problem of allocating fixed costs and expenses to product units. Under the variable costing approach, in establishing a product's price, a certain amount needs to be added to cover the company's fixed costs and fixed expenses and the profit desired by stockholders. This is accomplished by means of the desired contribution margin of the product, which should express the goals and strategies of the company.

According to Indounas (2006, pp. 418), the contribution margin analysis approach is not a cost-based method, but "a value-based pricing method that endeavours to incorporate not only cost, but also competitors´ and customers´ inputs when levying prices into a single mathematical formula." Based on this statement it is possible to identify an underlying integrative approach to the contribution margin analysis, which would combine (not considering mutually exclusive) the different pricing methods (e.g., cost-based, competition-based and demand-based).
Warren et al. (2001) defined the concept of the contribution margin in terms of a percentage of variable costs and expenses. Other authors, such as Nagle and Holden (2003), have defined the concept of the contribution margin as a percentage of the final sales price, rather than as a percentage of costs.

In Brazil, taxes on costs and sales add a certain degree of complexity to any profitability analysis and any planning process for product sales pricing. In a typical scenario, the value of goods purchased incorporates an amount of tax that can be recovered. For example, if the cost of a purchased good is $100, state recoverable taxes are charged at the rate of 18%, and federal recoverable taxes are charged at the rate of 9.25%; thus the product's real cost is $72.75. On the other hand, when charged on sales, these same taxes are considered as deductions from revenues—that is, they are not included in the company's net revenues.

Sales price formation based on cost-plus approach, considering contribution margin as percentage on the sales price, requires the following fundamental elements:

Product cost: In the case of a commercial company, the product cost should be the net purchase cost of recoverable taxes. For goods and service companies, it should be the manufacturing variable cost.

Taxes charged on the price: State and federal taxes are charged on the price.

Variable sales expenses: The most common variable expenses are sales commissions and product delivery freight.

Desired contribution margin: This corresponds to the planned percentage of profitability of a specific product.

The product price (sp) corresponds to the cost (ct) divided by the mark-up (mk). The mark-up is determined by taking 100% (that is, the price) and subtracting the percentages of all elements to be covered by the price (except for product cost)—that is: (a) tax percentage charged on price; (b) variable expenses percentage; and (c) desired contribution margin percentage.

An example can be given using the following data:
Product cost: $72.75
Taxes on sales: state: 18%; federal: 9.25%
Variable expenses: sales commissions and freights: 5%
Margin for covering fixed expenses and profit: 25%

The computation of the mark-up rate is thus made as follows:
1 – 0.5725 = 0.4275
sp = $72.75 ÷ 0.4275 = $170.17

Hence, the essential elements to determine the sales price are: (a) variable product cost; (b) tax percentage charged on price; (c) percentage of variable sales expenses; and (d) desired contribution margin percentage. All elements, except for the desired contribution margin, are available data. The fundamental issue in a product's pricing process is, therefore, the establishment of the desired contribution margin.

The definition of the desired percentage of contribution margin of individual product is a strategic decision of the firm and should be done considering a set of information – such as market prices of similar products, the company's cost structure, its desired return on investment, its available production capacity, the importance of the product for the client, the type of technology involved, the potential trade volume, the trading frequency, and so on. Moreover, it should consider available information about the company's historical margins, the margins of its most profitable products, and its general average planned contribution margin.

The calculated amount of $170.17 in the example given above represents an ideal price, based on a desire to obtain a 25% contribution margin. When making price decisions in daily life negotiations, companies commonly must analyze price alternative driven by customers. An alternative price of $ 140,00 driven by customer.

Profitability is given by the price less unit cost less taxes and variable cost and expenses as follows:
$140 – $72.75 – (0.3225 x $140.00) = $ 22.10 (that is, a percentage margin of 15.8%).
What does this mean in terms of profitability? Despite the importance of the percentage contribution margin as a measure of leverage between sales volume and profit (Nagle and Holden, 2003), it can be observed that the true meaning of a percentage depends on the calculation base. However, expressing the contribution margin as a percentage does not facilitate adequate communication about product profitability among the financial, commercial, and manufacturing operations of an organization. In the case study section of this paper we discuss some weaknesses related to price-decision using the contribution margin as percentage.

Price Decision Based on Contribution Margin per Time Unit

The Time-Based Management Approach

The expression 'time-based management' appears in the beginning of 90s through the seminal works of Stalk and Hout (1990a, 1990b, 1990c), that put emphasis on time as a key factor for management, and saying that time is a strategic weapon such as money, productivity, quality, and even innovation. Many studies related to time-based competition, as of Dibrell, Davis and Danskin (2005) emphasizes time cycles reduction. Hutchinson (2007) makes the case for the link between time-based management, by exploring time-based manufacturing practices, and management accounting system, suggesting a positive association with overall business performance.
Time is said to be useful in all areas of management, and it may replace other managerial technologies such as cost accounting. According Mouritsen and Bekke (1999), time-based management may be seen to generalize time's importance to management not only in terms of operations, but also in terms of product development, customer-relations, and decision making processes. The continuous attention to time may increase speed and punctuality, which, if generalized to all aspects of the firm's activities, may improve competitiveness (Smith, 1995).

In the context of the just-in-time (JIT) approach, time has been used both as a source of competitive advantage and as a fundamental industrial performance measure. According to the JIT approach, producing or delivering products long before or after the planned date is seen as a waste (Neely et al., 1995). In the logistics studies time is emphasized through many concepts and performance indicators, such as time compression and inventory carrying costs (Lambert and Pohlen, 2001). Focusing on time as unit of performance measure, Tangen (2003) noted that one problem to be tackled in productivity measurement is how to define input and output. Depending on the company, output can be a single product, a range of different products, or various models of a range of different products. Monetary measures are commonly used to define these outputs, and these monetary measures are, in

turn, influenced by production factor prices. The time per produced unit can be used as a measure when different products are produced. In a similar vein, Jackson and Petersson (1999) proposed a productivity measure based on time—defined as the quotient between the value added during the time period and the time used.

Theory of constraints emphasizes the use of time as a measure (especially time related to the constraint resource) for profitability analysis and price planning (Noreen et al., 1995; Corbett Neto, 1997). According to this theory (Ifandoudas and Gurd, 2010), the quotient of throughput (contribution margin) divided by the time of the constraint resource is the main performance measure at product level and guides the planning of the production and sales mix. Dugdale and Jones (1998a; 1998b) present different approaches in so-called throughput accounting—mainly from the perspective of the original approach by Goldratt (1990) and his followers (Noreen et al., 1995), as well as by the English consultants Galloway and Waldron (1988a; 1988b) —in which the concept of constraint resource time appears in calculations for the main performance-assessment measures.

Price Setting Based On Contribution Margin per Hour

Although the most commonly adopted pricing method is based on internal data using the contribution margin as a price percentage, the use of this procedure can create distorted sales prices. Cornachione (2001) have proposed a planning model for price and profit based on a product's unit value contribution margin and Spaller (2006) focus on utilizing the contribution margin concept for pricing decisions in a bank environment.

The unit value contribution margin is a more meaningful measure than the percentage margin, but its significance is not absolute. The underlying premise of the present study is that a more appropriate way of determining a product's unit value contribution margin is by utilizing the concept of *contribution margin per hour*. In this model, the expression of a product's profitability is manifested in terms of the value of the unit contribution margin divided by the manufacturing time of the product.

Sprohge and Talbott (1990) emphasized the importance of applying the concept of contribution margin per hour to analyze service profitability in a small business and Dugdale and Jones (1997) showed that a product which uses a bottleneck should ensure that it generates some target throughput per bottleneck minute. Despite the importance of the theme, a review of the literature carried out in this study shows that there is a lack of studies approaching the concept of contribution margin per hour in price decisions. It is important to highlight the study of Ifandoudas and Gurd (2010) exploring the concept of contribution margin per hour within the theory of constraints environment for both long-term and short-run decisions.
The concept of contribution margin per hour can be associated with the concepts of speed, on-time response, and time compression that are prominent in studies of logistics and supply-chain management. The competitive market has reduced the unit sales prices and margins of products and services. However, technological developments have enabled significant reductions in the time required to obtain the contribution margin. The concept of contribution margin per hour is aligned with the principles of the JIT approach (Warren et al., 2001), as well as aligned with the philosophy of lean manufacturing and with the principles of pull-system production. All of these models recommend the speed of throughput flow to be increased by reducing manufacturing and set-up times.

The basic premises of the contribution margin per hour model can be summarized as follows:

- The company has to pay, within a defined time period (say, a month), an amount of fixed expense plus an amount of return to stockholders.
- The fixed expenses and return to stockholders are paid dropwise through the unit contribution margins of each sold product unit.
- The company has a finite volume of time (total hours per month) available for production. This time should be used as economically as possible.
- At a more analytical level, products create profitability for the company through the contribution margin they generate each work hour.

The concept of contribution margin per hour makes it possible to link up unit elements (work hour and product unit) with the amount of the total targeted contribution margin (fixed expenses plus desired profit) for a certain period.

The sales price based on the contribution margin per hour is calculated with the following formula:

sp = ve . sp + vc + cm . pt

where:
sp = sales price;
ve = variable sales expenses (percentage of price);
vc = variable cost;
cm = target contribution margin per hour; and
pt = production time.

The following data can be used in the example:

variable cost: $72.75
variable sales expenses: 32.25% on the price
target contribution margin per hour: $14.18
production time: 3 hours

When applying the formula:
sp = (0.3225 . sp) + $72.75 + ($14.18 x 3)
sp = $170.1
It should be noted that the model presented here takes an internal view of the pricing process at the level of an analyzed product. The calculated prices should obviously be assessed in the context of the company's overall global strategies and profitability projections, as well as taking into account appropriate market variables (Guerreiro and Angelo, 1999).

Case Study at MM

This case study aims at providing insights to analyse the pricing decision process, under the alternatives approaches of contribution margin as a percentage and contribution margin per hour in the presence of specific business scenarios. This case study, based on action research, was conducted on a Brazilian medium-sized manufacturing company located in southern Brazil. For the sake of confidentiality, the company is referred to here by the pseudonym Model Manufacturing (MM). Action research, and its derivative forms, is known by the support offered to research development, especially in the social science arena. Kaplan (1998) argues in favour of action research in social science and management, mainly due to its benefits to overcome particular obstacles and limitations.

This research method essentially links research with action in a process whereby the involved actors participate with researchers to produce and utilize knowledge simultaneously (Thiollient, 1997). In action research, the researcher plays an active role in formulating, implementing, and reflecting on action—with a view to developing, enriching, and testing theoretical reference frameworks that are relevant to the phenomena in the study (Brandão, 1985). In the present case, one of the authors of this study participated in a team that developed a new conceptual price-and-cost system for MM.

Background to the Case

MM produced customized outputs, and such firms commonly use the cost-plus pricing method (Guilding et al., 2005). When it started operating, the firm was mainly focused on the production of custom-made moulds, parts, and accessories for plastic injection clients. Later, the company expanded its range of activities and began to manufacture equipment and parts for other types of industries. MM now manufactures a wide range of products, from large equipment to small parts, according to customer specifications.

For some of these products, raw material represented a significant proportion of total costs, whereas in other types of orders, raw material costs were less significant. In certain contracts, customers supplied the raw material for their orders with a view to guaranteeing product quality; in other contracts, MM was responsible for providing all raw materials needed to manufacture the products.

When this case study began, the company used the full costing method to formulate prices. Total production costs were allocated on the basis of the manufacturing time of an order, and expenses (administrative, commercial, and financial) were allocated on the basis of a percentage applied to order costs. Prices were calculated by adding a certain profit percentage to the budgeted amount of costs and expenses for each manufacturing order.

Following discussions regarding this cost-and-price system, the project team decided to choose the variable costing method to calculate the costs (budget and actual) of manufacturing orders, with special attention to the concept of the contribution margin. According to the conceptual model that was adopted, the variable cost of an order was constituted by the costs of raw material and the variable transformation costs—with the latter consisting of direct labour costs and variable overhead costs (indirect material and energy). The cost of raw material was thus directly linked with the manufacturing orders, whereas the variable transformation costs were allocated to the product orders according to the cost drivers of the manufacturing process—that is, basically machine-hour or labour-hour. Following the guidelines of the variable costing method, fixed manufacturing costs were considered as expenses of the period and were not allocated to the products.

With respect to the conceptual price-planning model, the initial plan regarding the concept of contribution margin as a percentage of the price was to plan order prices on the basis of variable budgeted costs. However, initial studies of the application of this method demonstrated that it brought about significant distortions in order prices in certain situations (as described next). These findings challenged the price-planning model based on targeted contribution margin percentage and forced the project team to rethink the initial conceptual model. Subsequent studies and reflections induced the project team to choose a pricing concept that was based on the concept of contribution margin per hour.

The case of MM is well illustrated in two typical scenarios applying alternative pricing methods: (a) based on the contribution margin percentage; and (b) based on the contribution margin per hour.

Two Price-Planning Scenarios at MM

Scenario 1

Here, MM was required to consider pricing proposals for two product orders whose cost composition was different; however, by coincidence, the two orders entailed the same manufacturing direct costs.

(a) *Using the Percentage Contribution Margin*

Using the percentage contribution margin, the prices are calculated as follows.

Order K proposal:
Direct material cost: $3,000.00
Labour and variable overhead costs: $7,000.00
Total variable cost: $10,000.00
Taxes on sales: 27.25%
Variable expenses (sales commissions and freight charges): 5%
Targeted contribution margin: 25%
Production time: 100 machine-hours

The mark-up was calculated as follows:
1 – 0.5725 = 0.4275
Price = $10,000.00/0.4275 = $23,391.81

Order L proposal:
Direct material cost: $6,500.00
Labour and variable overhead costs: $3,500.00
Total variable cost: $10,000.00
Taxes on sales: 27.25%
Variable expenses (sales commissions and freight charges): 5%
Targeted contribution margin: 25%
Production time: 50 machine-hours

The mark-up was calculated as follows:
1 – 0.5725 = 0.4275
Price = $10,000.00/0.4275 = $23,391.81

Because the total cost of each order was the same, so were their calculated prices. This is despite the fact that order K used more machine hours and consequently required more capacity and more assets than did order L.

(b) *Using the Concept of Contribution Margin per Hour*

Applying the concept of contribution margin per hour the prices are calculated as follows.

Order K proposal:
Direct material cost: $3,000.00
Labour and variable overhead costs: $7,000.00
Total variable cost (vc): $10,000.00
Variable expenses (ve): 32.25% (taxes on sales: 27.25% ; sales commissions and freight: 5%)
Targeted contribution margin per hour (cm): $80.00
Production time (pt): 100 machine-hours

The sales price (sp) based on the contribution margin per hour was calculated as follows:
sp = (ve . sp) + vc + cm . pt

When applying this formula:
sp = (0.3225 . sp) + $10,000.00 + $80.00 x 100 hours
sp = $26,568.26

Order L proposal:
Direct material cost: $6,500.00
Labour and variable overhead costs: $3,500.00
Total variable cost (vc): $10,000.00
Variable expenses (ve): 32.25% (taxes on sales: 27.25% ; sales commissions and freight: 5%)
Targeted contribution margin per hour (cm): $80.00
Production time (pt): 50 machine-hours

The sales price (sp) based on the contribution margin per hour was calculated as follows:
sp = (ve . sp) + vc + cm . pt

When applying this formula:
sp = (0.3225 . sp) + $10,000.00 + $ 80.00 x 50
sp = $20,664.20

According to the criterion of contribution margin per hour, the targeted contribution margin included in the order prices was proportional to the manufacturing effort. Thus, order K, which used more factory time, should produce a higher margin than order L, which used less time.

Scenario 2
In Scenario 2, MM was required to consider proposals for two orders of similar products for different customers in the same month. One customer supplied all of the material requirements for both proposal X and Y.

(a) *Using the percentage contribution margin*
Using the percentage contribution margin, the scenario was as follows.

Customer X proposal:
Direct material cost: $5,250.00
Labour and variable overhead costs: $1,750.00
Total variable cost: $7,000.00
Taxes on sales: 27.25%
Variable expenses (sales commissions and freight charges): 5%
Targeted contribution margin: 25%
Production time: 25 machine-hours

The mark-up was calculated as follows:
1 – 0.5725 = 0.4275
Price = $7,000.00/0.4275 = $16,374.27

Customer Y proposal:
Direct material cost: $0.00
Labour and variable overhead costs: $1,750.00
Total variable cost: $1,750.00
Taxes on sales: 27.25%
Variable expenses (sales commissions and freight charges): 5%
Targeted contribution margin: 25%
Production time: 25 machine-hours

The mark-up was calculated as follows:
1 – 0.5725 = 0.4275
Price = $1,750.00/0.4275 = $ 4,093.56

In this model, the total cost drove sales price. Thus, the order for customer X, whose cost was higher because of the material cost, yielded a higher price and contribution margin—despite the fact that factory occupation was similar for both orders.
(b) *Using the concept of contribution margin per hour*

Using the contribution margin per hour, the scenario was as follows.

Customer X proposal:
Direct material cost: $5,250.00
Labour and variable overhead costs: $1,750.00
Total variable cost (vc): $7,000.00
Variable expenses (ve): 32.25% (taxes on sales: 27.25% ; sales commissions and freight: 5%)
Targeted contribution margin per hour (cm): $80.00
Production time (pt): 25 machine-hours

The sales price (sp) based on the contribution margin per hour was calculated as follows:
sp = (ve . sp) + vc + cm . pt

When applying this formula:
sp = (0.3225 . sp) + $7,000.00 + $80.00 x 25 hours
sp = $13,284.13

Customer Y proposal:
Direct material cost: $0.00
Labour and variable overhead costs: $1,750.00
Total variable cost (vc): $1,750.00
Variable expenses (ve): 32.25% (taxes on sales: 27.25% ; sales commissions and freight: 5%)
Targeted contribution margin per hour (cm): $80.00
Production time (pt): 25 machine-hours

The sales price (sp) based on the contribution margin per hour was calculated as follows:

sp = (ve . sp) + vc + cm . pt

When applying this formula:
sp = (0.3225 . sp) + $1,750.00 + $80.00 x 25 hours
sp = $5,535.05

According to the criterion of contribution margin per hour, the supplied material cost in client X's order affected the price, but not the desired contribution margin. Irrespective of the total costs of these orders, both included the same amount of desired contribution margin in the price, in accordance with the time of production.

Case Discussion

The case study examined two scenarios of price decision-making that are common at MM and similar manufacturers of customized goods.

In Scenario 1, MM was required to consider pricing proposals for two product orders whose cost compositions were different, but which, by coincidence, had the same manufacturing direct costs. The results of implementing a pricing model based on percentage contribution margin demonstrated that both products had the same prices and generated the same contribution margin. The main criticism of this method is that it does not take into account the impact of each order on the shop floor. Although the total cost of each order was the same, order K required significantly more production time and assets than order L. Therefore, the profit from order K should be higher than that from order L.

According to a pricing model based on the *contribution margin per hour*, the two proposals had different prices and generated different amounts of contribution margin (despite the fact that their total manufacturing cost was the same). The price calculated for order K was $26,568.26, with a total contribution margin of $8,000.00. The price calculated for order L was $20,664.20, with a total contribution margin of $4,000.00. In this model, the desired profit included in the prices is driven by factory occupation and use of production assets (measured through time production).

The case study demonstrates that a pricing model based on percentage contribution margin establishes a targeted contribution margin with limited meaning for many company managers, especially in the production area. After all, what does a margin of 25% of the price mean?

On the other hand, a pricing model based on the concept of *contribution margin per hour* makes more sense for production managers—that is, irrespective of the customer order, each run hour should generate an average contribution margin of $80. If all factory hours produced this unit margin per hour, the company would achieve the targeted contribution margin (in this case, $80,000.00) needed to pay all fixed costs and expenses and generate the desired profit. The contribution margin per hour establishes an economic link between the micro (product) and the macro (company), and it also establishes a link between the production area and the commercial area. Ultimately, it establishes a reliable link between what is planned and what is achieved.

Scenario 2 is common in the manufacturing environment of customized goods. In this scenario, MM was required to consider proposals for two orders of similar products for different customers in the same month (with one customer supplying all of the material requirements).

According to the pricing model based on percentage contribution margin, the prices calculated for the two proposals were quite different. From the perspective of an economic return, customer X's order generated a contribution margin of $4,093.56 (25% of $16,374.27), compared with $1,023.39 (25% of $4,093.56) for client Y's order. Such a large difference in margin between these two orders does not make any sense—given that the only difference in completing these job orders related to the additional task required of MM in purchasing materials for customer X's order.

When applying the method of *contribution margin per hour*, the price of client X's order was $13,284.13, compared with $5,535.05 for client Y's order. This price difference is mainly due to the fact that there were no material costs for client Y's order. Despite this price difference, they produced exactly the same amount of total contribution margin ($2,000.00) because both orders demanded an equal amount (25 hours) of factory time. It is obvious that, for client X's order, an additional cost could be

charged, related to the service of purchasing materials.

An analysis of the prices in Scenario 2, as calculated by the percentage contribution margin criterion, reveals that the price of client Y's order produced a contribution margin per hour of only $40.93 ($1,023.39/25 hours), which is much lower than the average targeted contribution margin of $80.00. In contrast, the price of client X's order generated a contribution margin per hour of $163.74 ($4,093.56/25 hours), which is much higher than the targeted contribution margin of $80.00. The client could consider this price to be very high; as a consequence, there is a high probability of losing the order.

Conclusion

The present study is based on the conventional cost accounting theory, which emphasises that the variable costing method and contribution margin concept must be used in product profitability decisions. The study proposes that, in industrial companies, the use of the concept of the contribution margin per hour in price-planning and price-profitability analysis demonstrates stronger adherence to the goal of optimizing company's global earnings than does the use of the criterion of percentage contribution margin. Findings of the study corroborate that assumption.

The findings and evidences in this empirical case study support the superiority of the concept of contribution margin per hour when compared to the percentage contribution margin. The main conceptual contribution is linked to the fact that evidence from this study fills an important void in the pricing literature. It is noteworthy, based on evidence from this study, that strategic decisions, in terms of pricing, will be made based on totally different influences, according to the available information. Thus, information may induce error and decisions that do not optimize earnings. Considering that the price factor may be assumed as a strategic element of organizational competitiveness, this can make a significant difference. We also observed that multiproduct manufacturers, acting as price-makers and employing man- or machine-hour as measuring units, will benefit, directly, from these findings. With the presence of time constraints in such environment, the relevance of the proposed method becomes even stronger, since the pricing process adopts the same criteria, as suggested by the traditional theory, for the profitability analysis of products when manufacturing bottlenecks are found.

It should be noted that the conceptual proposition of the study must be tested in other empirical situations. We strongly suggest a multi-case method approach, including other countries, while also to apply these ideas to the service industry. Despite this methodological limitation, the results of the study offer a valuable contribution to the task of determining the 'plus' in cost-plus pricing.

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