

Pricing Analytics

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Session Overview

- Introduction
- Course Requirements and Overview
- Role of Costs in Pricing Decisions
- Linking Cost Structure to Pricing and Profits
- Measuring Price Sensitivity

Introduction

Pricing Decisions

- A business creates:
 - a good product,
 - implements a good promotional program,
 - and a good distribution system,to enhance the *value* of its offerings.
- Pricing helps capture a part of that value back into the business

“

There are two kinds of fools in any market. One charges too much. The other charges too little.

”

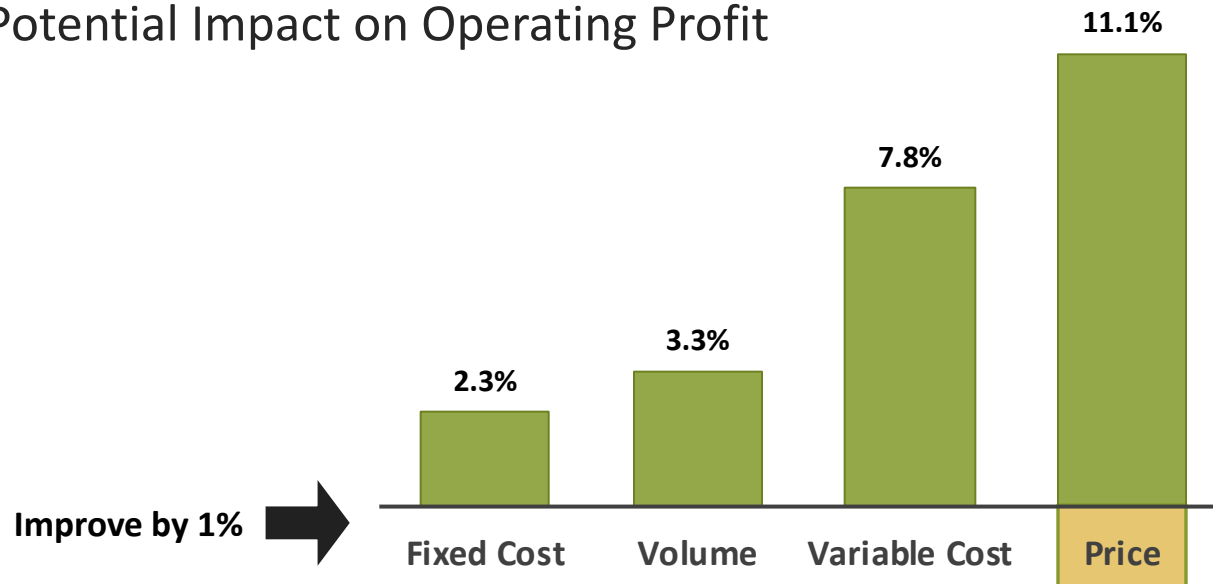
Russian Proverb

Importance of Pricing

- Important aspect of managerial decision making
- Even more so recently:
 - New Product / Idea Revolution
 - Pricing schemes that *could not* be implemented earlier
 - Return to focus on the top-line
 - Revenue model a key decision in many new ventures
 - Wide variation in the level of sophistication within and across industries
- Therefore, there is still substantial low-hanging fruit to be enjoyed!

Role of Price as a Profit Driver

- Potential Impact on Operating Profit



- The importance of this lever has driven a three-fold increase in the number of pricing directors reporting to C-level officers.

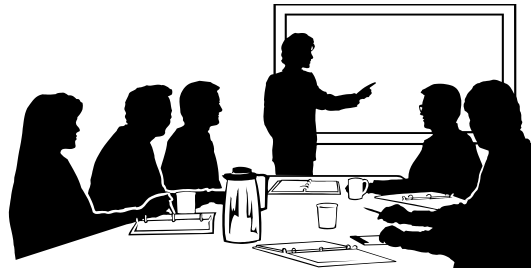
Impact of 2% price change on operating profits

- | | |
|-----------|--------|
| • IBM | 9.4% |
| • Toyota | 34.4% |
| • Verizon | 198.5% |

Course Requirements and Overview

Classroom Process

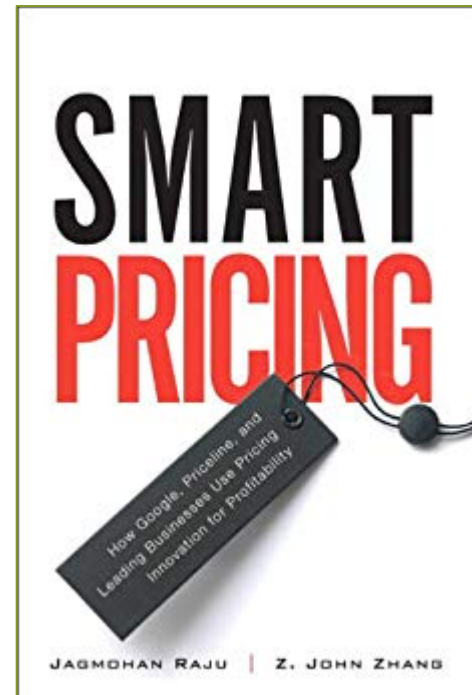
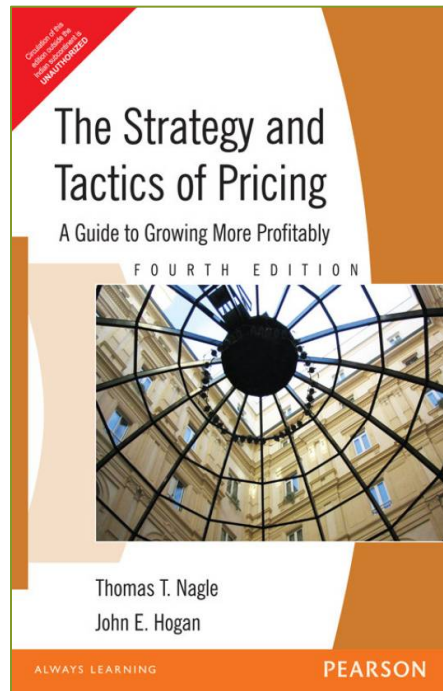
- Lecture Discussions
- Case Discussions
- In-Class Exercises



Requirements

- Class Participation [10%]
- Problem set [20%]
- Case write-up (in groups) [20%]
- Final Exam [50%]

Suggested Books



Course Overview

■ Topics Covered

- Role of costs and margins in pricing decisions
- Measuring price sensitivity
- Price Engineering: product line pricing, two-part tariffs, quantity discounts
- Temporary price discounts and temporal pricing
- Competitive pricing

■ Cases:

- Cambridge Software: Pricing different versions of a software program
- Tweeter: Competitive Pricing in a Retail Setting
[No *submission*]

Academic Associate

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Role of Costs in Pricing

Objectives

- Cost Analysis for Pricing Decisions:
 - Should we include costs in pricing decisions?
 - What costs should we include in pricing decisions?
 - How should we include costs in our pricing decisions?
- Break-Even Profit Elasticity
 - A Quick Overview of the “Price Elasticity” Concept
 - Using break-even elasticity to establish a relationship between cost structure, price changes and profitability

Role of Costs in Pricing Decisions

- Marketers: Do not think too much about what your costs are – focus on buyer's willingness to pay!!
- Accountants: As long as you set prices based on enough markups over costs, you can't go wrong!!
- Economists: Set price so that marginal revenue equals marginal cost!!

What Costs?

- Cost classifications:
 - fixed vs variable
 - total vs average vs marginal
 - controllable vs uncontrollable [vs out of control costs!!]
 - incremental costs
 - sunk vs avoidable costs
- Keep in mind all costs that are “affected” by the pricing decision:
 - only those costs that can be expressed as $c(p, Z)$, where p is price and Z is a “vector” of other variables.

Book Publisher Example

- Background: Publisher of “esoteric” books
- Situation:
 - Price = ₹200 per copy
 - Cost = ₹160 per copy
 - Contribution to overheads + profit = ₹40 per copy
- Problem:
 - Publisher printed 2000 copies
 - Only half of the books were sold in the first year. The company was moderately profitable. They felt that the ₹40 contribution wasn't big enough
- Invited a price consultant!

A Solution

- Pricing Consultant's Recommendation: Run a half-price sale on all slow-moving titles (₹100)
- Customer's Reaction: “Our prices are not currently adequate to cover our overhead. I fail to see how cutting prices even lower (below cost of production ₹160) is a solution to our problem!”
- Why is the consultant right?
 - The variable cost of printing the books is sunk and is irrelevant to the pricing decision. It can not be expressed as $c(p, Z)$.
 - However, price will determine how many books are sold and money released for other purposes (opportunity cost).
- What is the consultant missing, however?

Oil Refinery Example

- What are the relevant costs for a gasoline company selling oil at one of its stations?
 - Cost of crude oil used to make gasoline
 - Cost of refining and distribution
- The “variable cost” here is not constant over time!
- What should the firm do if cost of replacement goes up and why?
- What should the firm do if cost of replacement goes down and why?

Role of Costs in Pricing

- Which costs to consider?
 - Costs that are affected by change in prices
 - Can be expressed as $c(p, Z)$
- Incremental and avoidable
 - Historical vs future cost associated with making a sale
 - Requires careful allocation of costs

Linking Cost Structure to Pricing and Profits

Break-Even Profit Elasticity

Question?

- Admiral Electric has 3 different products (business groups). It is thinking about changing the prices for these products.
- Contribution margins for the three products are 85%, 55%, and 15%.
- The company is considering lowering prices by 5%.
- Where is the price change most likely to “work out”?

Price Elasticity (of Demand)

Price Elasticity of Demand

- It is very important to formalize the notion of price elasticity if we want to be able to determine the effects of costs on price
- The usual way to do this is to use price elasticity (or more aptly described as the elasticity of demand with respect to price):

$$PED = \frac{\% \text{ Change in unit sales}}{\% \text{ Change in price}} = \frac{\% \Delta Q}{\% \Delta p} = \frac{\Delta Q}{Q} \frac{p}{\Delta p}$$

- Notice that elasticity is a “pure” number, and it doesn't matter whether we are talking about meters, kilograms, liters, tons, etc.

Elasticity of Revenue

Relationship between Demand and Revenue Elasticity

- A key measure of interest is revenue:

$$\text{Elasticity of Revenue} = \frac{\% \text{ Change in revenue}}{\% \text{ Change in price}} = \frac{\% \Delta R}{\% \Delta p} = \frac{\Delta R}{R} \frac{p}{\Delta p}$$

- Using the chain rule from calculus we can show that:

$$\text{Elasticity of Revenue} = 1 + \text{Elasticity of Demand}$$

- This leads us to the basic result:
 - inelastic demand (revenue decreases when price is cut)
 - $0 > \text{PED} > -1$
 - elastic demand (revenue increases when price is cut),
 - $\text{PED} < -1$

Break-Even Profit Elasticity (of demand)

Linking Cost Structure to Elasticity and Profits

Break-Even Profit Elasticity: Example

- Admiral Electric has 3 different products (business groups). It is thinking about changing the prices for these products.
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Break-Even Profit Elasticity

$$p, q, c$$

$$p_2 = p + \Delta p \quad q_2 = q + \Delta q$$

$$(p_2 - c) q_2 = (p - c) q$$

$$\Rightarrow (p + \Delta p - c) (q + \Delta q) = (p - c) q$$

$$\Rightarrow \frac{q + \Delta q}{q} - 1 = \frac{p - c}{p + \Delta p - c} - 1$$

$$\Rightarrow \frac{\Delta q}{q} = \frac{(p - c) - (p + \Delta p - c)}{p - c + \Delta p} = \frac{-\Delta p}{p - c + \Delta p}$$

Break-Even Profit Elasticity

$$\left(\frac{\Delta q}{q} \right) = \frac{-\Delta p}{p - c + \Delta p} = \frac{\left(-\frac{\Delta p}{p} \right)}{\left(\frac{p - c}{p} \right) + \left(\frac{\Delta p}{p} \right)}$$

$$\Rightarrow \frac{\Delta q}{q} \cdot \frac{p}{\Delta p} = \frac{-1}{\% \text{ margin} + \% \text{ change in price}}$$

↓
PED

Admiral Electric Example

$$\text{B/E Profit Elasticity} = \frac{-1}{(\text{current \% margin} + \% \text{ price change})}$$

$$85\% \quad \frac{-1}{0.85 - 0.05} = \frac{-1}{0.8} = -1.25$$

$$55\% \quad \frac{-1}{0.55 - 0.05} = -2$$

$$15\% \quad \frac{-1}{0.15 - 0.05} = \underbrace{-10}$$

Summary

- Costs are a key element in any pricing decision.
 - Incremental costs
 - Affected by pricing decision
 - Avoidable costs
 - Historical vs future costs associated with a sale
- We developed a very useful rule that allows us to evaluate how cost-structure affects whether a price change is profitable:
 - Break-Even Profit Elasticity (of demand)

Measuring Price Sensitivity

Measuring Price Sensitivity: Summary of Methods

Variable Measured	Conditions of Measurement	
	Natural	Experimental/Controlled
Actual Purchase	<ul style="list-style-type: none">• Aggregate sales data• Customer panel data	<ul style="list-style-type: none">• In-store experiments• Laboratory experiments<ul style="list-style-type: none">• A/B testing
Preferences / Intentions	<ul style="list-style-type: none">• Direct questioning• Buyer response surveys	<ul style="list-style-type: none">• Trade-off (conjoint) analysis

Using Historical Data to Measure Price Sensitivity

Statistical Analysis of Secondary Data: Fed-Ex Example

Weeks	Units Sold	Price (\$)			
1	119	5.00	15	470	10.00
2	166	5.00	16	525	10.00
3	228	5.00	17	607	10.00
4	409	5.00	18	631	10.00
5	350	5.00	19	631	11.50
6	409	5.00	20	584	11.50
7	424	8.50	21	673	11.50
8	425	8.50	22	769	11.50
9	442	8.50	23	773	11.50
10	405	8.50	24	810	11.50
11	413	8.50	25	854	11.50
12	431	8.50	26	905	11.50
13	444	10.00	27	927	12.50
14	457	10.00	28	1064	12.50
			29	1013	12.50

Analysis of Historical Data

- Historical data, if analyzed carefully, can give quite good measures of price elasticity
- Good estimates within existing range of operation
- Can be misleading because of changes in confounding factors!
- Need to capture the shape of the demand curve
- Need variation in price and reasonably recent data
- Might need to estimate separate demand curves for different segments

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Intentions vs. Behavior



Summary

- Many ways to estimate price sensitivity
 - Survey Questionnaire
 - Controlled Surveys
 - Analysis of Historical Data
 - Field Experimentation
- Be careful of the interpretation
- Use multiple methods for convergence

Next Few Classes

- Session 2
 - Principles of Price Engineering
 - In-class exercise
- Sessions 3
 - Product Line Pricing
 - Cambridge Software Case

Appendices

Linear Demand Model

- Simple linear demand model:

- $q = a - b p$

- Elasticity:

- $\frac{\Delta q}{\Delta p} \frac{p}{q} = -b \frac{p}{q}$

Log-log Demand Model

- Log-log demand model:
 - $\ln(q) = a - b \ln(p)$
- Elasticity is equal to b (constant elasticity):
 - $\frac{\Delta q}{\Delta p} \frac{p}{q} = -b$