



## After-sales service competition in a supply chain: Optimization of customer satisfaction level or profit or both?

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### ABSTRACT

For durable consumer products, after-sales services play an important role in customers' purchase decisions. A manufacturer offers basic warranty available to all customers who buy the product, while a retailer offers optional after-sales service that is available only to customers who pay for the option. We explore the interaction of these two after-sales services assuming two customer segments. Formulating five analytical models, we found that after-sales service plans that are determined to maximize profits do not match optimal after-sales service levels that can satisfy customers the most.

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### 1. Introduction

Consider the following computer sales situation. A customer buying a personal computer (PC) at a computer shop is asked by the shop employee whether he wants to purchase certain after-sales service options, such as a longer warranty than usual. In most cases, PC manufacturers already offer a manufacturer's warranty, which is generally the default for every customer, whose support is limited, usually to a single year. For example, notebook computers sold at [dell.com](http://dell.com) have a default hardware warranty that states "1 Yr Ltd Warranty, 1 Yr Mail-In Service, and 1 Yr Technical Support." At the same time, [dell.com](http://dell.com) offers customers optional after-sales service plans, such as "3 Year Basic Service Plan" that includes a "\$50 Dell Promo Gift Card" at the additional price of \$119.00 ([dell.com](http://dell.com) web site, 2010). Some customers may be sensitive to price and think the base warranty is sufficient; however, other customers may pay much more attention to after-sales service and would welcome such an additional service option with an extra payment. Hence, it is critical for both the retailer and the manufacturer to create a reasonable after-sales policy that will result in the highest level of customer satisfaction.

An optional after-sales service plan is an important business tool for durable goods, such as electric appliances and PCs. It is well known that the margin from after-sales service is much larger than that from the product. That is, after-sales service is considered a key revenue generator in certain categories (Cohen

et al., 2006; Cohen and Whang, 1997). Also, after-sales service is now considered a critical strategic tool in the automobile industry (Flees and Senturia, 2008). Hence, on one hand, offering a large number of extra after-sales service plans to consumers leads to higher profitability. Recent marketing management focuses on lifetime value of a customer and maintaining long-term relationships with customers (Gupta and Lehmann, 2007). From this customer-relationship viewpoint, after-sales service is regarded as an important factor that has an impact on establishing good relationships with customers. On the other hand, a default and free basic after-sales service, such as a manufacturer's warranty, also plays an important role in attracting more customer attention in a market with severe brand competition (Chien, 2005). A good example of an excellent default warranty plan is Hyundai's, which offers a 5 year/60,000 mile bumper-to-bumper and 10 yr/100,000 mile powertrain protection warranty on all of its cars sold in the USA. Consequently, one challenge that a durable product manufacturer must resolve is the determination of the optimal combination of a default base after-sales service plan and the optional after-sales service plan. This is done through an analysis of the trade-off between a profit gain from the optimal plan and a sale gain from the base warranty.

#### 1.1. Supply chain and after-sales service

Offering adequate after-sales service to customers has become a major generator of revenue, profit, and competency in modern industries (Cohen et al., 2006; Cohen and Kunreuther, 2007). At the same time, after-sales services, such as warranties, cost firms a substantial amount of money. Many scholars have explored

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after-sales service from various viewpoints, such as spare parts supply chain, warranty, customer relationship, and so on. However, little research has been published so far on competition between the after-sales service offered by retailers and that offered by manufacturers taking both customer satisfaction and profit maximization into consideration.

In this paper, the objective is to analyze whether the after-sales service that both a retailer and a manufacturer offer to maximize their profit is equivalent to the after-sales service that would most satisfy customers, considering the balance between a default after-sales service and an optional after-sales service for a two-stage supply chain of a manufacturer and a retailer. We note that the equilibrium service level can be understood as that determined from an operations perspective, and the optimal service level in terms of customer satisfaction is that determined from the marketing perspective. In a sense, we analyze the marketing–operations interface in a two-stage supply chain of durable goods and electronics from the view of after-sales service plans. Our model sets up two customer segments: one is the group of customers who use only the base after-sales service offered by a manufacturer (hereafter Segment 0), and the other is the group of customers who apply and pay for an optional after-sales service offered by a retailer in addition to the manufacturer's base after-sales service (hereafter Segment 1). Note that a warranty, as an optional after-sales service with extra payment, is also called a *pro rata warranty* (Matis et al., 2008). That is, the manufacturer's base after-sales service plan influences the purchase of every customer, while the retailer's optional after-sales service plan has an impact on only customers belonging to Segment 1. Fig. 1 is a schematic representation of our modeling framework.

Using the aforementioned supply chain structure, we explore the following business cases:

Case 1. *Nash solution (base model)*: How can both supply chain members, a retailer and a manufacturer, determine the optimal after-sales service level when the service level is determined by the two firms simultaneously, the after-sales services being additive, and there being no interaction between them? We apply a Nash game to tackle this question.

Case 2. *Global optimization*: What will be the optimal after-sales service plan when we consider an integrated model where a manufacturer and a retailer are aggregated and only one decision maker controls the entire system?

Case 3. *Stackelberg solution*: Assuming that manufacturers make an after-sales service decision first, and then retailers make their after-sales service decision next, what will be the optimal

after-sales service level for the system? We apply a manufacturer-leader Stackelberg game to solve this question.

Case 4. *Price-sensitive optional service plan*: In the base model, demand for an optional after-sales service plan depends on level of the optional service, not on additional charge for the option. However, we relax this price independency and explore the effect of payment for an optional plan on after-sales service decision.

Case 5. *Interaction between two service plans*: The base model assumes that the manufacturer's warranty and the retailer's optional service plan have no interaction effect. We also investigate the effect of interaction between two after-sales service plans on equilibrium decision.

We also compare the results of Cases 2–5 with that of Case 1 (i.e., the base model). In addition, we propose several managerial insights and implications based on the obtained analytical results.

## 2. Literature review

In modern business in mainly durable goods, such as computers, automobiles, electric appliances, and construction equipment, after-sales service is regarded as a key revenue generator and a main competitive differentiator. Many scholars have modeled after-sales services. Cohen and Lee (1990) discuss the importance of excellent after-sales service with regard to spare parts, citing two cases: one in the computer industry and the other in the automobile industry. Cohen and Whang (1997) applied a product life-cycle model to study the relationship between product prices and after-sales service levels. In the model of Cohen and Whang (1997), a customer can obtain after-sales service only from either the manufacturer or an independent service shop. However, our model allows a customer to obtain simultaneously two after-sales services, one from the product's manufacturer and the other from the retailer. Interviewing representatives at leading manufacturers, Auromo and Ala-Risku (2005) identify that adequately and simultaneously managing demand for industrial services and supply network structure contributes to integrated and value-added services to customers. Service guarantees can be divided into two categories: economic payout and noneconomic payout. Baker and Collier (2005) define a systematic quantitative model that can determine for business the best portfolio of economic and noneconomic service guarantees. Smith and Eroglu (2009) empirically examine customer's evaluation on various off-site customer service contact methods, such as fax, email, and telephone. They develop a versatile off-site customer service scale that can be applied for various service encounter settings. Kameshwaran et al. (2009) analyze product-service bundling and pricing for a complex durable product that will more likely be maintained than replaced. Their game theoretic model shows how a firm should offer an after-sales program: offering product only, product and service independently, or product and service bundled. Analyzing the panel data over various product categories, Chen et al. (2010) explore the impact of extended service contracts on retail business of durable products. Their results show how an extended service purchase is influenced by hedonic/utilitarian value of products, marketing action, and consumer's characteristics.

Supersaturation of marketing efforts on customer response is a commonly experienced occurrence. For example, the majority of Internet users consider spam – unsolicited electronic junk mail from business that promote or advertise goods and services – so annoying and bothersome that the US government passed an anti-spam law in 2003 (Haag et al., 2007). On the other hand, marketing efforts on the part of Southwest Airlines and JetBlue Airways are frequently cited as successful examples of airlines applying a no-frills service policy. However, very little academic

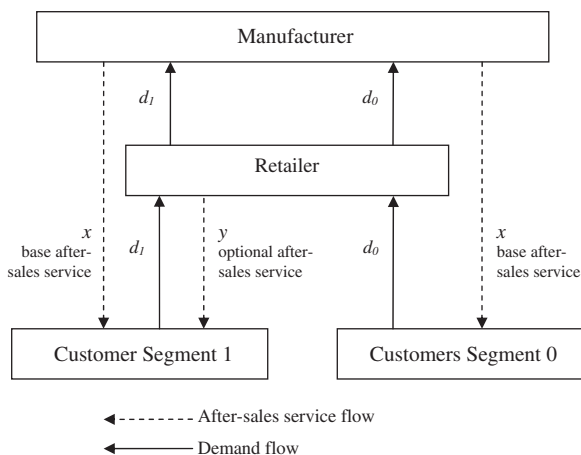


Fig. 1. Supply chain structure.

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