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FREE TRIAL OR NO FREE TRIAL: OPTIMAL SOFTWARE PRODUCT DESIGN WITH NETWORK EXTERNALITIES

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Abstract

Software free trial is a common practice that has both positive and negative effects. On the one hand, it helps firms to exploit the positive network externalities by building up the total user base; on the other hand, it cannibalizes partial demand for the commercial software. The objective of my dissertation is to determine the conditions under which the firms should introduce the free trial and how should the firms design the quality of the free trial optimally. The impact of competition on free trial decisions is analyzed in the end.

Introduction

A positive network effect, or network externality, refers to the increase of consumer utility when more consumers become the users of the same product. Positive network externality is extremely important for software products for several reasons. A larger network of software users usually means more compatibility with other users. With greater size of the user base, there is greater chance of forming newsgroups that share usage and troubleshooting experiences. The post-purchase benefits, such as technical support and product update, depend greatly on the total number of users of the software product. Therefore, nowadays there is a common phenomenon in software industry called the “free trial” version of a commercial application. By offering a free trial version along with the commercial application, the software producers aim to build up the user base of their product to exploit the benefits from positive network externalities.

Offering free trial, however, can have negative impact on the software firm. When a firm offers a free trial version with limited functionality together with the fully functional commercial software, some consumers who have fewer requirements on quality and functionality of the application will be satisfied with the free trial version and won't buy the commercial software. In other words, the free trial software “cannibalizes” the demand for the full-functional commercial software.

This leads to a dilemma for the software producers: should the firm offer free trial to take advantage of the positive network externality or forgo the free trial to avoid the negative “cannibalization” effect? One major objective of my dissertation is to study the tradeoff between the network effect and the cannibalization effect. In particular, the following three research questions are to be addressed. First, under what conditions should the firm offer free trial? Secondly, how should the firm choose an optimal quality level of the free trial and set the price of the commercial software to maximize the profit? Finally, what will be the impact of competition on a firm's decisions on whether to offer free trial and the quality of the free trial software?

Literature Review

There is a lack of extant literature to address the software free trial problems although the network externalities have been a mainstream research tool for many software product design problems. Farrell and Saloner (1985, 1986) study the software compatibility and standardization problem by considering the impact of the size of the installed user base. Katz and Shapiro (1985, 1986) explore the technology adoption in the presence of network externalities. A more recent paper by Conner (1995) proposes that in the presence of large network externalities, an innovator will allow its competitors to “clone” its product with a lower quality to take advantage of the positive network externalities. Jing (2002) studies the product line structure design and market segmentation using the network externalities. Haruvy and Prasad (1998) study the optimal pricing strategy of a firm offering two

complementary products with different qualities by examining a separating equilibrium. Although the software free trial problem resembles the product line problems in the above papers in that the commercial and free trial software are essentially similar products with different qualities, the zero price feature of the free trial software prohibits a direct application of their models to study the problem.

According to the model in Conner’s (1995) paper, the firm’s optimal profit, however, is decreasing in the quality of the free trial software. This implies that the firm will set the quality of the free trial product to the lowest possible value, i.e. zero, in order to maximize its profit. In other words, the firm will *not* offer free trial software in *all* circumstances. Jing (2002) uses a similar approach as the one used in Conner’s (1995) paper. The model in Jing (2002) also reduces to no free trial result in all circumstances. In addition, the separating equilibrium in Haruvy and Prasad’s paper (1998) requires the optimal price of the lower quality product to be set to the customer’s reservation price, which is non-zero. A closer look at the models in Conner (1995) and Jing (2002) reveals that when the price of one product, i.e. the free trial software, is set to zero, the total user base is independent of the quality of the free trial software. That is, no matter how good (or how bad) the quality of the free trial is, there will be the same number of users of the software. Another interesting observation of their models is that the demand of the commercial product remains unchanged with the introduction of the free trial software. This suggests that the positive network effect is exactly offset by the negative cannibalization effect with the introduction of the free trial software. Further, the optimal price of the commercial software is increasing in the quality difference between the commercial and the free product. As a result, the optimal profit is decreasing in the quality of the free trial product and the no free trial conclusion follows.

Our experience with software products tells us that even if some software products are offered free of charge, we won’t try them all because it takes time to learn the functionality of the product and learn how to use it and get familiarized, etc. In the words, there are costs associated with using the software. Hence, the quality of the free trial software has to be at least high enough to induce trial from the consumers. In addition, the quality of the free trial software affects total the number of the software users, instead of being independent of the total user base as in the models of Conner (1995) and Jing (2002). Therefore, I will incorporate the aggregate software usage cost and follow Conner’s (1995) model with network externalities to study the optimal software product design problem.

The Model and Preliminary Findings

In general, the dissertation is divided two sections, one in monopoly market structure and the other in duopoly market structure. First consider a monopoly selling some software application. The firm will offer free trial only if it can achieve more profit from it. Therefore, to study the conditions under which the free trial is preferable, we need to compare the benchmark case when there is no free trial with the case when the firm offers both the free trial and the commercial software. In both cases, the valuation of the products increases with the size of the installed user base with positive network externalities. Let Q be the size of total user base and γ be the intensity of the network externality, then each consumer’s valuation of the software is increased by γQ . Following Conner’s model, the potential customer’s preferences on software quality are uniformly distributed between the interval $[0, 1]$ without network effects and the distribution shifts to $[0, 1 + \gamma Q]$ in the presence of network externalities. Then the demand of the commercial software in the benchmark case is given by

$$D = N(1 + \gamma Q) \left[\frac{(1 + \gamma Q) - \theta_0}{1 + \gamma Q} \right] \tag{1}$$

where N is the number of potential customers and θ_0 denotes the marginal consumer with zero net utility from using the software, i.e.,

$$\theta_0 \cdot s_H - P - c = 0 \tag{2}$$

Here s_H and P denote the quality and price of the commercial software. c is the aggregate software usage cost. Customers with greater preferences have positive net utility and will buy the commercial software. Rational expectation equilibrium requires the final installed base of the commercial software (Q) equal the demand of the commercial software (D). Then we can derive the commercial software demand from (1) and (2).

When the firm offers both the free trial and the commercial software, the total installed user base is the sum of free trial users and the commercial software buyers. In addition, there are two marginal consumers. The marginal consumer (θ_1) who is indifferent

between doing without and using the free trial is described by $\theta_L \cdot s_L - c = 0$ and the marginal consumer (θ_H) who is indifferent between the free and the commercial software is described by $\theta_H \cdot s_L - c = \theta_H \cdot s_H - P_H - c$. Here s_L and s_H denote the quality of the free trial and the commercial software ($s_L < s_H$). Therefore, consumers with preference between θ_L and θ_H will use the free trial software while consumers with preference between θ_H and $(1 + \gamma Q)$ will buy the commercial software. Note that the number of free trial users has two countervailing effects. On the one hand, they “cannibalize” the demand of the commercial software; on the other hand, they help to increase the total installed user base.

By solving the profit maximization problem for the firm in the benchmark and the two-product case, we can derive the condition under which the firm has incentive to offer the free trial software. Intuitively, when the network externality is large, the positive effect dominates the negative cannibalization effect. Of more interest will be the effect of the aggregate software usage cost. The second research question, how to set the quality level of the free trial software can be addressed by solving the profit maximization problem of the firm, taking the quality of free trial software and the price of the commercial software jointly as decision variables.

As to the free trial decision in duopoly market, I will introduce two firms and compare the firm’s profit with and without the free trial software in the similar approach as in the monopoly market. Obviously, the firm’s decision will also be dependent on the intensity of the network externality. In addition, the quality difference between the competing firms’ products will play an important role since it affects the profit distribution between the two firms.

Summary

The dissertation aims to study the firm’s optimal software free trial design strategy by considering the tradeoff between the network externalities and the cannibalization effect. There is a lack of extant literature to address the issues of software free trial. Applying models from related literature models fails to produce useful insights because of the zero price nature of the free trial software. Therefore, I propose an extension to the model of Conner (1995) by explicitly incorporating the aggregate cost of using the software.

Under the framework of the current model, I seek to uncover the conditions under which the firm will offer the free trial software and answer what will be the free trial software’s optimal quality and the optimal price of the commercial software. Finally, the impact of competition on the optimal strategy of free trial software will be examined.

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