UNIVERSITI PUTRA MALAYSIA

MODEL DEVELOPMENT FOR MANUFACTURER PRICE AND RETAILER SERVICE COMPETITION IN A DUOPOLY COMMON RETAILER CHANNEL

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By

FATEMEH FIROUZI

Thesis Submitted to the School of Graduate Studies, University Putra Malaysia, in Fulfillment of the Requirement for the Degree of Master of Science

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DEDICATION

To

My Parents and Husband

Abstract of the thesis presented to the Senate of University Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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April 2009

Chairman: Associate Professor. Rosnah Mohd Yusuff, Ph.D.

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A model had been considered where there is price competition between two manufacturers and one retailer. Subsequently, this model was extended by including price competition between two manufacturers and two retailers. Moreover, price and service competition had been studied where there are two manufacturers producing competing products and selling them through a common retailer. The consumer demand depends on two factors: (1) retail price and (2) service level provided by the manufacturer.

In this study, a channel structure in which there are duopoly manufacturers and duopoly common retailers in competition between channel members under wholesale price and retail's margin and service provided by retailer was studied. Customer demand depends on two factors: (1) price and (2) service level provided by the retailer. Both of these manufacturers produce competing products and sell their products to both common retailers. This study focuses on the role of service provided by the retailer, how the bargaining power can affect the decision variables and channel member's profit, when there is competition between the retailers service and

margin and manufacturers price (decision variables). To overcome this problem a solution on the effect of bargaining power to supply chain equilibrium was studied. The demand function model was developed by considering service by retailer in duopoly retailer channel structure. The effect of bargaining power on equilibrium solution when the manufacturer or the retailer is a leader, and the effect of increase production cost and market base and price and service competition index on the channel's decision variables was determined. The game theory approach was used to derive equilibrium solutions for wholesale prices, retailer margins and service, and profits for each channel member. To study the effect of bargaining power in this supply chain equilibrium solution, Manufacturer Stackelberg, Retailer Stackelberg, and Vertical Nash were used. In this study, it was shown that customers receive the least benefit from service when the retailer is leader. They are better off when the manufacturer is leader. The effect of changes in price competition indexes (b_p, θ_p), service competition indexes (b_s, θ_s), production cost (c_i), and market base (a_{ij}) on market sensitivity were analyzed. The result showed that when c_i of one manufacturer increases, the firm can sell its product at a higher price and with lower quantity but its competitor benefits. By increasing the market base of one of the manufacturers, the wholesale and retail price increase. When customer tends to choose a product with lower price, the manufacturer sells its product with lower wholesale price. Since, it was assumed that the cost of providing service increases by the power of 2, it is not economical to invest in service. Therefore, by increasing θ_s and b_s the service level first increases and then decreases.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

PEMBANGANAN MODEL UNTUK PERSAINGAN HARGA ANTARA DUA PENGILANG DAN SERVIS ANTARA DUA PERUNCIT DALAM SALURAN YANG SAMA

oleh

FATEMEH FIROUZI

April 2009

Pengerusi   : Profesor Madya. Dr. Rosnah Mohd Yussuf, PhD

Fakulti   : Kejuruteraan

Tiga faktor utama dalam menggambarkan sifat persaingan: (1) struktur saluran, (2) kepimpinan saluran dan (3) persaingan produk dan simpanan. Suatu model telah diambilkira di mana persaingan harga di antara dua pengeluar dan satu peruncit. Seterusnya, model ini dilanjutkan dengan mengambilkira harga persaingan antara dua pengeluar dan dua peruncit. Tambahan pula, kajian antara persaingan harga dan perkhidmatan telah dibut mana terdapat dua pengeluar menghasilkan produk yang sama dan menjualnya terus kepada seorang peruncit. Permintaan pengguna bergantung kepada dua faktor: (1) harga runcit dan (2) tahap perkhidmatan yang disediakan oleh pengeluar.

Dalam kajian ini, struktur saluran yang mana terdapat dua pengeluar dan dua peruncit bersaing di bawah harga jualan borong dan margin runcit serta perkhidmatan yang disediakan oleh peruncit telah dikaji. Permintaan pengguna bergantung kepada dua faktor: (1) harga dan (2) tahap perkhidmatan yang disediakan oleh peruncit. Kedua-dua pengeluar ini menghasilkan produk yang sama dan menjualnya kepada kedua-dua peruncit. Kajian ini memfokuskan kepada peranan

v

perkhidmatan yang disediakan oleh peruncit, bagaimana kuasa tawar-menawar boleh memberi kesan kepada perubahan sesuatu keputusan dan keuntungan anggota saluran, apabila terdapat persaingan antara perkhidmatan para peruncit dan margin serta harga pengeluar (pembolehubah keputusan). Model fungsi permintaan telah dibangunkan dengan mengambil kira perkhidmatan oleh peruncit dalam struktur saluran peruncit duopoli. Kesan daripada kuasa tawar-menawar dalam proses penyelesaian seimbang apabila pengeluar atau peruncit mendahului dan kesan daripada peningkatan kos pengeluaran dan dasar pasaran dan harga serta indeks persaingan perkhidmatan kepada pembolehubah keputusan saluran telah dikenalpasti. Pendekatan teori *game* telah digunakan untuk memperolehi keputusan seimbang untuk jualan harga borong, margin peruncit dan perkhidmatan serta keuntungan untuk setiap anggota saluran. *Manufacturer Stackelberg, Retailer Stackelberg* dan *Vertical Nash* telah digunakan untuk mengkaji kuasa tawar-menawar dalam keputusan seimbang rantaian bekalan. Dalam kajian ini, ia menunjukkan bahawa apabila peruncit mendahului para pengguna menerima keuntungan yang paling kecil daripada perkhidmatan. Pengguna akan mendapat keuntungan yang lebih bila pengeluar mendahului. Kesan perubahan terhadap indeks persaingan harga (b_p, θ_p), indeks persaingan perkhidmatan (b_s, θ_s), kos pengeluaran (c_i) dan dasar pasaran (a_{ij}) dalam kepekaan pasaran telah dianalisis. Keputusan menunjukkan bahawa apabila c_i pengeluar meningkat, syarikat tersebut boleh menjual produk mereka pada harga yang tinggi dengan kuantiti yang lebih rendah. Dengan meningkatkan dasar pasaran pengeluar, jualan borong dan harga peruncit juga turut bertambah. Apabila pelanggan cenderung untuk memilih sesuatu produk dengan harga lebih rendah, pengeluar akan menjual produk mereka dengan harga borong. Ianya telah diandaikan bahawa tidak ekonomikal untuk melabur dalam

perkhidmatan oleh kerana peningkatan kos persediaan perkhidmatan dengan kadar dua kali ganda. Tahap perkhidmatan meningkat dan kemudian menurun dengan peningkatan θ_s dan b_s.

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I certify that a thesis Committee has met on 24 April 2009 to conduct the final examination of Fatemeh Firouzi on her thesis entitled "Model Development For Manufacturer Price and Retailer Service Competition In A Duopoly Common Retailer Channel" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Puta Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotation and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

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FATEMEH FIROUZI

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Date:

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

a	Market size for product
a_i	Market base for product i
a_{ij}	Market base of product i at store j
c	Manufacturing costs
c_i	Production cost of product i
c_k	Production cost of product k
GT	Game theory
IT	Information technology
m_j	Margin for retailer j
m_l	Margin for retailer l
m_1	Margin for retailer 1
m_2	Margin for retailer 2
m_j^*	Optimal value of margin for retailer j
M_1	Manufacturer 1
M_2	Manufacturer 2
MS	Manufacturer Stackelberg
p_i	Retailer price for product i
p_j	Retailer price for product j
P_{ij}	Price of product i sold by retailer j
p_1	Price for the end product sold by dealer 1
p_2	Price for the end product sold by dealer 2

q	Amount of technological quality improvement
Q_i	Demand for product i
Q_{ij}	Demand quantity of product i by retailer j
r	A synergy parameter
RS	Retailer Stackelberg
R_1	Retailer 1
R_2	Retailer 2
SCM	Supply chain management
S_j	Level of service provided by retailer j
S_l	Level of service provided by retailer l
S_j^*	Optimal value of service level provided by retailer j
S_1	Level of service provided by retailer 1
S_2	Level of service provided by retailer 2
S_i	Service level for product i
VSC	Vertical strategic complementarily
VSI	Vertical strategic independence
VSS	Vertical strategic substitutability
w_1	Wholesale price for product 1
w_2	Wholesale price for product 2
w_i	Wholesale price for product i
w_k	Wholesale price for product j
w_i^*	Optimal value of wholesale price for manufacturer i
x_1	Decision variable of player 1

x_2	Decision variable of player 2
$x_2{}^*$	Optimal value of decision variable of player 2
θ_s	A group of customers switch from other product at higher service as a result of increase service
α	Parameter for product differentiation
β	Parameter for store differentiation
$\prod M_i$	Profit of manufacturer i
$\prod M_k$	Profit of manufacturer k
$\prod R_j$	Profit of retailer j
$\prod R_l$	Profit of retailer l
η_i	Service cost coefficient of service provider i
$\pi_2(x_1, x_2)$	Profit function of player 2
$\pi_1(x_1, x_2)$	Profit function of player 1
b_p	A group of customers prefer to buy product that they have bought as a result of decrease in price
b_s	A group of customers prefer to buy product that they have bought as a result of increase in service
θ_p	A group of customers switch from other product at smaller price as a result of decrease price
η	A parameter that determines how expensive it is to improve quality
θ	Willingness of consumers to substitute the product of one of the downstream buyers for that of the other

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Emphasis in business has swung towards those strategies that can create long-term costumer loyalty as the main focus. The recognition that customer retention is the key to long-term profitability has brought with it an understanding of the critical importance of customer service. Customer today is very demanding and asks for more and more value. The capability required for market entrance and leadership has changed from ability to supply to ability to add more and more value to the customer (Altekar, 2006).

Today, independent retailers sell most consumer goods who also sell other competing brands (substitutes). Their normally goals have conflict from those of the manufacturers. These retailers are often much larger than many manufacturers, and are gaining more influence on distributing and pricing the product. On the other hand, in some markets manufacturers have more power than the retailer and their decisions influence the pricing and distributing of products (Choi, 1996).

Conditional upon the situation in any particular industry, the bargaining power of retailers and manufacturers can vary significantly. Variation in bargaining power in a particular supply chain can create three scenarios following the notions in (Choi, 1991; Charoensiriwath, 2004):

1) Manufacturer Stackelberg (MS): The manufacturers possess more bargaining power than the retailer and thus are the Stackelberg leader. In this situation, both of the manufacturers have equal bargaining power.

2) Retailer Stackelberg (RS): The retailer has more bargaining power than the manufacturers and is the Stackelberg leader.

3) Vertical Nash (VN): The bargaining power is equal for both the manufacturer and the retailer.

Due to current dynamic and competitive environment, manufacturers must compete with more complicated strategies than lowering their price with their rival. Non-price factors such as service have become more effective in a consumer's preference to buy a product than other. Product price is not only concerns for end customer, but one of the major concerns for them is how good product service (the after-sale and repair service) is. A manufacturer must consider issues such as competitive pressure from other manufacturers and their channel coordination with retailer in their decision processes as well.

Post-sale customer support, product advertising, improved product quality, on-time product delivery, responsive product repair, guideline about how to install or use the product, maintenance service, or warranty and guaranty repairs, free repair, faster check-out, etc is included as example of services. The consumer's perceived value of the product can be increased by each of these services. As mentioned above, these

retailers are more effective on amount of sell of goods so the service can be provided by these retailers for customer.

A model that included price (decision variable) competition with two manufacturers and a single retailer has been analyzed by Choi (1991). This study focuses on the effects of retailer power that occur as a result of dealing with multiple products. Choi (1996) extended Choi's (1991) analysis by including price competition between duopoly common retailers. A model with two manufacturers and two retailers has been analyzed. Its focus was on the intra- and inter-channel price competition instead of channel coordination.

Charoensiriwath (2004) studied a case where there are two manufacturers producing competing products and selling them through a common retailer. The consumer demand depends on two factors: (1) retail price and (2) service level provided by the manufacturer. They extended Choi (1991) by adding a service factor.

1.2 Problem Statement

Choi (1996) analyzed price competition where there are two manufacturers and two retailers. He considered effect of bargaining power on his model's decision variables.

As Charoensiriwath (2004) mentioned, "Because, the potential impact from the service quality to consumer demands, negotiations between the manufacturer and retailer on their price and order quantity will be affected. Moreover, competitive pressure from other manufacturers and their channel coordination with retailer are

issues that a manufacturer must consider in their decision processes." They studied competition under manufacturer service and retail price in channel structure that are two manufacturers and a common retailer. They considered the effect of bargaining power in their supply chain.

Consequently, this study focused on the role of service provided by the retailer and how bargaining power can affect the decision variables and channel members profit, where there is competition between the retailers service and margin and manufacturers price.

This research explored the role of bargaining power in supply chain strategy interactions and investigated. It took into account the strategic behavior of firms when the manufacturer posses more bargaining power than the retailer, when the retailer posses more bargaining power than the manufacturer, and when both of them have equal bargaining power. Details of this investigation are explained in chapter 3.

1.3 Objective

In a market with a monopolist or a group of oligopolists, more bargaining power would be possessed by the manufacturers than the retailers. He would be able to sell their product by adding some charges above the competitive price. On the other hand, the manufacturer's profit can be brought down, when the retailers possess more negotiation power, He will absorbed more to the profit. By developing a demand function model the following objectives can be investigated:

1) To determine the effect of bargaining power on equilibrium solutions (wholesale price, retailer margin, service level, manufacturer and retailer profit) when the manufacturer or the retailer is a leader.

2) To determine the effect of increase in production cost and market base on the channel's decision variables (retailer margin, wholesale price and service levels).

3) To determine the effect of increase in price and service competition index on the channel's decision variables.

Although the service competition between channel members in duopoly common retailers channel structure has not been investigated by retailer, therefore, providing service by retailer can not be neglected in real-life problems.

1.4 Scope of Study

In this supply chain structure a case where there are two manufacturers producing competing products was studied. Both of these manufacturers sell their products to both common retailers, who sell the products to the customer.

It is assumed that the only decision variables were wholesale prices, service provided by the retailer, and retail margins. That is, each manufacturer produces a single product and decides its wholesale price, and then the retailers raise the sale price to their respective margins to determine retail prices. Only services provided by the