



Dynamic decision-making in a two-stage supply chain with repeated transactions

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ABSTRACT

This research investigates how the experience learned in repeated transactions by consumers and manufacturers would affect supply-chain partners' strategic decisions such as price, order quantity and service level. Consumer demand depends on two factors: (1) retailer price and (2) service level provided by the manufacturer in the past and current transaction periods. Game theory is used to understand interactions between the horizontally competitive suppliers and their vertical interactions to the common retailer in the one-period looking-ahead decision environment. Dynamic-system concepts are integrated into the game-theoretic model for understanding the evolution of the strategic decisions over multiple time periods. The research shows that the manufacturer with any type of cost-advantage for providing more services to its customers will capture a larger market than its competitor. Comparison of our model to the myopic model indicates that the myopic suppliers, who ignore the customer learning effect on future periods, shrink their market sizes and earn less profit over time. The manufacturers who use the future experience to plan future investment can prevent this phenomenon from happening and enhance their competitiveness.

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1. Introduction

Faced with marketplace factors like cross-channel behavior, media fragmentation and advertising saturation, companies today are faced with the difficulty of retaining empowered, demanding and media-savvy customers. As a result a new term has emerged: Customer Experience Management (CEM). CEM's premise is the reverse of Customer Resource Management (Gurney, 2002). It states that every interaction between the company and customer results in the customer learning something about the company. Depending on the experience, customers may alter their behavior in ways that affect the company's profitability. Thus, by managing these experiences companies can orchestrate more profitable relations with customers. A superior customer experience means both cost and service efficiency. Service is defined as any action that a manufacturer takes to help customers obtain maximum value from their purchases (Goffin, 1999). Examples of service include end-to-end online services (e.g., financing, insurance, and customer support) or product-related merchandise to strengthen

customer experience with the company (e.g., discount coupons, and rebates).

Most savvy executives recognize that forging long-term relationships with their key customers is the route to success in an increasingly competitive and dynamic marketplace. These companies routinely use their transaction data to identify new customer segments, improve the profitability of existing customer segments, enhance each customer interaction and build customer relationships. Customer retention is not only a cost effective and profitable strategy, but in today's business world it is necessary especially when we remind ourselves that 80% of the sales in any business come from 20% of the customer and clients. When a customer buys a product he looks for how well the product fits his needs. He also evaluates the quality and service of the product. If any of the attributes does not fit well with the customer's expectation, he may choose a competitor's product. In doing so he is willing to undertake risk associated with trying a new product. On the other hand if the customer is satisfied with the product he will be feel less uncertain about it in the next period and repeat the transaction. The motivation for the paper was the observation that between 1971 and 1990, total sales of Japanese cars in the US increased by 427% while total new car sales increased only 9%.

Experience learned from past transactions about product price, quality and service can help consumers decide what brand of products to buy and what price he/she is willing to pay. The same

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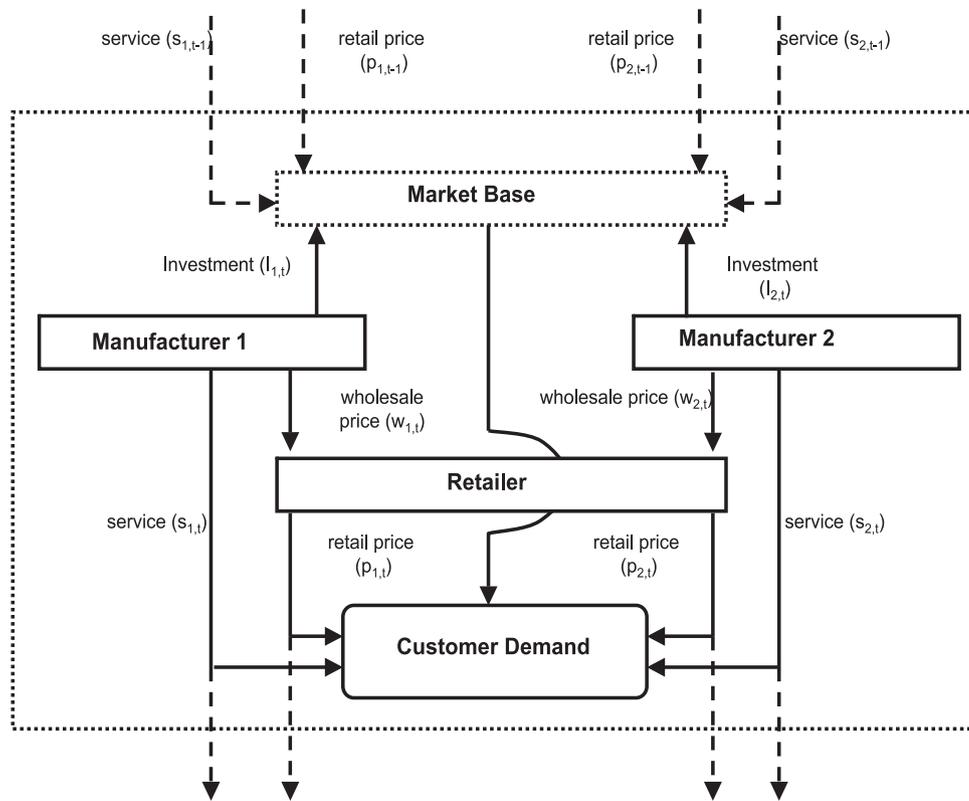


Fig. 1. Supply-chain system.

experience can also help manufacturers decide on their future investments for improving their market share and hence their competitiveness. Keaveney (1995), Wojcik (2001) and Gurney (2002) discuss how customer learning experience can impact the demand of a product.¹ This research focuses on the problem of deciding product price, order quantity and service level from the experience gained from (1) supply-chain partners' repeated transactions and (2) consumer's memory of price and service difference between the product brands. To limit the scope of research, the supply chain considered in this article has two manufacturers producing competing products and selling them through a common retailer.

This article analyzes the behavior of each firm over time when faced with learning demands as shown in Fig. 1. In our model, the market base for each product in any given period is affected by two types of components: (1) inter-temporal factors, i.e., the difference in price, service and investment between the two products in the previous period and (2) the amount of investment by each manufacturer in the given period to expand the market base of its product (or brand). Each period can be viewed as one selling season or a span over one product generation, e.g., one quarter or one year. The decision on the amount of investment is made at the very beginning of each period. The decisions on the wholesale price and service level are taken by each manufacturer after the market has been influenced by the investment. Finally, the retailer makes its decision on the retail price of both products at the end of each period. The decision cycle is repeated over time in this order. Fig. 2 shows the timeline of decisions made within each transaction. To investigate the strategy and impact of

¹ Keaveney (1995) discusses that continuing customers are high valued as they increase their spending at an increasing rate and purchase at full-margin rather than discount prices. Loss of a continuing service customer is a loss from the high-margin sector of the firm's customer base.

Timeline of events within each period (selling season):

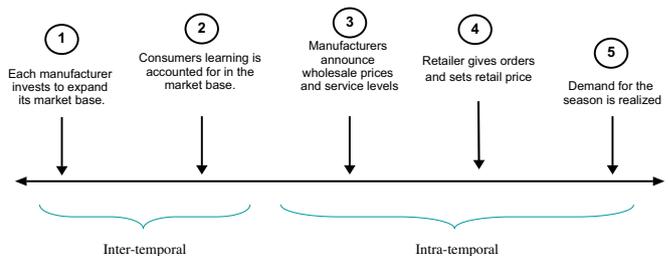


Fig. 2. Timeline of events within each transaction.

investment made by manufacturers, we use the Manufacturer Stackelberg model.²

In the real world both the manufacturer and the retailer offer services. For our paper we assume that the end customers do not distinguish between these services. We do not model the services offered by the retailers in this paper. This seems to be a reasonable assumption in most scenarios. For example, if a single facility owns both the manufacturer and the retailer then service is set for both the facilities jointly. Even if separate entities own them, the manufacturer has a financial incentive mechanism to reward the retailer for improving sales and service. Thus, all the costs are factored into the manufacturer's cost. Manufacturer incentives to the retailer to improve sales and service is a vast area in itself and is outside the scope of this research.

The model in our research can be applied to both durable goods (e.g., compact diskettes, computer parts, etc.) and non-durable goods such as food grains. The only assumptions we make are (1)

² See Charoensiriwath and Lu (2006) for a study of comparing this model against Retailer Stackelberg and Nash models in a single-period situation.

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