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Experience information goods: "Version-to-upgrade"

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ABSTRACT

In contrast to "search goods" whose true quality can be determined before inspection, we examine information goods that are "experience goods" — goods whose true quality can only be determined through use. We analyze a "version-to-upgrade" strategy where a monopolist generates vertically differentiated versions as bridges that lead consumers to experience the goods so that they can assess their true quality, and then provide upgrades to consumers that initially purchase lower quality versions. Adopting a two-stage model, we find that if consumers have homogeneous expectations about quality before experience, then the version-to-upgrade strategy involves upgrading all the consumers that in the first stage purchased the low quality version. In this way, consumers that upgrade effectively pay a tax for learning. When consumers have heterogeneous expectations about quality before experience, if consumers are pessimistic, then the version-to-upgrade strategy still drives all consumers to upgrade. However, if consumers are optimistic, then, the version-to-upgrade strategy may induce only some of the consumers that initially purchased the low quality version to upgrade. As profits from upgrades increase, the monopolist sets the quality of the low quality version to the lowest quality that can feasibly reveal the true quality, justifying the use of trial or demonstration versions.

1. Introduction

Development of information technology has made information goods popular. Characterized by large sunk costs of development, and negligible costs of reproduction and distribution, information goods are distinct from traditional physical goods [13]. Products such as computer software, online content and digitalized music, movies and books are typical examples of information goods [7].

Shapiro and Varian [13] suggest almost all information goods can be considered experience goods because consumers have to experience them to reveal their true quality. Different from search goods whose quality can be determined simply by inspection before purchase, the quality of experience goods is realized only after use [10,18]. For example, it is difficult for a software vendor to credibly describe all the features of its software in sufficient detail to communicate its true quality before use. Indeed, the more a consumer actually uses or experiences the software, the better they know its true value.

The concept of experience goods is originally due to Nelson [10], who contrasts an experience good with a search good. When a new product or service is introduced, potential users typically have imperfect information about the product's features, even though these features may be important to them. A critical source of information about the good comes with actual experience — hence the term "experience good" [10,12,18]. Shapiro [12] examines the pricing of experience goods with repeat purchases when consumers are optimistic and when they are pessimistic. With a multi-period model, he finds that when consumers are optimistic — that is, when consumers' expected quality is higher than the true quality, the monopolist takes advantage of consumers' optimism via a declining price path followed by a jump to a terminal price. But when consumers are pessimistic, the monopolist encourages more consumers to experience the good by using a low introductory price followed by a higher regular price. Similarly, Kim [8] uses a two-stage model to investigate monopoly pricing strategies for experience goods based on the credibility of price precommitment. His model shows that if the monopolist can credibly precommit prices, then it is optimal to set a high price in the first stage and a low price for the second stage. If the price precommitment is not credible, then the results reverse. Other research about experience goods includes Riordan [11] who investigates product variety and equilibrium quality of experience goods, Liebeskind and Rumelt [9] who analyze market for goods with uncertain product quality, and Villas-Boas [16] who models dynamic competition with experience goods.

Previous research mostly focuses on non-durable experience goods with repeat purchases. However, information goods are reusable durable goods and consumers typically purchase at most one unit of the good. To contrast our work with previous research, with durable goods consumers may choose to replace the old product with a new improved version where "version-to-upgrade" can be a strategic option, whereas with repeat purchases there is no need for upgrades.

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In order to communicate the true quality of their information goods, some producers distribute demonstration versions, and others even send out trial versions. Recently, Microsoft has adopted a versioning and upgrading strategy for the delivery of Windows Vista and Windows 7. Windows Vista has four versions, and in increasing order of capability/quality they are: Home Basic, Home Premium, Business and Ultimate. Windows Vista anytime upgrade (http://www.microsoft.com) allows consumers to upgrade from a lower quality version to any of the higher quality versions anytime by purchasing the corresponding upgrade license.

Without upgrades, providing four versions of Windows Vista is normally referred to as "versioning".[1] Versioning is second-degree price discrimination: "offer a product line and let users choose the version of the product most appropriate for them" [13]. To implement versioning, the monopolist usually produces a flagship version and disables some functionality to generate lower quality versions. Individual versions are delivered to separate targeted market segments.

Versioning of information goods has been studied in various contexts such as network externalities [6], competition [7,17] and anti-piracy [19]. In a setting of vertical product differentiation of information goods, they all reach the conclusion that versioning is not optimal without certain constraints, consistent with Bhargava and Choudhary [1]. Combining experience and information goods together, Chellappa and Shivendu [2] model pricing and sampling strategies for digital experience goods in vertically segmented markets to manage piracy. They find that piracy losses are more severe for products that do not live up to their hype rather than for those that have been undervalued in the market, thus requiring a greater deterrence investment for the former. Dogan et al. [4] propose a software versioning model when a monopolist offers a lower quality product in the first period with an upgrade in the second period. They find that the optimal software design in each period depends on demand variability and endogeneity. In their model, an upgrade is offered only after the initial version is provided. In contrast, our model explores the situation when a lower version, a higher version, and an upgrade option are provided simultaneously in the first period, letting the consumers decide whether to upgrade in the second period.

Allowing an upgrade makes versioning more complicated. Naming the strategy "version-to-upgrade", we examine how a monopolist prices different versions and the upgrade, and how the version-to-upgrade strategy impacts consumers' choices. Using a two-stage model where consumers purchase a version in the first stage and those that chose a lower quality version can upgrade in the second stage, we show that version-to-upgrade whereby at least two versions are offered can be an optimal strategy. We find that if consumers have homogeneous expectations about quality before experience, then the result of the version-to-upgrade strategy is to drive all consumers that chose the low quality version in the first stage to upgrade to the high quality version in the second stage. In this way, consumers that upgrade effectively pay a tax for learning. When consumers have heterogeneous expectations about quality before experience, the results depend on whether consumers are pessimistic or optimistic. If consumers are pessimistic, then the version-to-upgrade strategy still drives all consumers that chose the low quality version in the first stage to upgrade. However, if consumers are optimistic, then under certain conditions, the version-to-upgrade strategy results in only some of the consumers that purchased the low quality version in the first stage upgrading in the second stage. This is our first contribution.

We also find that in choosing qualities, the optimal quality of the high quality version depends on the tradeoff between increased profits from consumers purchasing the high quality version and from the upgrade as a result of an increase in quality, and the costs of developing a higher quality good. The optimal quality of the low quality version depends on the tradeoff between consumers that switch from the high to low quality version in the first stage and an increase in the overall number of consumers that purchase with an increase in the quality of the low quality version. In some cases this results in demonstration or trial versions that are of sufficient quality as to reveal the true quality of the higher quality versions. This is our second contribution.

The rest of the paper is organized as follows. We set up our modeling structure as well as notation and assumptions in Section 2. We propose the version-to-upgrade strategy in Section 3. In Section 4 we present a two-stage, two-version model of experience information goods with homogeneous consumer expectations of quality. We extend the model to the situation when consumers have heterogeneous expectations in Section 5. In Section 6 we endogenize the monopolist's quality choices. Discussion and future research are included in Section 7.

2. Modeling structure

Our structure is a two-stage model that involves a monopoly producer of information goods and consumers with heterogeneous tastes for quality. The information good we consider is an experience good so that before purchase, consumers only know the expected quality of the good. The true quality of the good is known to consumers only after actual purchase and use. We assume a consumer that only purchases a lower quality version of the good is able to appreciate the true quality of the higher quality version. This is reasonable because features embedded in the lower quality version usually help consumers appreciate the value of possible features included in the higher quality version. The typical example is Adobe Reader — only after we are familiar with the Adobe Reader can we fully appreciate the editing features included in the Adobe Professional.

We further assume each consumer purchases at most one unit of the good per period. In the first stage the monopolist offers its highest quality version and a degraded lower quality version. In the second stage, consumers that purchased the low quality version in the first stage can upgrade to the high quality version.

Consumers are heterogeneous in their individual taste of quality denoted as θ which is normalized to be in the interval [0,1]. We assume that θ has probability density and cumulative density functions $f(\theta)$ and $F(\theta)$ to set the population to unity. The density is strictly positive over its support and continuously differentiable. Following Bhargava and Choudhary [1], Jing [6] and Sundararajan [15], we make the following assumption about the distribution of consumer tastes:

Assumption 1. The reciprocal of the hazard function, $\frac{1-F(\theta)}{f(\theta)}$, is non-increasing in θ.[2]

We denote the true quality of the good as $q \in [\underline{q}, \overline{q}]$, where $\overline{q}$ is the highest possible quality under a general technology constraint and $\underline{q}$ is the lowest quality that reasonably can be used so that consumers can update their information about the quality of the good from experience. After the high quality version q_h is developed, it can be degraded to generate a lower quality version q_l. Before experiencing

[1] The demonstration and trial versions mentioned above can also be treated as a lower quality version of the final product. In that sense, providing demonstration and trial versions is versioning as well.

[2] As discussed in Bhargava and Choudhary [1], this assumption is satisfied by common distributions such as the uniform, normal, logistic, chi-squared, exponential, and Laplace distributions, and any distribution with increasing density.