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Optimal imperfect pricing decision-making: Modifying and applying Nash's rule in a service sector context

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Abstract

This paper aims to demonstrate how a simple rule of thumb can form a basis to offer a rational and consistent approach to pricing decision-making when faced with (partially) unknown demand and cost functions. To this purpose Nash's decision rule (1975) is re-evaluated, modified, and applied in a service product context. The decision rule can provide management with a powerful indicator of the direction in which profit will change as the result of a change in price. It specifies the conditions under which differential pricing or discounting may be (more) profitable. In this way, the rule provides a basis for a more competitive business pricing policy. The modification to Nash's rule demonstrates that pricing can benefit from quantitative techniques which are comparatively straightforward to understand and apply. It reduces uncertainty by specifying the required elasticity of demand necessary to make change in price worthwhile. With this rule, managers have an additional tool to evaluate potential price changes in the context of particular market circumstances. The paper concludes by explaining how Nash's applied and modified rule provides an original and rational methodology for exploring whether discounting is a suitable pricing strategy for service businesses with high variable costs and inelastic demand patterns.

Keywords: Rule of thumb; Hotel; Rooms; Pricing; Cost structure; Elasticity of demand

There is a significant gap 'between the interest of managers and the contributions of academics in pricing' (Bonoma et al., 1988, p. 338). 'While management has preoccupied itself with many of the partially manipulable or understandable pricing stimuli, the academic community has concentrated its pricing interests on the reactions of consumers and the ''value in use'' derived from vendor offerings' (Bonoma et al., 1988, p. 359). This gap between pricing literature and practice cannot, however, be attributed to a general inability and disinterest in solving managerial pricing problems. On the contrary, little research has addressed the key pricing concerns of managers because academics have generally relied on conventional price theory 'both as a paradigm for guiding theoretical model development and as a conceptual framework for steering empirical efforts' (Diamantopoulos and Mathews, 1995, p. 19). As 'pricing in the real world is *much* more complex than *any* theoretical perspective suggests' (Diamantopoulos, 1991, p. 166, italics in original), it may be no surprise that 'price theory and pricing research have won little recognition in business practice' (Simon, 1982, p. 23). To recall Oxenfeldt (1973, p. 48) 'the current pricing literature has produced few new insights or exciting new approaches that would interest most businessmen enough to change their present methods'. Thus, while the normative models developed by academics 'are impressive in their mathematical sophistication and claims to internal validity, few efforts are marked by the pragmatism necessary to impact' on 'managerial practice' (Bonoma et al., 1988, p. 338).

Normative pricing models generally assume the maximisation of an objective function. While different in content of this function, they can all be considered as models of optimisation (Hague, 1971). Under conditions of

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perfect information the models can be used to evaluate pricing decisions 'in terms of whether or not they are optimal—meaning they result in outcomes which maximise an objective function' (Dorward, 1987, p. 4). In practice, however, the application of maximisation models is constrained by imperfect information. Managerial pricing decisions are subject to risk and uncertainty and can lead to more than one possible revenue outcome. Instead of maximising an objective function, firms, therefore, develop performance measures to encourage the pursue of goals that will best benefit the business as a whole. In these circumstances, experience, intuition, and rules of thumb tend to guide company pricing decision-making (Fog, 1994). When faced with imperfect information, Baumol and Quandt (1964, p. 23) found that simple 'rules of thumb are among the more efficient pieces of equipment of optimal decision-making.' They argued that learning and pseudo-maximising rules permit close approximation of the maximising price. Learning rules are rules whereby a firm, if a price rise leads to a profit increase, it raises price again, while, if profits have fallen, in the next period it lowers its price. Pseudo-maximising rules are rules in which simple demand and cost curves are crudely fitted by quick and inexpensive methods to recently obtained data and, from these simple curves, an approximative profit function is derived and used to determine the price formula (rule of thumb) which maximises the value of the approximative function (Baumol and Quandt, 1964, p. 27). In practice, where the optimal price will never be known in advance of the pricing decision, a rule of thumb may, therefore, provide a solid base for profit optimisation (Dorward, 1987).

The purpose of this paper is to demonstrate how Nash's rule of thumb, published as a note in *The Accounting Review* more than three decennia ago, can aid managerial pricing decision-making under conditions of uncertainty. Nash (1975, p. 384) argued that the 'direction of the change in net income can be predicted in terms of the contribution margin ratio and the market elasticity of demand.' The rule indicates 'whether a company, having a particular cost structure, should raise or lower its prices in order to increase net income' (Nash, 1975, p. 384). In this way, Nash has built on Dorfman and Steiner's (1954) work on optimal advertising and quality and provides an application to the field of price competition. Since production firms have a tendency to place particular stress on cost accounting and cost control, a service operation has been chosen to evaluate and modify Nash's pricing rule. Due to their market orientation (Kotas, 1973) firms which are predominantly service-related tend to place greater emphasis on developing sophisticated pricing strategies and tactics. The provision of a hotel room represents a near 'pure service' product containing a high degree of service element. It encompasses many key features commonly attributed to the service industry, including fixed capacity, perishability, seasonality, diffuse location and small size, labour and capital intensity, and high fixed cost structure (Harris, 1992). The hotel room service product has, therefore, been selected to illustrate how Nash's rule can offer a rational and consistent approach to pricing decision-making when faced with (partially) unknown demand and cost functions.

1. Illustration

When considering the changing of room rate prices, hotel managers deal with the question of how a pricing decision will affect occupancy, revenue and profitability. Although they cannot 'have advance knowledge of how much demand will change in response to a given change' in room price, they 'can calculate the tolerable limits of change within which departmental profit will remain constant' (Walker, 1997, p. 105). The following example will illustrate this issue.

Three competing mid-scale city centre hotels with 150 bedrooms are each operating at a room occupancy of 54.79% per year, at an average house rate of €150 per room. The hotels have fixed and variable costs as illustrated by Table 1.

At this occupancy, as Table 2 shows, the three hotels enjoy precisely the same departmental profit. 'Armed with knowledge of existing demand levels' and the incremental cost to occupy a room, revenue managers 'can determine how much volume must increase', in the case of a room rate reduction, 'or the limit of how far it can fall, in the event of an increase' in room price, in order for the change not to affect departmental profit (Walker, 1997, p. 105). These minimum or maximum volumes are given by a contribution margin(volume) formula:

$$Q_2 \geqslant \frac{Q_1(P_1 - V)}{(P_2 - V)}, \tag{1}$$

Table 1
The cost structures of three hotels

Hotel	Occupancy (rooms)	Fixed cost	Variable cost per room
A	30,000	€1,650,000	€25.00
B	30,000	€1,800,000	€20.00
C	30,000	€1,950,000	€15.00

Table 2
Departmental profit per hotel

Hotel	A	B	C
Revenue	€4,500,000	€4,500,000	€4,500,000
Variable cost	€750,000	€600,000	€450,000
Contribution	€3,750,000	€3,900,000	€4,050,000
Fixed cost	€1,650,000	€1,800,000	€1,950,000
Departmental profit	€2,100,000	€2,100,000	€2,100,000