SOFTWARE DYNAMIC PRICING BY AN OPTIMIZATION DETERMINISTIC
MODEL WITH PRESENCE OF PIRACY

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DEDICATION

To my worthy parents who are virtuous pillars of my growth. Moreover to people who seek the reality to quench their curiosity and use their faculty to change the world for the better.

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ABSTRACT

This project presents an optimization model for pricing a monopolistic software application with presence of piracy. The purpose is raising revenue produced by product's sale with adjusting prices in a price skimming strategy and minimizing amount of piracy. The model is a multifunctional price skimming optimization with simplex method which accompanied by deterministic and stochastic methods for calculating time intervals of each segment. Linear functions are used to describing demand of each segment. In addition a linear piracy function is proposed to making piracy a dynamic parameter. The model has the ability to apply penetration pricing and controlling market share. Windows 7 is chosen for case study. Optimizing case of Windows 7 is resulted in 8.2 percentage increase in revenue, while value of net market share is virtually constant. Therefore the developed model demonstrates its competence in optimizing revenue by modifying prices with presence of piracy. Results show that to face with piracy, range of price skimming must decreased in a way that highest price need to be intensely decreased and also lowest one must be slightly decreased. By using this strategy lowest loss in revenue due to piracy can be recurred. Effects of an escalation in piracy on proposed optimization model are: increase in number of sale, demand, selling portion, market share but decrease in price, price difference between segments, and revenue. Time intervals between successive prices, which are obtained for Windows 7, is obtained by deterministic and stochastic technics which are shown to be nearly equal due to large number of customers.

ABSTRAK

Kajian ini mengetengahkan pengoptimasian model untuk menentukan harga perisian berbentuk monopolistik dengan kewujudan masalah cetak rompak. Ia bertujuan untuk meningkatkan pulangan melalui penjualan produk tersebut. Ia dilaksanakan dengan menggunakan kaedah penentuan harga permulaan yang tinggi ketika produk tersebut baru diperkenalkan dan pada masa yang sama mengurangkan kadar cetak rompak. Model tersebut mempunyai pelbagai fungsi dalam menentukan harga termasuk kaedah simplex, kaedah boleh tentu dan kaedah stokastik. Fungsi berkadar terus digunakan untuk menentukan jumlah permintaan pada setiap segmen. Tambahan itu, fungsi yang berkadar terus dengan cetak rompak telah dicadangkan dengan menjadikan cetak rompak sebagai parameter yang dinamik. Model ini berupaya untuk menembusi pasaran dan menguasai pasaran. Perisian Windows 7 telah dipilih sebagai bahan ujikaji. Pengoptimasian perisian Windows 7 ini berjaya mengingkatkan pulangan sebanyak 8.2% manakala nilai penguasaan pasaran adalah tidak berubah. Oleh yang demikian, model yang telah dibina ini berjaya menunjukkan keupayaannya untuk mengoptimasikan pulangan dengan mengubah harga walaupun dengan kehadiran masalah cetak rompak. Keputusan kajian menunjukkan julat harga perlu dikurangkan bagi mengurangkan aktiviti cetak rompak. Peningkatan aktiviti cetak rompak pada model yang telah dioptimumkan ini adalah peningkatan jualan, permintaan pasaran, penguasaan pasaran tetapi perlu seiring dengan penurunan harga, perbezaan harga antara segmen dan pendapatan. Tempoh masa antara dua harga telah ditentukan melalui kaedah "deterministic" dan "stokastik". Nilainya adalah hampir sama memandangkan bilangan pengguna yang besar.

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INTRODUCTION

1.1   Introduction

In this chapter a background is presented to explain basic definitions and concepts of pricing and software market. Then research question, problem statement, objective and scope of project is presented.

1.2   Background

Revenue management is the use of pricing to increase the profit generated from a limited supply of supply chain assets. The impact of revenue management on supply chain performance can be significant. Pricing influences the amount of product demanded and the total revenue generated (Chopra & Meindl, 2010). It also is an important lever to increase supply chain profits by better matching supply and demand. Pricing plays a key role in most organizations' strategies (Simon 1992). It directly affects revenues and therefore, in the long term, profits. Incorrect decisions can jeopardize the company's reputation and customer relationships. Despite its importance, pricing strategies are often deficient in a number of respects, including lack of rationality in the shape of ad-hoc or arbitrary decisions (Florissen 2008). Small and midsize enterprises frequently rely on gut feeling when they make pricing decisions.

Dynamic pricing is the tactic of varying price over time, and suitable for assets such as fashion apparel that have a clear date which they lose a lot of their value beyond. Studies show that price adjustment at the right time usually has a greater impact on profit than a reduction in costs. For instance, a price adjustment of just 1 % can lead to a rise in operating profit of some 8 % (Marn et al., 2003).Price skimming is one of strategies of dynamic pricing. In that a rather high starting price gradually reduced in the course of time. The aim is to reach customers with a high willingness to pay first and to skim consumers with lower reservation prices later by a lower price (Buxmann et al., 2008a). Effectively this create multi-degree price discrimination segmenting customers with different values for the good. (Talluri & Van Ryzin, 2005). Price discrimination is strategy of charge customers with different prices for modified versions of a product.

The software industry is fundamentally different from other industries. This is partly due to the unique nature of software as a product, but also the structure of software markets. A distinctive feature of software products is that they, like all other digital goods, can be reproduced cheaply. In other words, variable costs are close to zero. This cost structure has the result that the licensing side of software providers' business is generally more profitable than the service side. Moreover, software can be copied any number of times without loss of quality. In addition, once a software product has been developed, it is relatively simple to create different versions or packages and sell these to separate groups of customers at different prices; this technic names versioning or price discrimination.

Software markets also have some unique characteristics. The software industry is more international in nature than practically any other sector. Software can be developed by distributed teams working almost anywhere in the world, and sold over the Internet in seconds, at negligible cost. This has fueled global competition between software providers. In comparison with other industries, providers in many segments enjoy little ''home advantage'' in their national markets. Moreover, the network effects associated with software often creates winner-takes-all markets (Buxmann, et al., 2013). It is relatively expensive to develop a first copy of a digital good. But the marginal cost of an additional copy is near zero. It cause cost-based pricing be useless

here and demand- or value-based pricing makes more sense. This means that software providers need to base their prices on how much their potential customers are willing to pay.

Regarding to special features which is alluded so far about software pricing conventional pricing models are not directly applicable to software products (Bontis and Chung 2000). Furthermore for price skimming have been not offered any model yet in software industry and it is the fact that inspires this research.

Most implemented models in supply chain minimize the cost of meeting demand rather than maximizing net revenue which is more appropriate for tactical and strategic planning (Shapiro, 2007). This is advantage of using revenue management that let managers to focus on maximizing revenue. Variables under control of marketing affect demand. A powerful one is price which changing it can influence on demand significantly. This strategy name dynamic pricing. Dynamic pricing is as old as commerce itself. Firms and individuals have always resorted to price adjustments (such as haggling at the bazaar) in an effort to sell their goods at a price that is as high as possible yet acceptable to customers. However, the last decade has witnessed an increased application of scientific methods and software systems for dynamic pricing, both in the estimation of demand functions and the optimization of pricing decisions (Talluri & Van Ryzin, 2005).

Price skimming is a strategy that can be used for software regarding to its nature which has a decreasing value until it get zero price. Thereby it is a prominent field that using it gives a noticeable profit to an organization. Price skimming increase number of sales by selling product to several segments. It rise the penetration rate of product that is very important for software since it boost number of users and the network effect in a synergy.

Segmenting of customers with differential pricing decreases the number of lost sales and thus improves asset availability to the customer, while improving profits for the asset owner (Chopra & Meindl, 2010). Availability of software in low price for

customers dims amount of piracy. This is attributable to the fact that the most common reason offered for pirating software is the high cost of legal software (Cheng, 1997)

According to the fourth BSA and IDC Global Software Piracy Study (Business Software Alliance), 43% of the software installed in 2009 on personal computers worldwide was obtained illegally, amounting to $51.4 billion in global losses (Anon., 2009). Base on the fact that piracy change demand of software remarkably it has to considered in pricing models in order to model make sense.

1.3   Research Questions

Fundamental questions by which this project is written are:

i.   What are optimum prices for selling software that maximize revenue with presence of piracy?

ii.   How to minimize piracy loss?

iii.   How to calculate time interval of each customer's segment?

1.4   Problem Statement

There is not an optimization price skimming model for software applications in the literature. Models use other mathematical methods include arithmetic, heuristic, exhaustive search. Furthermore limitative assumptions make models far from reality. In addition models are intricate and complex which are difficult to use. Common models for tangible goods are not useful in the case because they are based on inventory. Therefore a practical model which be able to describe properly the real situation of market is required.

1.5   Objective

The objective of the study is presenting a deterministic price skimming model for a software with existence of piracy in order to maximize revenue by adjusting prices in a dynamic situation of market. Furthermore obtaining time interval of customer's pricing segments.

1.6   Scope

Assumptions and tools that are used include: Market is monopoly, customers are heterogeneous and strategic, product is perishable, durable and therefore there is a finite sale horizon. Price skimming as a technique of dynamic pricing is used. Product is software and Windows 7 is used as the case study. Presence of software Piracy is considered. Mathematic tools that are used are nonlinear programing, optimization with Excel Solver, Matlab, Vensim and also revenue management techniques. Furthermore price skimming as a technique of dynamic pricing is used.

1.7   Conclusion

This chapter defines the project with presenting research questions, problem statement, objective and scope. In the next Chapter literature review is presented.

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