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Equilibrium and strategies of horizontal mergers inasymmetric differentiated oligopoly

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EQUILIBRIUM AND STRATEGIES OF HORIZONTAL MERGERS IN ASYMMETRIC DIFFERENTIATED OLIGOPOLY

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EQUILIBRIUM AND STRATEGIES OF HORIZONTAL MERGERS IN ASYMMETRIC DIFFERENTIATED OLIGOPOLY

by
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ABSTRACT

Equilibrium and Strategy of
Horizontal Mergers
in Asymmetric Differentiated Oligopoly

by

LU Juan

Master of Philosophy

Building an asymmetric differentiated goods quantity competition model, the present paper explores how substitutability of products, one of the factors affecting the unilateral effect, determines horizontal mergers and acquisitions equilibrium and strategies. It seems intuitively obvious that the merger between firms with goods that are sufficiently close substitutes can be more profitable. However, this thesis's counter-intuitive results show that, for some parameter values, a merger is more profitable for the merging firm when the target firm produces a distant substitutes (i.e., when it is not the closest competitor to the acquiring firm in the market).The theoretical analysis shows that to merge with firm with low substitute parameter is more profitable provided that target firms are close enough and the both of them are distant enough from merging firms. The results in Cournot model and Bertrand have some similarities, for example, they both harm to consumer surplus and the optimal strategy harms most. For the difference, for example, in Cournot model, whenever it is profitable to merge with a distant competitor, it is the optimal strategy, while in Bertrand model, it depends. The paper also extends the classical "horizontal merger paradox" to a setting of asymmetric differentiated oligopoly.

Keywords: asymmetric oligopoly; horizontal merger; merger paradox.

DECLARATION

I declare that this is an original work based primarily on my own research, and I warrant that all citations of previous research, published or unpublished, have been duly acknowledged.

SIGNED

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Date: 24/09/2013

CERTIFICATE OF APPROVAL OF THESIS

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CONTENTS

LIST OF TABLES iii

LIST OF FIGURES iv

ACKNOWLEDGEMENTS v

Chapter

1. INTRODUCTION 1

1.1 Background of Economics and Merger Guidelines 1
1.2 Motivation of this Thesis 2
1.3 Outline of the Thesis 4
1.4 Contribution to the Existing Literature 5

2. LITERATURE REVIEW 9

2.1 Price, Quantity and Profit Effects of Horizontal Merger 9
2.2 Discussions on Profitability 10
2.3 Concentration and Market Structure 12
2.4 Welfare and Efficiency 13
2.5 Costs Consideration 14
2.6 Entry and Exit 15
2.7 Product Substitutability 16
2.8 Other Related Literature 16

3. HORIZONTAL MERGERS UNDER COURNOT COMPETITION 20

3.1 Theoretical Framework 20
3.2 Dropping Product Line 25
3.3 Special Case 28
3.3.1 Effects on Price and Quantity 29
3.3.2 Merger Profitability and Optimal Strategy in Semi-asymmetric Model 31
3.3.3 Consumer Surplus and Social Welfare 33
3.4 Asymmetric Substitutability 35
3.4.1 Merger Profitability 36
3.4.2 Target Optimal Strategy and Equilibrium 37
3.4.3 The Unilateral Effects 39

3.4.4 Impacts on Consumer Surplus and Social Welfare 41

4. HORIZONTAL MERGERS UNDER BERTRAND COMPETITION 44

4.1 Theoretical Framework 44
4.2 Dropping Product Line 48
4.3 Asymmetric Substitutability 51
4.3.1 Merger Profitability 52
4.3.2 Target Optimal Strategy and Equilibrium 53
4.3.4 Unilateral Effects 55
4.3.5 Impacts on Consumer Surplus and Social Welfare 56

5. A COMPARISON OF BERTRAND AND COURNOT 58

5.1 Comparison of Asymmetric Bertrand and Cournot Competition Model 58
5.2 Comparisons with Others Researches: Asymmetric and Symmetric 61

6. POLICY IMPLICATION AND CONCLUSIONS 63

6.1 Policy Implication 63
6.2 Concluding Remarks 64
6.3 Future Extensions 65

Appendix 66

BIBLIOGRAPHY 72

LIST OF TABLES

Table 1: Comparison of Asymmetric Bertrand and Cournot Model.....56

Table 2: Comparison of Asymmetric and Symmetric.....59

LIST OF FIGURES

Figure C1: Impacts on Prices.....28

Figure C2: Impacts on Quantities.....29

Figure C3: Impacts on Consumer Surplus.....33

Figure C4: Impacts on Social Welfare.....33

Figure C5: Profitable Mergers and Optimal Mergers in Cournot Model.....34

Figure B1: Dropping Product Lin after Merger.....48

Figure B2: Profitable Mergers and Optimal Mergers in Cournot Model.....50

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Chapter 1 Introduction

1.1Background of Economics and Merger Guidelines

"Horizontal merger" refers to those companies with similar functions in production or sale of comparable products merge that together and are direct competitors. In the economic market, horizontal merger could be a double-edged sword. A merger could enable merging parties to eliminate competition, enhance market power and reduce unnecessary efficiency losses. Also, it could increase the risk of coordinated, accommodating, or interdependent behavior among rivals and improve market power. It is also possible to encourage monopoly, drastically increase price, discourage innovation and reduce social welfare, which harm both consumers and potential entries. Qiu and Zhou (2007) say that why firms merge and how they merge are the focus of economic researchers. For this thesis, I also explore how a merging firm could choose to merge.

Merger guidelines and policy enforcement provide a useful benchmark for evaluating a merger. It is widely agreed that Merger Guidelines provide a benchmark for evaluating a merger and they have experienced several large changes. In 1960s, merger policy tends to in part reflect that the authorities seems desire to preserve and protect small business for noneconomic reasons (Schmalensee, 1987, p.41). According to the recent revised Merger Guidelines, the Federal Trade Commission (FTC) may consider horizontal merger to be an anticompetitive merger strategy according to total market share and concentration. In August, 2010, the U.S. Department of Justice and the Federal Trade Commission issued Horizontal Merger

Guidelines[1]. These guidelines try to encapsulate the analytical techniques, practices, and the enforcement policy of the U.S. Department of Justice and the Federal Trade Commission (the Agencies) with respect to merger and acquisition, which may involve actual and potential competitors, namely horizontal mergers, under the federal laws. The agencies try to find ways to identify competitively harmful mergers and avoid possible interference with mergers either competitively beneficial or neutral. Types of evidence for these guidelines outline are adverse competitive effects, actual effects observed in consummated mergers, direct comparison based on experience, market shares and concentration in a relevant market, substantial head to head competition, and disruptive role of a merging party. Since being issued, the Horizontal Merger Guidelines have far-reaching influence on the development of anti-monopoly control and they also reflect the information of the most forefront of relating practices and theories. Although the guidelines describe some analytical techniques and types of evidence to judge a horizontal merger lessening competition, there is much we could do to help perfect the guidelines about how to judge a horizontal merger.

1.2 Motivation of this Thesis

Although there are enormous existing literatures about this issue, there is a huge developing space of supporting theories and models behind these guidelines. This paper thus tries to build a model to interpret companies' merger behavior and predict the impacts of these merger behaviors on some factors, such as price, social welfare, profit and output. Besides, it is known that horizontal mergers may drastically increase price, decrease product quality, discourage innovation, and thus reduce

[1]The original guidelines were published in 1982. These guidelines replace the Horizontal Merger Guidelines issued in 1992, and revised in 1997. This change reflects the ongoing accumulation of experience at the agencies. The commentary on the Horizontal Guidelines issued by the Agencies in 2006 remains a valuable supplement to these Guidelines. When it is necessary, the agency would revise these guidelines from time to time to cover changes in enforcement policy, to solve new problems under practice.

social welfare. It is taken for granted that the competition effect of mergers depends on product substitutability and the extent of such negative unilateral effect depends on the degree of substitutability of non-merging firms in the relevant market. The existing literatures have been exploring horizontal mergers in symmetric differentiated oligopoly and few consider asymmetric differentiated oligopoly. The assumptions about symmetric differentiated oligopoly are divorced from the reality and firms are expected to face more complicated situation. A firm, for instance, often faces different types of firms target for acquisition, for example, firm 1 and firm 2 provide similar products, while firm 3 offers a more differentiated product. Is it ever the case that it is always more profitable for a merging firm to acquire a closer competitor which seems harms merging firm most? How does the product substitutability affect the incentives of merger? Exactly how firm incentive for mergers depends on product substitutability is not well studied in the literature. In this thesis, both Cournot and Bertrand models are developed to demonstrate these questions. I believe that this is an auspicious point for suitable improvement in economic theories and has reference value for both competition authorities and merger firms.

On the other hand, related progress about horizontal merger in China economic market is stagnant. Anti-monopoly law is the basic of market economy and it plays an important role of promoting competitive mechanism and social welfare. Unfortunately, China did not issue the first anti-monopoly law, which still cannot satisfy the market demand of laws and bills until 2008. This law marks an important milestone in China's antitrust regime. China' economy needs market competition to thrive in a healthy and robust manner and related law issues have become first concerns of companies. The

fact that there would be substantial overlap between U.S. Guidelines and the corresponding in China makes researches on U.S. Guidelines immediately applicable to the guidelines in China. With these historical circumstances, the Chinese government should borrow ideas from Horizontal Merger Guidelines and promote the development of corresponding guidelines according to actual state of economic development in China.

1.3Outline of the Thesis

This thesis begins with a comprehensive overview of the economic theories about horizontal mergers. Chapter 2 provides an overview of the related literature and attempt to clarify complicated research issues about horizontal merger. In this section, I would definitely stress the concept of "merger paradox" first intensified by Salant *et al.* (1983), which demonstrates that a merger is not always profitable in Cournot market with homogeneous firms and when the market share exceed 80 percent then the merger can be profitable. Further, the literature studies are classified into a few sorts: price, quantity and profit effects, profitability, concentration and market structure, welfare and efficiency, cost consideration, entry and exit, product substitutability, other related literature and literature remarks. This classification also offers perspectives to understand economic theories behind merger guidelines. Chapter 3 and Chapter 4 focus on horizontal mergers under asymmetric Cournot and Bertrand competition models. In these sections, I present differentiated products Cournot and Bertrand competition models with two different substitute indexes and derive a set of lemmas and propositions. Definitely, these two parts answers the question regarding a firm's best merger strategies when facing firms with different product substitutability. For chapter 5, comparisons between Bertrand and Cournot

model are developed. In Chapter 6, I move my focus to the analysis of policy implication and the application of this research to the guidelines.

1.4 Contribution to the Existing Literature

Much of the literature has stayed with product homogeneity assumption or symmetric differentiated oligopoly. But I am unaware of studies which consider further differentiated oligopoly about horizontal merger. This main contribution of this thesis lies in the relaxation of symmetric differentiated oligopoly. The purpose of this relaxation is to demonstrate how the web of substitute parameters affects merger strategies and I will emphasize the importance of competitive effects analysis.

Under the assumption of homogeneity or symmetric differentiated oligopoly, researchers found that a merger can be profitable only when the substitution parameter is sufficiently small in Cournot goods market and the non-merging firms tend to benefit from a merger. For instance, Salantet al. (1983) points out that a merger is profitable only if when the merger is more than 80 percent pre-merger market share. Hsu and Wang (2010), using standard differentiated goods quantity competition setting, demonstrate that a merger between two firms distant enough is profitable and conclude that differentiated goods markets encourage many more mergers than homogeneous goods market. While researchers as Deneckere and Davidson (1985), using Shubik-type demand system, study the merger paradox in symmetric price competition and show that mergers of any size are beneficial. It is a worthwhile job further to extend the symmetric oligopoly model to asymmetric oligopoly model. Asymmetry in this thesis refers to product substitutability and we use substitute parameters to describe this. As far as substitute parameter is concerned, the U.S. Horizontal Merger Guidelines in 2010 state briefly that when products are

close substitute they compete strongly with each other and a merger is expected to diminish competition by raising price one or both products. In other words, substitutability among products would definitely influence the extent of diminishing competition and thus affect the merger decisions of merging firms. It is obvious that the results in Bertrand case can be in sharp contrast to Cournot case and therefore this thesis would take the two situations into consideration and analyze them respectively.

Sizable existing literatures make research on the issue of horizontal merger from distinct perspectives. Researches on the price and profit effects are definitely the fundamental and primitive (As Barton and Sherman (1984), Perry and Porter, Fareell and Shapiro (1988), Higgins, Johnson and Sullivan (2005), Mizuno (2009), Fridolfsson and Stennek (2010).). When considering profitability, researchers introduce the concept of "Insiders' dilemma" or "Merger paradox", which later become one of focuses of researches and they even try to solve this problem(As Stigler (1950), Salant *et al.* (1983), Farrell and Shapiro (1990), Lindqvist and Stennek (2005), Cesi (2010)). Some literature concentrates on concentration or market structure and provides theory support for merger guidelines to some extent (As Huck, Konrad and Muller (2004), Fridolfsson and Stennek (2010), Hendricks and Mcafee (2010)). Another significant consideration about horizontal merger is welfare and efficiency (As Farrell and Shapiro (1988), Zhou (2008), Mizuno (2009), Oldale and Padilla (2010), Verge (2010), Fridolfsson and Stennek (2010), Gelves (2010), Erkal and Piccinin (2010)). Besides, the character of cost is an important factor affecting horizontal merger and attracts much attention (As Ferreira (2010), Farrell and Shapiro (1988), Gelves (2010)). Whether a merger induces an entry or

exit, equilibrium merger tend to be different since when there is an entry or exit, the market structure is changed and the resulting consequences relevant to horizontal merger are supposed to be influenced (As Gowrisankaran (1999), Filson and Sonsamphant (2005), Erkal and Piccinin (2010)). In the later literature section, I will also recite some literature discussing other aspects of horizontal merger. With regard to asymmetric product substitute, few researchers discuss this topic in details (As Deneckere and Davidson (1985), Ramaswamy (1997)). Although, to further consider this issue is complicated and challenging, it is a worthwhile job to explore and this thesis will try to contribute in this aspect.

This thesis attempts to study how the firm incentive for mergers depends on product substitutability and what the resulting unilateral anticompetitive effects are after merger in my assumption. The merged firms and its rivals both has the motive power to pursue their unilateral self-interests and a horizontal merger drive the merged firm to charge a higher price, and lower the output while non-merging firms do not alter their strategies (Werden and Froeb, 2006). This thesis firstly presents differentiated products Cournot and Bertrand competition models with three firms and two different substitute parameters. Under this assumption, there are several interesting facts about horizontal merger, which are not found in homogeneous or symmetric differentiated oligopoly. In asymmetric Counot oligopoly, first, the merger paradox still exists and a profitable merger with a close competitor has the largest proportion of portfolio of two different substitute parameters than a profitable merger with a distant competitor. In other words, to merge with a close competitor is more "likely" to be profitable than to merge with a distant competitor. Second, very absorbing, however, is whenever it is profitable to acquire a more distant competitor, it is the

optimal strategy, which is counter-intuitive. Since we usually believe that we should always acquire the close competitor threatening us most. In later section, I would develop my propositions rigorously and furnish this thesis's perspective of comprehension. In asymmetric Bertrand oligopoly, any merger is profitable and it is more profitable for a merging firm to acquire a close firm and dropping is possible in Bertrand. Similarly, I will definitely describe and prove them in strict economic methods. Although, there are limitations to my thesis, it commendably contributes to the existing literature about horizontal merger by exploring asymmetric differentiated oligopoly and extending our discussion about horizontal merger.

Chapter 2 Literature Review

2.1Price, Quantity and Profit Effects of Horizontal Merger

This thesis will analyze the literature on price, quantity and profits effects of horizontal merger as the starting point. Salant, Switzer and Reynolds (1983) come to the conclusion that the output of insiders contracts and the output of the outsiders expands after a merger. Using data covering a ten year period from the merger between Xidex Corporation and its two competitors, Barton and Sherman (1984) test the price and profit effect. Their results indicate that price increases can be traced to the acquisitions. They also find that the raising price result into firm's profit gain which is enough to cover the cost of acquisition. Perry and Porter (1985) believe that a merger result in a price increase and the incentive to merge is determined by two forces, the first is the price increase and the second the output reduction. And, they point out that the S-S-R mode could severely underestimate the incentive to merge but once the merged firm is allowed to be large as each partner, the reduction of output would be lower than in the S-S-R model. Farrell and Shapiro (1990) analyze the mergers as transfer of capital and develop the proposition that under some conditions a small transfer of capital from firm one firm to another would reduce output and increase price. They point out that when a weighted sum of other firms' market shares are large compared to participants' market shares, external effects is positively connected to capital transfer. One ambiguous result is that increasing capital's concentration is beneficial to raise overall welfare even when it increases price.

Rather differently with the view that a merger is supposed to raise the prices of both the merged and merging firms when considering the model of Cournot Oligopoly

(See, for example, Werden and Froeb (1994), Shapiro (1996)), Higgins, Johnson, and Sullivan (2005) hold that merger of competitors does not necessarily raise the prices in the Bertrand competition model. Actually, the merger can increase consumer welfare. This is one of the reasons why this thesis will consider both the Cournot and Bertrand Oligopoly models for the same issue. Fridolfsson and Stennek (2010) present their endogenous mergers and demonstrate that competitors' share prices may be reduced by anti-competitive mergers when there is announcement or rumor that informs the market that the competitors fail to buy the target. They conclude that anti-competitive mergers can still reduce competitors' share prices when increasing their profits, which is very similar to the statement that not raising all prices does not invoke efficiencies (See Higgins, Johnson, and Sullivan (2005)).

Werden and Froeb (2006) introduce and discuss important research about unilateral effects in detail. "*Horizontal mergers give rise to unilateral anticompetitive effects if they cause the merged firm to charge a higher price, produce a lower output, or otherwise act less intensely competitive than the merging firms, while non-merging rivals do not alter their strategies*". Firstly, the economic theory underlying the unilateral competitive effects of mergers is reviewed and then, two classes of empirical methods to predict quantitatively the unilateral effects of proposed mergers will be applied.

2.2Discussions on Profitability

With regards to profitability, the most well-known issue is the merger paradox. Salant, Switzer and Reynolds (1983), Szidarowsky and Yakowitz (1982), and Davidson and Deneckere (1985) all put forward that a merger is not necessarily

always profitable and a merger is possible to reduce the profits of participating firms. Increase in production by outsiders following the merger is possible to reduce insider profits, which is thus less than the increase in equilibrium profits when the outsider output is hold constant. And a merger is profitable only if the concentration of firms exceed 80 percent (See Salant et al. (1983)). The results in my Cournot are consistent with their demonstration that not all mergers are expected to be beneficial to firm's profits. While in differentiated products price competition model, a merger is always beneficial to existing firms and the profitability increases with the increasing of merger size (See Deneckere and Davidson (1985)).

There are different opinions about this issue. For instance, Huck, Konrad and Muller (2004) find that a merger with commitment by governance or endogenous commitment is profitable in symmetric linear Cournot markets with more than four firms. When considering the profitability of horizontal mergers in the dynamic competition with price stickiness, Dockner and Gaunersdorfer (2001) conclude that any total number of mergers between two and ten in the case of dynamic competition. Benchekroun (2003) shows that when firms use open-loop strategies, large market share is needed to guarantee a profitable merger and when firms use feedback strategies, even an arbitrarily small market share is enough to lead to a profitable merger. Besides, the author demonstrates that in closed-loop environment more competitors is even more harmful and thus a coalition through a merger, even of small size, is attractive. Many of researchers have been trying to revise the original model to analyze the profitability of mergers, as Perry and Porter (1985) replace the original constant costs assumption with quadratic costs assumption. Faul-Oller (1997) set costs of two different firms as asymmetric. Huck et al. (2004) add the variable of

information to the model. Hsu and Wang (2010) point that a two firm merger is profitable provided that the goods are distant substitutes enough when they study horizontal merger in a differentiated Cournot Oligopoly. Zhou (2008) builds a model in which firms are uncertain about productions costs. Information structure determines firms' incentives to merger and, when possessing more complete information, firms are less attracted to merge. Cesi (2010) shows a bilateral horizontal merger is profitable when a stick and carrot strategy equilibrium exists.

2.3Concentration and Market Structure

Market shares and Concentration in a relevant market is one of the evidences of adverse competitive effects used by the agencies to address the question of whether a merger substantially lessens competition. Normally, the agencies calculate market shares to reflect firms' competitive significance. One useful indicator of likely competitive effects of a merger is market concentration. The traditional measurement of concentration is Hirsman-Herfindahl Index (HHI). HHI index refers to the sum of the squared market shares of firms and is assumed to be proportional to the difference between price and cost and is zero for perfect competition and one for monopoly. In the U.S. Horizontal Merger Guidelines of 2010, the agencies classify markets into three types: unconcentrated markets with HHI below 1500, moderately concentrated markets with HHI between 1500 and 2500, and highly concentrated markets with HHI above 2500.As the major criteria of concentration analysis by the U.S. Department of Justice and the Federal Trade Commission, HHI, to some extent, help to evaluate concentration of mergers and tend to be useful. But, there are moments when it fails, e.g. Farrell and Shapiro (1988) conclude that to measure the concentration using HHI index when it is already high is misleading since both the

distribution of outputs across firms and aggregate output level are important aspects of industry performance, and thus some researchers try to solve this problem. For example, Hendricks and Mcafee (2010) develop an alternative theory applying to intermediate goods industries with large number of firms to expand HHI inapplicable when market is concentrated. When there is no market power, the new index system specializes to the HHI. But, limitations of their development still exist: their theory is restricted to homogenous good markets and the extension of theoretical approach to differentiated markets is still challenging.

2.4Welfare and Efficiency

With respect to efficiencies, the Horizontal merger guidelines demonstrate that merger-generated efficiencies is beneficial to competition and help to counteract the negative effects of merger since two ineffective competitors is able to form a more effective competitor, e.g., by combing complementary assets. Nevertheless, it is difficult to verify and quantify efficiency because, in part, the much of related information is possessed by the merging firms. When a merger has sufficiently cognizable efficiencies, it is possible not to be challenged by the Agencies.

Welfare and efficiency discussions are not rare in the existing literatures. Williamson (1968) explicitly investigates the welfare tradeoffs about scale economy and market power effects in merger questions. Qiu (1997) compares the efficiency of Bertrand and Counot equilibrium in a duopoly with R&D competition. The research finds that Bertrand is not expect to achieve higher dynamic efficiency that Cournot. Debates about consumer welfare and total welfare have been long-standing and hot topic in the analysis of horizontal merger. Few of arguments about the use of consumer

welfare standard are convincing and optimal welfare standard is perhaps the total welfare. Governments enacting merger legislation are encouraged to take the long-run total welfare maximization as the target, but, the problem is it is difficult to estimate and measure the long-run effects of a merger and thus it is not a practical guide. It is suggested that the discussions on assessing whether to use a total or consumer welfare standard is nonsense. And we should move the debate on this controversy to how the short term price influence the long term outcomes for consumers and economy and how to balance competition and efficiency (See Oldale and Padilla 2010).

Erkal and Piccinin (2010) estimate how the consumer welfare is affected in differentiated oligopolies with linear demand. They found all entry-inducing mergers are harmful to consumer welfare since there are no sufficient large merger-generated efficiencies and mergers inducing exit result in sufficiently high cost saving and is beneficial to consumer welfare. Verge (2010) pays attention to the formal analysis of structural remedies about merger and shows that it turns out to be useful only a very limited set of cases. When divested assets are transferred to a single outsider or the largest firm is not big enough in a market with three firms, consumer surplus hurts by the merger and the merger should be blocked.

2.5Costs Consideration

Cost is an important factor and different researches consider costs from distinct perspectives when analyzing horizontal mergers and resulting competitive effects. Some scholars assume costs as uncertain and explore the competitive effects of mergers. For example, Perry and Porter (1985) assume that the cost function is

determined by the firm's fraction of the capital stock and the output x, further, cost function is linearly homogenous in the fraction of capital stock and output. Thus, constant returns to scale are result in and the possibility of scale economies as a motive for merger is ruled out. Farell and Shapiro (1988) do the equilibrium analysis of horizontal mergers with the assumption of quadratic costs and constant marginal costs. In the paper mentioned before by Gelves (2010), costs are assumed to be asymmetry between leader and follower in the Stackelberg model. Ferreira (2010) deal with rivals' costs with incomplete information and make the assumption that uncertainty is uniformly distributed. Similarly research method is taken by Zhou (2008) who consider horizontal merger when firms is faced with production shock and future costs are uncertain.

2.6Entry and Exit

Entry is also mentioned in the Horizontal Merger Guidelines, and timeliness, likelihood, and sufficiency of the entry efforts an entrant might practically employ are examined by the agencies. Through huge amount of literature, I find there is limited literatures about entry and exit exist and it turns out to be a significant aspect about horizontal mergers and even could be a tool for antitrust policy analysis. Entry is proved to be a factor to defer mergers between firms and decrease the profitability of mergers (See Gowrisankaran(1999), Erkal and Piccinin (2010)) and, on the contrary, the probability of mergers could also influence the entry and exit of firms (See Gowrisankaran (1999), Filson and Songsamphant (2005)). Gowrisankaran (1999) finds that if mergers are allowed entry rate will significantly increase while the exit rate drops dramatically, and exit scrap value and changes in entry costs affect differently on the probabilities of both entry and exit. Erkal and Piccinin (2010) point

out that entry acts as a deterrent to competitive effects of horizontal merger and harms consumer welfare (See welfare and efficiency part in this chapter), nevertheless, the merger guidelines does not emphasize the relationship between entry and merger-generated efficiencies. Filson and Songsamphant (2005) analyze how the exit is affected by horizontal mergers in declining industries.

2.7 Product Substitutability

In this thesis, I will embark on related researches about how product substitutability affects a horizontal merger. In 2010 U.S. Merger Guidelines, it is admitted that competition may be harmed by a merger between firms selling differentiated products and the agencies may consider two firms close substitutes by the level of HHI in the markets with differentiated products. And a merger between close differentiated products is possible to be challenged by the authority. Although, there are large amount of literature discussing horizontal mergers, few expand the discussion from homogenous products model or differentiated products model to asymmetric product model. Hsu and Wang (2010) build a differentiated Cournot oligopoly model and illustrate sufficiently distant substitute goods could solve the problem of merger paradox. When analyzing international merger, Qiu and Zhou (2006) point out that the extent of product differentiation affects the profitability of output coordination.

2.8Other Related Literature

Considering the development of merger guidelines for these years, this thesis organizes the literature reviews in chronological order and thus we could easily capture the trend of research about merger guidelines. There are large amount of

literature concentrating in a few years after 1982, in which the revised merger guidelines were released by Department of Justice and the Federal Trade Commission. Some researchers criticize that the new Guidelines consider too many vague and general factors and result in more uncertainty and unpredictability than old merger law (See Sims& Blumenthal (1982), Turner (1982), Spivack (1982), and Harris & Jorde (1983)). Clanton (1983) challenges this criticism and details how the new merger guidelines make competition law applicable and understandable for the antitrust authority and industry sectors. Although the market share, a crude measurement of market power, is still not a perfect tool and is regarded with suspicion, it definitely contributes to the new merger guidelines by making it more clear and predictable than the old corresponding one. I believe that Kauper (1983) cannot agree more with Clanton since he similarly concludes that the new merger guidelines develop compared with the old one. According to Kauper's argument, some horizontal mergers challenged under the old Guidelines would not be challenged under the new Guidelines since the 1982 Guidelines divide the horizontal merger world by Herfindahl-Hirschman Index, the safe harbor provision: markets are not concentrated if the post-merger HHI is below 1000, moderately concentrated if between 1000 and 1800 and highly concentrated if above 1800. Kauper's powerful contribution also lies on his calling attention to efficiency, which now is the enforcement goal.

Schmalensee (1987) argues however that courts should not be required to consider the efficiency effects of proposed mergers nor to take many other factors into account. This paper also points out that competitive levels rather than present and likely future levels should be the price baseline for Guidelines' market definition standard. After 1992 when the Merger Guidelines were revised again, Coate (2005) presents an empirical analysis of merger enforcement and suggests that HHI is the best to predict

the enforcement decisions when the relevant theory is collusion and the number of significant rivals is the best when the relevant theory is unilateral effects. When researchers focus their work on merger guidelines, Foer (2001) moves forward to explore horizontal merger remedy guidelines as an addendum and even proposes a working draft. After 2002, in which year the European Commission adopts a proposal to amend the EC Merger Regulation (ECMR), some researches focus on analyzing the similarities and differences of economic analysis about horizontal mergers in U.S. and EU competition law even focus on EU competition law (See Coppi& Walker (2004), Verouden, Bengtsson & Albaek (2004), and Bergman, Coate, Jakobsson & Ulrick (2006), Gilbert & Rubinfeld (2010)).

Besides focusing on the content of merger guidelines, it is a worthwhile job to test or derive the best policy for the authority to consider. As Nocke and Whinston (2010) demonstrate, an antitrust authority can adopt dynamically optimal policy to maximize the discounted expected consumer surplus and decide whether or not to approve a merger. It is pointed out that the analysis of market definition has some limitations and the U.S. Guidelines and guidelines more generally are suggested to emphasize the importance of competitive effects analysis in merger evaluations (See Gilbert and Rubinfeld (2010)). Some researchers are interested in comparing European versus the United States merger policies (See, e.g. Bergman, Coate, Jakobsson, and Ulrick (2010)).

Qiu and Zhou (2007) study the merger dynamic process by developing an endogenous mergers model. They identify firm heterogeneity and negative demand shocks as the two necessary conditions for merger to occur. Some mergers occur

because of negative demand shock and some because of strategic reasons.

Chapter 3 Horizontal Mergers under Cournot Competition

3.1 Theoretical Framework

Most of existing literature focused on horizontal mergers in a homogenous or symmetric differentiated market. This paper will mainly focus on markets with asymmetric markets, namely where the degree of substitutability across products is different.

Specifically, I consider a three-firm industry producing three differentiated products indexed by i=1,2,3. I also assume the following inverse demand system for the three products:

$$\begin{aligned} p_1 &= a - q_1 - \beta q_2 - \gamma q_3 \\ p_2 &= a - q_2 - \beta q_1 - \gamma q_3 \\ p_3 &= a - q_3 - \gamma q_1 - \gamma q_2 \end{aligned} \tag{1}$$

Where p_i is the price for each product, q_i is the quantity for each product, β is the substitute parameter between firm 1 and firm 2, γ is the substitute parameter between firm 3 and firm 1 or firm 2. In other words, for firm 1, firm 2 is the close competitor and firm 3 is the distant competitor, then the relationship between β and γ should be $0 < \gamma < \beta \leq 1$.

Mainly for tractability, I assume that production involves zero marginal cost and no fixed cost for the three firms (i=1, 2, 3). No entry is assumed. Firms compete by choosing quantities both before and after a merger. Since there are just three firms in the market, it is assumed that any merger is two-firm merger (bilateral merger).

Because the developed demand market is asymmetric, we further assume that firm 1 is the initiator of a merger, namely the merging firm and chooses to merge with firm 2 or

firm 3.[2]In this thesis, a proposer (acquirer) refers to the firm proposing a merger and a target refers to the firm receiving the proposal. As we know that firms are always seeking for commercial profits, thus the merged entity will choose production quantities of two products to maximize its profit if a merger happens and the total profits of merged entity should be $\left(\Pi_1^{(1,2)}+\Pi_2^{(1,2)}\right)$ when firm 2 is the target and be $\left(\Pi_1^{(1,3)}+\Pi_3^{(1,3)}\right)$ when firm 3 is the target. Before merger, the equilibrium prices, quantities and profits are represented by (p_i^*, q_i^*, Π_i^*) (i=1,2,3); After the merger between firm 1 and firm 2, the prices, quantities and profits are represented by $(p_i^{(1,2)}, q_i^{(1,2)}, \Pi_i^{(1,2)})$ (i=1,2,3); After the merger between firm 1 and firm 3, the prices, quantities and profits are represented by $(p_i^{(1,3)}, q_i^{(1,3)}, \Pi_i^{(1,3)})$ (i=1,2,3).

Firm 1 is the merging firm in the first stage and it chooses to merge with firm 2 or firm 3, firm 2 is the close competitor for firm 1 and firm 3 is the distant competitor. The first thing that the acquirer should consider is whether to acquire another firm I (i=2,3) is profitable since there is possibility that benefits of insider by merger would be offset by outsiders and when both firm 2 and firm 3 are profitable mergers, the merging party considers which one to merge. Otherwise, it is enough for the merging entity to merge the profitable firm. Salant *et al.* (1983) formulates the unprofitability of merger as "merger paradox". This well-known consideration will be discussed in later sections of this thesis. When the target receives the proposal and the new market evolves to the state of equilibrium, the first stage ends. In the second stage, the three-firm industry develops to duopoly, and firms are lured to go a step further and

[2]As a matter of fact, both firm 2 and firm 3 could be the merging firm, if firm 2 is the merging firm we would meet with the similar results as if the firm 1 is the merging firm, the only difference is just the expositions; if firm 3 is the merging firm, we will lose the values of asymmetric consideration since firm 2 is as distant as firm 1 from firm 3(Note, one of crucial question we want to explore is: merging firm should merge the distant competitor or the close competitor.)

merge to a monopoly. Nevertheless, this is not the point of my discussion in this thesis and monopoly is not allowed. Thus, it is not necessary to put much effort in the second stage mentioned above. Here comes my first assumption.

Assumption 1 Duopoly is allowed when a merger happens, but a merge is not allowed to proceed up to monopoly.[3]

Before a merger occurs, each firm chooses quantity to maximize its own profit $\Pi_i = p_i q_i, i = 1,2,3$.

The first order conditions in the Cournot equilibriumas follow:

$$\begin{aligned} \frac{\partial \Pi_1}{\partial q_1} &= \alpha - 2q_1 - \beta q_2 - \gamma q_3 = 0 \\ \frac{\partial \Pi_2}{\partial q_2} &= \alpha - 2q_2 - \beta q_1 - \gamma q_3 = 0 \\ \frac{\partial \Pi_3}{\partial q_3} &= \alpha - 2q_3 - \gamma q_1 - \gamma q_2 = 0 \end{aligned} \tag{2}$$

And the second-order conditions are:

$$\frac{\partial^2 \Pi_i}{\partial q_i^{\,2}} \le 0 \quad i = 1,2,3$$

The equilibrium quantities, prices, and profits are as follows:

$$q_1^* = q_2^* = \frac{\alpha(\gamma-2)}{2(\gamma^2-\beta-2)}, q_3^* = \frac{\alpha(2\gamma-\beta-2)}{2(\gamma^2-\beta-2)} \tag{3}$$

$$p_1^* = p_2^* = \frac{\alpha(\gamma-2)}{2(\gamma^2-\beta-2)}, p_3^* = \frac{\alpha(2\gamma-\beta-2)}{2(\gamma^2-\beta-2)} \tag{4}$$

$$\Pi_1^* = \Pi_2^* = \frac{\alpha^2(\gamma-2)^2}{4(\gamma^2-\beta-2)^2}, \Pi_3^* = \frac{\alpha^2(2\gamma-\beta-2)^2}{4(\gamma^2-\beta-2)^2} \tag{5}$$

$$\Pi_1^* + \Pi_2^* = \frac{\alpha^2(\gamma-2)^2}{2(\gamma^2-\beta-2)^2}, \Pi_1^* + \Pi_3^* = \frac{\alpha^2\left[(\gamma-2)^2 + (2\gamma-\beta-2)^2\right]}{4(\gamma^2-\beta-2)^2}$$

[3]The same assumption is provided by Larry D. Qiu (2007) when he analyzes merger waves in a homogenous quantity model. The author enumerates two justifications for this: the antitrust authority is expected to step in to prevent the firms' substantially increasing market power and monopolization will utterly throw the discussions pointless and unjustifiable.

Obviously, before a merger occurs, I have $p_1^* = p_2^* < p_3^*$ and $q_1^* = q_2^* < q_3^*$. In the Cournot equilibrium, firm 3 dominates the largest proportion of market share and earns greater profit than do the other two firms, because its product is more differentiated than the other two products.

Next, I derive the Cournot equilibrium, if firm 1 merges with firm 2[4].

If firm 2 is the target, the merging party maximizes the total profits by choosing the units of production for product 1 and product 2 and firm 3 maximizes its profit by choosing its own product 3.

The first order conditions for the post-merger Cournot equilibrium are as follows:

$$\begin{aligned}
\frac{\partial \Pi^{(1,2)}}{\partial q_1} &= \alpha - 2q_1 - 2\beta q_2 - \gamma q_3 = 0 \\
\frac{\partial \Pi^{(1,2)}}{\partial q_2} &= \alpha - 2q_2 - 2\beta q_1 - \gamma q_3 = 0 \\
\frac{\partial \Pi_3^{(1,2)}}{\partial q_3} &= \alpha - 2q_3 - \gamma q_1 - \gamma q_2 = 0
\end{aligned} \tag{6}$$

And the second-order condition conditions are:

$$\frac{\partial^2 \Pi_i}{\partial q_i^{\,2}} \le 0 \; i, j = 1,2,3 \;, \frac{\partial^2 \Pi_i}{\partial q_i^{\,2}} \frac{\partial^2 \Pi_j}{\partial q_j^{\,2}} - \frac{\partial^2 \Pi_i}{\partial q_j \partial q_i} \frac{\partial^2 \Pi_j}{\partial q_i \partial q_j} \ge 0 \; i, j = 1,2$$

The corresponding equilibrium quantities, prices and profits are as follows:

$$q_1^{(1,2)} = q_2^{(1,2)} = \frac{\alpha(\gamma - 2)}{2(\gamma^2 - 2\beta - 2)}, q_3^{(1,2)} = \frac{\alpha(\gamma - \beta - 1)}{(\gamma^2 - 2\beta - 2)} \tag{7}$$

$$p_1^{(1,2)} = p_2^{(1,2)} = \frac{\alpha(\beta + 1)(\gamma - 2)}{2(\gamma^2 - 2\beta - 2)}, p_3^{(1,2)} = \frac{\alpha(\gamma - \beta - 1)}{(\gamma^2 - 2\beta - 2)} \tag{8}$$

[4]It is here assumed that there is no dropping product line after a merger. I later show that the merging firms will choose not to drop any product after the merger.

$$\Pi_1^{(1,2)} = \Pi_2^{(1,2)} = \frac{\alpha^2(\gamma-2)^2(\beta+1)}{4(\gamma^2-2\beta-2)^2}, \Pi_3^{(1,2)} = \frac{\alpha^2(\gamma-\beta-1)^2}{(\gamma^2-2\beta-2)^2} \tag{9}$$

$$\Pi_1^{(1,2)} + \Pi_2^{(1,2)} = \frac{\alpha^2(\gamma-2)^2(\beta+1)}{2(\gamma^2-2\beta-2)^2}$$

If firm 3 is the target, the merging parties maximize the total profits by choosing the units of production for product 1 and 3 and firm 2 maximizes its profit by choosing its own product 2.

The first order conditions for the merging firms are as follows:

$$\begin{aligned}
\frac{\partial \Pi^{(1,3)}}{\partial q_1} &= \alpha - 2q_1 - \beta q_2 - 2\gamma q_3 = 0 \\
\frac{\partial \Pi^{(1,3)}}{\partial q_3} &= \alpha - 2q_2 - \beta q_1 - 2\gamma q_3 = 0 \\
\frac{\partial \Pi_2^{(1,3)}}{\partial q_2} &= \alpha - 2q_3 - \gamma q_1 - \gamma q_2 = 0
\end{aligned} \tag{10}$$

And the second-order conditions are, respectively:

$$\frac{\partial^2 \Pi_i}{\partial q_i^{\,2}} \le 0, i = 1,2,3 \text{ and } \frac{\partial^2 \Pi_i}{\partial q_i^{\,2}} \frac{\partial^2 \Pi_j}{\partial q_j^{\,2}} - \frac{\partial^2 \Pi_i}{\partial q_j \partial q_i} \frac{\partial^2 \Pi_j}{\partial q_i \partial q_j} \ge 0 \; i, j = 1,3. i \ne j$$

Then the equilibrium quantities, prices and profits are as follows:

$$\begin{aligned}
q_1^{(1,3)} &= \frac{(\gamma-2)(\gamma-2+\beta)}{2(4-5\gamma^2-\beta^2+2\beta\gamma^2)} \\
q_3^{(1,3)} &= \frac{\alpha(\beta-2)(3\gamma-\beta-2)}{2(4-5\gamma^2-\beta^2+2\beta\gamma^2)} \\
q_2^{(1,3)} &= \frac{\alpha(1-\gamma)(\gamma+2-\beta)}{(4-5\gamma^2-\beta^2+2\beta\gamma^2)}
\end{aligned} \tag{11}$$

$$\begin{aligned}
p_1^{(1,3)} &= \frac{\alpha(4-5\gamma^2+3\beta\gamma^2+\beta\gamma-2\beta-\gamma\beta^2)}{2(4-5\gamma^2-\beta^2+2\beta\gamma^2)} \\
p_3^{(1,3)} &= \frac{\alpha(4-4\gamma^2-\beta^2+\beta\gamma^2-2\gamma+\beta\gamma+\gamma^3)}{2(4-5\gamma^2-\beta^2+2\beta\gamma^2)} \\
p_2^{(1,3)} &= \frac{\alpha(1-\gamma)(\gamma+2-\beta)}{(4-5\gamma^2-\beta^2+2\beta\gamma^2)}
\end{aligned} \tag{12}$$

$$\Pi_1^{(1,3)} = \frac{\alpha^2(\gamma-2)(\gamma-2+\beta)(4-5\gamma^2+3\beta\gamma^2+\beta\gamma-2\beta-2\gamma\beta^2)}{4(4-5\gamma^2-\beta^2+2\beta\gamma^2)}$$

$$\Pi_2^{(1,3)} = \frac{\alpha^2(1-\gamma)^2(\gamma+2-\beta)^2}{(4-5\gamma^2-\beta^2+2\beta\gamma^2)^2}$$

$$\Pi_3^{(1,3)} = \frac{\alpha^2(\beta-2)(3\gamma-\beta-2)(4-4\gamma^2-\beta^2+\beta\gamma^2-2\gamma+\beta\gamma+\gamma^3)}{4(4-5\gamma^2-\beta^2+2\beta\gamma^2)^2} \quad (13)$$

$$\Pi_1^{(1,3)}+\Pi_3^{(1,3)} = \frac{\alpha^2(\gamma-2)(\gamma-2+\beta)(4-5\gamma^2+3\beta\gamma^2+\beta\gamma-2\beta-\gamma\beta^2)}{4(4-5\gamma^2-\beta^2+2\beta\gamma^2)^2}$$

$$+\frac{\alpha^2(\beta-2)(3\gamma-\beta-2)(4-4\gamma^2-\beta^2+\beta\gamma^2-2\gamma+\beta\gamma+\gamma^3)}{4(4-5\gamma^2-\beta^2+2\beta\gamma^2)^2}$$

I will also consider the effect of a merger on consumer surplus. Differentiating the utility function with respect to quantity, the original inverse demand functions could be calculated. I follow the work of Singh and Vives (1984) and Qiu(1997) and assume the utility function as:

$$U(q_1,q_2,q_3) = \alpha(q_1+q_2+q_3) - \frac{1}{2}(q_1^2+q_2^2+q_3^2+2\beta q_1 q_2+2\gamma q_1 q_3+2\gamma q_2 q_3)$$

Consumer surplus refers the difference between utility of consuming goods and the pay for goods and is formally as:

$$CS = U(q_1,q_2,q_3) - \sum_{i=1,2,3} p_i q_i$$

Apply the price equations into utility functions and reorganize consumer equation as:

$$CS = U(q_1,q_2,q_3) - \sum_{i=1,2,3} p_i q_i = \frac{1}{2}(q_1^2+q_2^2+q_3^2+2\beta q_1 q_2+2\gamma q_1 q_3+2\gamma q_2 q_3) \quad (14)$$

I could also obtain the welfare (total surplus) as:

$$W = CS+\Pi = \alpha(q_1+q_2+q_3) - \frac{1}{2}(q_1^2+q_2^2+q_3^2+2\beta q_1 q_2+2\gamma q_1 q_3+2\gamma q_2 q_3) \quad (15)$$

3.2 Dropping Product Line

In this section, I look at whether dropping product one of two products is optimal for the merging firm. Specifically, is it the best strategy for the merging party to drop one of the owned two products after the merger? Product line decision is an

important issue for both the merging and non-merging firms and related brand positioning is also explicitly included in merger guidelines.

When firm 2 is the target, to drop product 1 or product 2 is the same for the merging party and to drop product 1 is assumed.

Then the demand system becomes:

$$p_i = \alpha - q_i - \gamma q_j \; i, j = 2,3, i \neq j \tag{16}$$

The first order conditions of equilibrium are as follow:

$$\frac{\partial \Pi}{\partial q_i} = \alpha - 2q_i - \gamma q_j = 0 \; i, j = 2,3, i \neq j \tag{17}$$

The second order conditions are as follow:

$$\frac{\partial^2 \Pi_{id1}}{\partial q_i^2} \leq 0$$

Corresponding price and quantities are respectively:

$$p_{id1}^{(1,2)} = \frac{\alpha}{(2+\gamma)}, q_{id1}^{(1,2)} = \frac{\alpha}{(2+\gamma)} \; i = 2,3 \tag{18}$$

The profit of merging party and firm 3 are:

$$\Pi_{1d1}^{(1,2)} = \frac{\alpha^2}{(2+\gamma)^2}, \Pi_{3d1}^{(1,2)} = \frac{\alpha^2}{(2+\gamma)^2} \tag{19}$$

When firm 3 is the target and the merging party chooses to drop product 1, repeat the similar process as showed above, I obtain:

$$\Pi_{3d1}^{(1,3)} = \frac{\alpha^2}{(2+\gamma)^2}, \Pi_{2d1}^{(1,3)} = \frac{\alpha^2}{(2+\gamma)^2} \tag{20}$$

And when firm 3 is the target and the merging party chooses to drop product 3:

$$\Pi_{1d3}^{(1,3)} = \frac{\alpha^2}{(2+\beta)^2}, \Pi_{2d3}^{(1,3)} = \frac{\alpha^2}{(2+\beta)^2} \tag{21}$$

Since β is larger than γ, to drop product 1 is more profitable than to drop product 3 when firm 3 is the target of the merger.

Product deletion is a part of the profit-maximization problem of the merging firm. Before considering the profitability of merger, the merging firm would check whether to drop or not a product line after a merger and then compare the largest post-merger profits with pre-merger profits.

Lemma 1

The merging party has no incentive to drop product line after a merger in the Cournot model.

Proof. See Appendix.

How a merger affects product variety could be quite ambiguous sometimes. Berry and Waldfogel (2001) demonstrate that, after mergers, firms are possible to withdraw duplicative products to reduce the competition between similar products or to crowd products together to preempt entry. Besides, cost reductions after consolidation enable firms to increase variety by providing additional products. They find evidence that increased concentration would not reduce variety and even increase the amount of programming variety absolutely when they do empirical work to explore radio broadcasting industry under the 1996 Telecom Act.

In my thesis, there are no entries and cost saving by assumption. Lemma 1 implies that $\prod_1^{(1,2)} + \prod_2^{(1,2)} > \Pi_{d2}^{(1,2)}$ and $\prod_1^{(1,3)} + \prod_3^{(1,3)} > \Pi_{d1}^{(1,3)}$, which indicates that if a merger occurs, the merging firm is not willing to drop product line and product variety does not change after a merger. It is concluded that consolidation of the market does not reduce product variety in the Cournot Model.

3.3 Special Case

Particularly when the substitute parameter between firm 1 and firm 2 equals to one, firm 2 is coessential competitor of firm 1. Under this premise, γ is the only unknown substitute parameter the inverse demanding functions becomes:

$$p_1 = a - q_1 - q_2 - \gamma q_3$$
$$p_2 = a - q_2 - q_1 - \gamma q_3$$
$$p_3 = a - q_3 - \gamma q_1 - \gamma q_2$$

For convenience, we could make entitle this case as semi-asymmetry or semi-symmetry. Before a merge happens, the firms choose their respective output to maximize their own profits and we could arrive at the Nash-equilibrium solutions as follows:

$$q_1^* = q_2^* = \alpha\frac{(2-\gamma)}{2(3-\gamma^2)}, q_3^* = \alpha\frac{(3-2\gamma)}{2(3-\gamma^2)}$$

$$p_1^* = p_2^* = \alpha\frac{(2-\gamma)}{2(3-\gamma^2)}, p_3^* = \alpha\frac{(3-2\gamma)}{2(3-\gamma^2)}$$

$$\Pi_1^* = \Pi_2^* = \alpha^2\frac{(2-\gamma)^2}{4(3-\gamma^2)^2}, \Pi_3^* = \alpha^2\frac{(3-2\gamma)^2}{4(3-\gamma^2)^2}$$

$$CS^* = \alpha^2\frac{(8\gamma^3 - 20\gamma^2 - 4\gamma + 25)}{8(3-\gamma^2)^2}$$

$$W^* = CS^* + \sum\Pi_i = \alpha^2\frac{(8\gamma^3 - 20\gamma^2 - 4\gamma + 25) + 4(2-\gamma)^2 + 2(3-2\gamma)^2}{8(3-\gamma^2)^2}$$

If firm 1 merges with firm 2, then market proceeds up to a duopoly and firm 1 faces the decision $\underset{q_i^{(1,2)}}{Max}\{\Pi = \sum_{i=1}^{2} p_i^{(1,2)} q_i^{(1,2)}\}$, and firm 3 maximizes its own profit:

$$q_1^{(1,2)} = q_2^{(12)} = \alpha\frac{1}{2(\gamma+2)}, q_3^{(1,2)} = \alpha\frac{1}{(\gamma+2)}$$

$$p_1^{(1,2)} = p_2^{(12)} = \alpha\frac{1}{(\gamma+2)}, p_3^{(1,2)} = \alpha\frac{1}{(\gamma+2)}$$

$$\Pi_1^{(1,2)} = \Pi_2^{(12)} = \alpha^2\frac{1}{2(\gamma+2)^2}, \Pi_3^{(1,2)} = \alpha^2\frac{1}{(\gamma+2)^2}$$

$$CS^{(1,2)} = \alpha^2\frac{(1+\gamma)}{(2+\gamma)^2}$$

$$W^{(1,2)} = CS^{(1,2)} + \sum \Pi_i^{(1,2)} = \alpha^2 \frac{(3+\gamma)}{(2+\gamma)^2}$$

If firm 1 merges with firm3, then:

$$q_1^{(1,3)} = \alpha \frac{(2-\gamma)}{6(1+\gamma)}, q_2^{(1,3)} = \frac{1}{3}\alpha, q_3^{(1,3)} = \alpha \frac{1}{2(1+\gamma)}$$

$$p_1^{(1,3)} = \frac{1}{3}\alpha, p_2^{(1,3)} = \frac{1}{3}\alpha, p_3^{(1,3)} = \alpha \frac{(3-\gamma)}{6}$$

$$\Pi_1^{(1,3)} = \alpha^2 \frac{(2-\gamma)}{18(1+\gamma)}, \Pi_2^{(1,3)} = \frac{1}{9}\alpha^2, \Pi_3^{(1,3)} = \alpha^2 \frac{(3-\gamma)}{12(1+\gamma)}$$

$$CS^{(1,3)} = \alpha^2 \frac{(13\gamma^2 + 24\gamma + 46)}{72(1+\gamma)^2}$$

$$W^{(1,3)} = CS^{(1,3)} + \sum \Pi_i^{(1,3)} = \alpha^2 \frac{(11\gamma^2 + 56\gamma + 80)}{72(1+\gamma)^2}$$

3.3.1 Effects on Price and Quantity

In this section I derive the straightforward Figure C1 and Figure C2 to show how the equilibrium prices and quantities are affected by a merger. The analysis in this part is helpful and necessary for understanding the results of merger profitability.

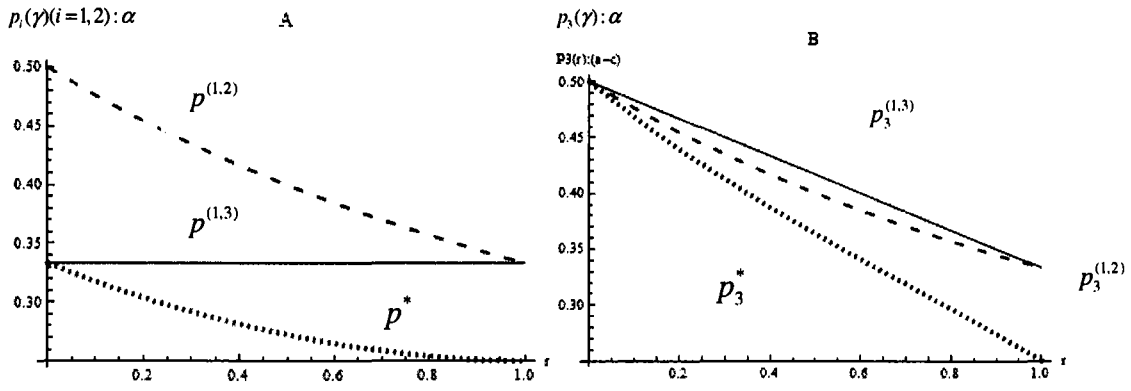


Figure C1: Impacts on Prices

From C1, it is obvious that any-bilateral merger would cause price increasing, firm 1 and firm 2 share the same price changing(See Figure C1: A). Since firm 1 and firm 2 are symmetric to firm 3, it is not surprising to find consistent price trend operating here. Firstly, to firm 1, equilibrium price is the largest when it merges with firm 2

given substitute parameter, and the price will hold with the changing of substitute parameter when it merges with firm 2. In other words, firm 2 tread on the heels of firm 1. Then, let us take a look at firm 3, obviously, when firm 1 chooses to merge with firm 3, firm 3 could increase equilibrium price most. Nevertheless, the corresponding increased space after the merger between firm 1 and firm 3 is more limited than the merger between firm 1 and firm 2.

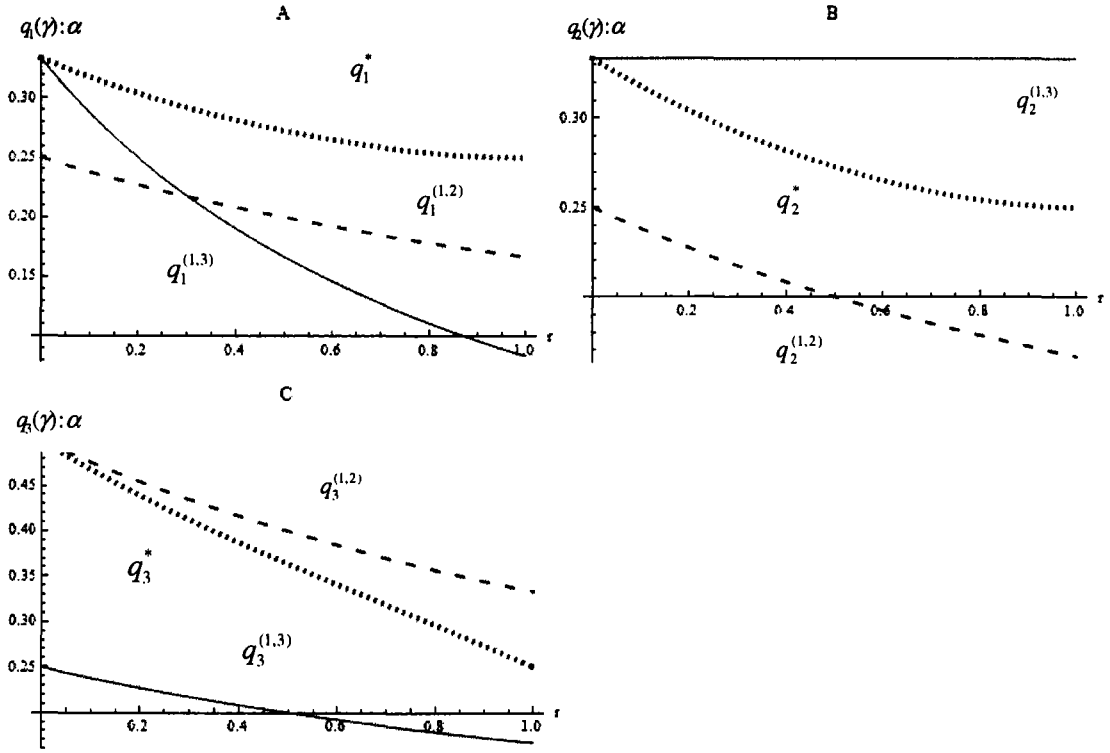


Figure C2: Impacts on Quantities

Following the analysis above, I ask how the firms choose quantities after a merger. Generally speaking, insiders of a merger would decrease output, but the outsider is likely to be encouraged to increase output. To the merging firm (firm 1, See Figure C2: A), it would decrease its output whichever to merge with, but for small γ, it could decrease output most when merging with distant competitor. When firm 2 is the outsider, it benefits from increasing its output and has incentive to increase its output, while being the insider definitely decreases

output to increase profit of merged entity. Similar logical thinking is true for firm 3, the outsider would be encouraged to increase output and insiders would be encouraged to decrease output.

3.3.2Merger Profitability and Optimal Strategy in Semi-asymmetric Model

Lemma 2

i. *Merger between firm 1 and firm 2 is profitable if and only if* $0 < \gamma < 0.7653$;

ii. *Merger between firm 1 and firm 3 is always non-profitable and merger paradox exists whenever* $0 < \gamma < 1$.

The merger paradox analysis is consistent with other researchers' results, which demonstrates that distant competitor should be distant enough. In an oligopoly market, when a merger occurs, the whole sale price for products of merging entity are normally expected to increase and the total quantity to decrease. In my model, the outsider would not excuse itself from charging higher price and would follow the insider to increase its product price. From the corresponding price equations, it is seen that the all product prices increase whatever how the relationship between two parameters look like. For both the insider and outsider, they all could benefit from this point. Although they do not collude with each other, the concentration by a merger results in unilateral effect.

For the outsider, however, it is a good opportunity to expand the quantity and race to control the market and thus insiders are harmed. The more the distant competitor is close to the acquirer, the more the distant competitor could benefit. This is not difficult to understand, imagine, when the distant competitor is close enough to the insiders, it would be easier for the consumers' to accept its products. From the

perspective of outsider, when the outsider is very distant from the insider, the possibility for the consumers who consuming the products of merging entity shift their consumption toward the outsider is very small.

To conveniently explore the reasons behind this lemma, I measure free-riding of outsider by $\frac{q_3^{(1,2)}}{q_3^*}$. It could be showed that when $0<\gamma<0.7653$,free-riding measurement $\frac{q_3^{(1,2)}}{q_3^*}$ is an increasing function in γ , namely $\frac{\partial(\frac{q_3^{(1,2)}}{q_3^*})}{\partial\gamma}>0$, and for large γ, free-riding by firm 3, the outsider, is large and turn out to be very harmful. When the benefits by outsider are small, the merging firm is more confident to choose to merge with close competitor. When the merger between firm 1 and firm 2 occurs, they share the same increasing price while the merged entity distributes the output quotas in the two production lines differently and line 2 decreases the most quantity than original equilibrium quantity. The outsider, firm 3 would choose to increase its output. Thus whether or not to merge with firm 2 depends on balance of merger benefits and outsider free-riding. When the merger between firm 1 and firm 3 occurs, the insider increase corresponding prices for the two products and decrease quantities produced, and the more distant the distant competitor is, the more quantities of product 3 are decreased. While the outside, firm 2, a complete free-rider of the price of product 1, could increase its output more than original equilibrium output. At his moment, the benefits from merger with firm 3 is completely offset by outsider, it is not surprising to find that to merge with firm 3 is non-profitable.

Based on the analysis of above, it is easy to understand why to merge with firm 3 is not always profitable. Firm 1 and firm 2 are homogeneous and outputs by firm 2 are

perfect substitute of outputs by firm 1. When firm 1 merges with the distant competitor, the market share quitted by firm 1 will be completely grabbed by firm 2. In other words, it is completely of no use to sacrifice quantity to charging higher price for product 1.

Lemma 3

i. *The optimal strategy for firm 1 is to merge with firm2 if and only if* $0 < \gamma < 0.7653$;

ii. *The merging firm has no incentives to merge with any firm when* $0.7653 < \gamma < 1$.

From lemma 1 to lemma 2, the conclusion is made that the optimal strategy for proposer is to merge with close competitor when it is profitable to do so or any bilateral merger would not occur. In semi-asymmetric market, a rational acquirer is not willing to acquire a distant competitor. Whether to merge the homogenous competitor depends on how far away the distant competitor is.

3.3.3Consumer Surplus and Social Welfare

Assuming a merger occurs, Figure 3 shows how the consumer surplus is influenced by the merger.

Lemma 4

i. *A profitable merger is harmful to consumer surplus (social welfare) and the resulting consumer surplus (social welfare) is a decreasing function in* γ.

ii. *When a profitable merger with close competitor (i.e. merger between firm1 and firm 2 occurs, social welfare decrease less than consumer surplus, i.e.* $(W^* - W^{(1,2)}) < (CS^* - CS^{(1,2)})$;

iii. *And the decreasing amount of consumer surplus is a decreasing function with*

substitute index between products of firm 1 and firm 2, while the decreasing amount of social welfare is increasing function, i.e. $\frac{\partial(CS^{*}-CS^{(1,2)})}{\partial\gamma}<0, \frac{\partial(W^{*}-W^{(1,2)})}{\partial\gamma}>0$

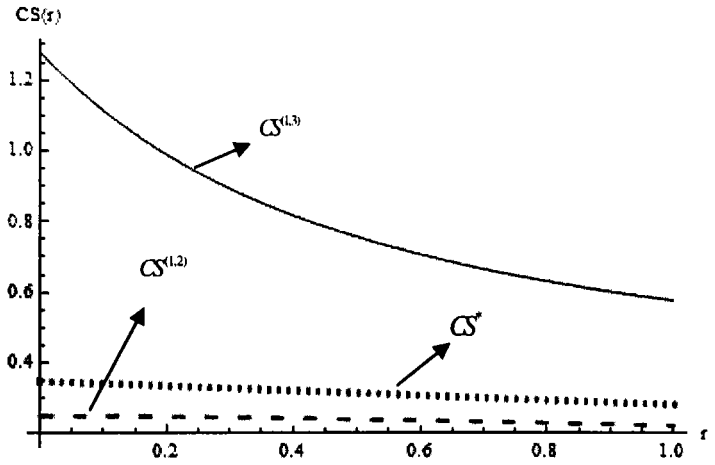


Figure C3: Impacts on Consumer Surplus

Even though, the merger between firm 1 and firm 3 is beneficial to increase consumer surplus but it is not realizable because of profitability. The only choice for merging firm is to merge with firm 2 and when it is profitable to do so, it is harmful to consumer surplus. The more close the distant competitor, the more harmful the merger between merging firm and close competitor. This is not difficult to understand: the more close the distant competitor, the more concentrated the firms.

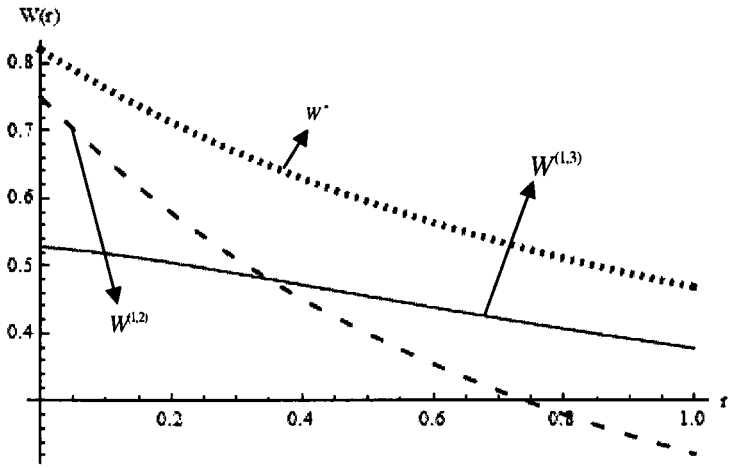


Figure C4: Impacts on Social Welfare

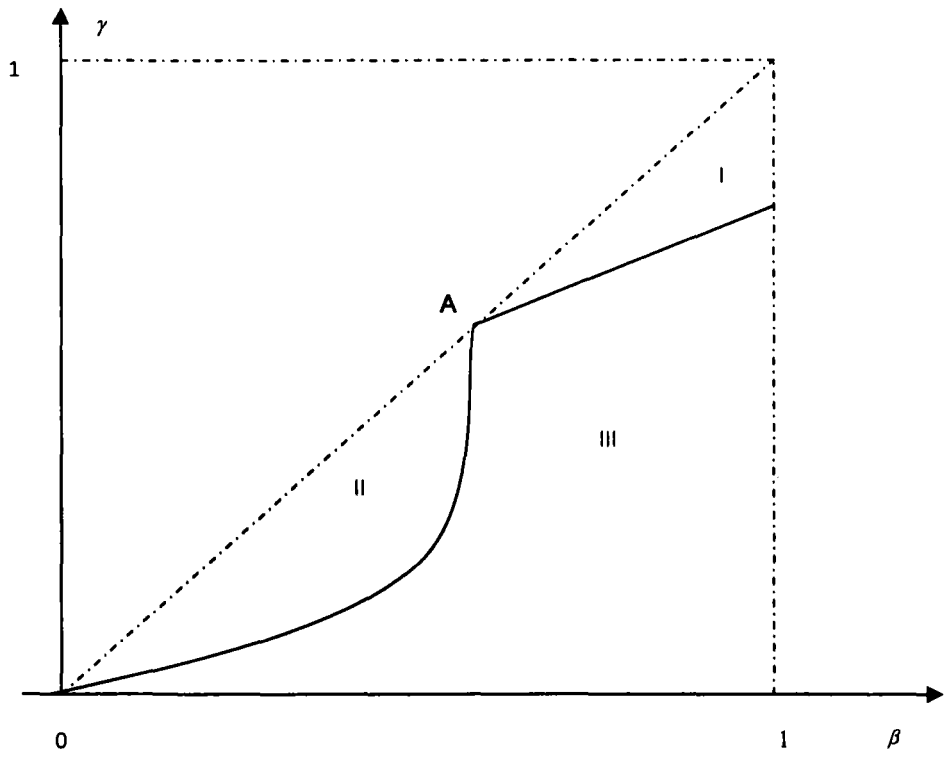
From Figure C4, a merger hurts social welfare. When the merger with firm 2 (the only possible profitable merger in this model) occurs, the decreasing amount,

compared to the original equilibrium, of social welfare after a merger is a increasing function of substitute parameter of distant competitor.

3.4Asymmetric Substitutability

Next, I turn to the main question of whether mergers are profitable in the original Cournot model and which merger is more profitable from the viewpoint of the acquiring firm, firm 1.

Here, both β and γ range from zero to one but could not be zero or one. From the last section, it is known that dropping product line would not occur when a merger occurs. This part will analyze merging firm's profitability, optimal strategies, influences on the price and quantities, and how the consumer surplus is affected by the merger without dropping. The following reference figure shows the understanding for the intuition of the results in Cournotmodel. And for convenience, the merger between firm 1 and firm 2 is denoted as (1,2) and merger between firm 1 and firm 3 is denoted as (1,3).



FigureC5:Profitable Mergers and Optimal Mergers in Cournot Model

I. Merger Paradox Exits

II. (1,2) and (1,3) are profitable, (1,3) is the optimal

III.Only (1,2) is profitable

3.4.1 Merger Profitability

It can be shown that, given β there exists unique $\tilde{\gamma}(\beta)$ and $\hat{\gamma}(\beta)$ such that:

$$\begin{cases} (\Pi_1^{(1,2)} + \Pi_2^{(1,2)}) - (\Pi_1^* + \Pi_2^*) > 0, \gamma \in (0, \tilde{\gamma}(\beta)) \\ (\Pi_1^{(1,2)} + \Pi_2^{(1,2)}) - (\Pi_1^* + \Pi_2^*) = 0, \gamma = \tilde{\gamma}(\beta) \\ (\Pi_1^{(1,2)} + \Pi_2^{(1,2)}) - (\Pi_1^* + \Pi_2^*) < 0, \gamma \in (\tilde{\gamma}(\beta), 1) \end{cases}$$

$$\begin{cases} (\Pi_1^{(1,3)} + \Pi_3^{(1,3)}) - (\Pi_1^* + \Pi_3^*) < 0, \gamma \in (0, \hat{\gamma}(\beta)) \\ (\Pi_1^{(1,2\backslash 3)} + \Pi_3^{(1,3)}) - (\Pi_1^* + \Pi_3^*) = 0, \gamma = \hat{\gamma}(\beta) \\ (\Pi_1^{(1,3)} + \Pi_2^{(1,3)}) - (\Pi_1^* + \Pi_3^*) > 0, \gamma \in (\hat{\gamma}(\beta), 1) \end{cases} \quad (22)$$

Thus, the following proposition is established.

Proposition 1

i. Merger between firm 1 and firm 2 is profitable if and only if condition A1:

$0 < \gamma < \min\{\tilde{\gamma}(\beta), \beta\} < 1$ holds.

Proof . See Appendix.

The conclusion is consistent with lemma 1 and demonstrates that only if when the distant competitor is distant enough, the merger with close competitor is profitable. When $0 < \beta < 1$, given β, free-riding measurement $\frac{q_3^{(1,2)}}{q_3^*}$ is a decreasing function in β, namely $\frac{\partial(\frac{q_3^{(1,2)}}{q_3^*})}{\partial\beta} < 0$ (See the illustration on the section of Influences on Unilateral Effects).

When β is large, the free-riding degree by firm 3 is small. In fact, the more close the close competitor to the merging firm, the more difficult the outsider competes with them. In other words, when β is smaller, the benefits of insiders by merger would be offset by outsiders. And thus, it is required that outsider should be more distant to prevent its free-riding and harms to insiders. Obviously, the requirement on the distance of outsider to insiders is stricter than that of semi-asymmetric model.

ii. *Merger between firm 1 and firm 3 is profitable if and only if condition A2:* $\hat{\gamma}(\beta) < \gamma < \beta < arc\hat{\gamma}(\beta) < 0.5550$ holds.

Proof . See Appendix.

In lemma 2, I conclude that to merge with firm distant competitor is never be profitable when there is homogenous substitute product for merging firm. Nevertheless, to merge with distant competitor could be profitable when the two substitute parameters satisfy the formulated relationship. In such an asymmetric industry structure, the outsider (the close competitor) turns out to be more-matched in strength with the target (the distant competitor). Therefore, the insiders are enabled the ability to bargain with the outsider and win back the merger benefits.

3.4.2 Target Optimal Strategy and Equilibrium

Proposition 2

Scenario 1: If $0.5550 < \tilde{\gamma}(\beta) < \gamma < \beta < 1$, *neither the merger between firm 1 and firm 2 nor one between firm 1 and firm 3 are profitable, merger paradox exists.*

Proof . See Appendix.

When both competitors are very close to the merging firm, the insiders could not resist the corrosive influence of outsider and the merging firm finds no endogenous incentives to intrigue a merger. This proposition helps explain why oligopoly with three members exists and holds up.

Scenario 2:When $0 < \gamma < \min\{\tilde{\gamma}(\beta), \hat{\gamma}(\beta)\} < 1$, *the merger between firm 1 and firm 2 is profitable but the merger between firm 1 and firm 3 is non-profitable, the optimal strategy for firm 1 is to merge with firm 2.*

Proof . See Appendix.

Scenario 3:When A1 and A2 holds, both the mergers between firm 1 and firm 2 or firm are profitable and the total profit after merger between firm 1 and firm 3 is large than that between firm 1 and firm 2, the optimal strategy for firm 1 is to merge with firm 3.

Proof . See Appendix.

Proposition 2 conveys a message that whenever it is profitable to merge with firm 3, it is the optimal strategy.

To analyze these reasons behind this proposition, I go back to the equilibrium before a merger occurs. Since the original market is asymmetric, the distant competitor has already made use of its product differentiation to dominate larger market share and earns larger profits than the other two firms. Firm 3 is more alluring than the firm 2 so that the merging firm is able to increase larger market share and profits and gain louder voice in the market.

In Cournot market in which firms compete with each other by quantity, to expand its market share is the most attractive incentive to merge for a proposer. A merging firm is expected not to miss the opportunity to increase its concentration whenever it is profitable to do so. In the next section, I would continue to discuss how the merger influences the prices.

3.4.3 The Unilateral Effects

In this part, I would like to investigate how the unilateral effect depends on the degree of substitutability after a merger. For example, I measure the unilateral effect with ratio: $\frac{p^{(1,2)}}{p^{*}}$.

Under the condition (A1), the merger between firm 1 and firm 2 is profitable, from equations (4) and (8), the following unilateral effect measurement is as follows:

$$\frac{p_1^{(1,2)}}{p_1^*}=\frac{p_2^{(1,2)}}{p_2^*}=\frac{(\beta+1)(\gamma^2-\beta-2)}{(\gamma^2-2\beta-2)},\frac{p_3^{(1,2)}}{p_3^*}=\frac{2(\gamma-\beta-1)(\gamma^2-\beta-2)}{(2\gamma-\beta-2)(\gamma^2-2\beta-2)} \tag{23}$$

$$\frac{\partial\frac{p_1^{(1,2)}}{p_1^*}}{\partial\gamma}=-\frac{2\gamma\beta(\beta+1)}{(2+2\beta-\gamma^2)}<0$$

$$\frac{\partial\frac{p_1^{(1,2)}}{p_1^*}}{\partial\beta}=\frac{(2+4\beta-3\gamma^2+2\beta^2-2\beta\gamma^2+\gamma^4)}{(2+2\beta-\gamma^2)}$$

$$=\frac{(2+2\beta-\gamma^2)+2(\beta+1)(\beta-\gamma^2)+\gamma^4)}{(2+2\beta-\gamma^2)}>0$$

This states that when the insider is closer and the outsider is more distant, the merging party is able to charge higher price.

$$\frac{\partial p_3^{(1,2)}}{p_3^*}\Big/\frac{\partial \gamma}{\partial \gamma} = \frac{2\beta(4+2\beta^2+6\beta+4\gamma^2+3\gamma^2\beta+\gamma^4-6\beta\gamma-4\gamma-4\gamma^3-2\beta^2\gamma)}{(2+\beta-\gamma^2)^2(2+2\beta-\gamma^2)^2}$$

$$= \frac{2\beta(2(1-\gamma)(2+\beta^2+3\beta+2\gamma^2)+3\gamma^2\beta+\gamma^4)}{(2+\beta-\gamma^2)^2(2+2\beta-\gamma^2)^2} > 0$$

$$\frac{\partial p_3^{(1,2)}}{p_3^*}\Big/\frac{\partial \beta}{\partial \beta} = \frac{2\gamma(4-6\beta+3\gamma^3-\gamma^4+\beta^2\gamma-2\beta^2)}{(2+\beta-\gamma^2)^2(2+2\beta-\gamma^2)^2}$$

$$= \frac{2\gamma(4-6\beta+3\gamma^3-\gamma^4+\beta^2\gamma-2\beta^2)}{(2+\beta-\gamma^2)^2(2+2\beta-\gamma^2)^2}$$

$$= \frac{2\gamma(4(1-\beta)+2(\gamma^3-\beta)+(\gamma^3-\beta^2)+\beta^2(\gamma-1)-\gamma^4)}{(2+\beta-\gamma^2)^2(2+2\beta-\gamma^2)^2} < 0$$

It is obvious that substitute parameters affect prices of insiders and outsider differently.

Specifically, when the outsider is more differentiated from the insider or the insiders are closer, the resulting price of firm 3, the outsider, would be lower. When a merger occurs, the resulting prices for products of both outsider and insider are expected to increase.

Under the condition (A2), the merger between firm 1 and firm 2 is profitable, from equations (4) and (12), the following unilateral effect measurement is as follows:

$$\begin{aligned}
\frac{p_1^{(1,3)}}{p_1^*} &= \frac{(2+\beta-\gamma^2)(4-5\gamma^2+3\beta\gamma^2+\beta\gamma-2\beta-\gamma\beta^2)}{(2-\gamma)(4-5\gamma^2-\beta^2+2\beta\gamma^2)} \\
\frac{p_3^{(1,3)}}{p_3^*} &= \frac{(2+\beta-\gamma^2)(4-4\gamma^2-\beta^2+\beta\gamma^2-2\gamma+\beta\gamma+\gamma^3)}{(2+\beta-2\gamma)(4-5\gamma^2-\beta^2+2\beta\gamma^2)} \qquad (24) \\
\frac{p_2^{(1,3)}}{p_2^*} &= \frac{(1-\gamma)(2+\beta-\gamma^2)(\gamma+2-\beta)}{(2-\gamma)(4-5\gamma^2-\beta^2+2\beta\gamma^2)}
\end{aligned}$$

Then, using the similar analysis above, I obtain the following results:

$$\frac{\partial \frac{p_1^{(1,3)}}{p_1^*}}{\partial \gamma} < or > 0, \frac{\partial \frac{p_1^{(1,3)}}{p_1^*}}{\partial \beta} < 0$$

$$\frac{\partial \frac{p_3^{(1,3)}}{p_3^*}}{\partial \gamma} < 0, \frac{\partial \frac{p_3^{(1,3)}}{p_3^*}}{\partial \beta} < 0$$

$$\frac{\partial \frac{p_2^{(1,3)}}{p_2^*}}{\partial \gamma} < or > 0, \frac{\partial \frac{p_2^{(1,3)}}{p_2^*}}{\partial \beta} > 0$$

The anti-monopoly authority is possible to disagree with the merger between merging party and its close competitor if the unilateral effects are checked. Specifically, whether in the merger between firm 1 and firm 2 or in the merger between firm 1 and firm 3, consumers would face higher prices when the outsider is more differentiated from the insiders. In other words, with this perspective of interpretation, to merge with close competitor harms more than merge with distant competitor, which is usually the view hold by anti-monopoly authority. For example, the 2010 Horizontal Merger Guidelines states briefly that one high-end product may compete more fiercely with another high-end product than the low-end product. The central to the evaluation of unilateral price effects is the extent of direct competition between products sold by the merging firms.

3.4.4 Impacts on Consumer Surplus and Social Welfare

Using the equations (3) to (15), I obtain the corresponding equilibrium consumer surplus equations and social welfare equations are formally as:

$$CS^* = \frac{\alpha^2(12-18\gamma^2+\beta^2+12\beta-4\gamma\beta-2\beta\gamma^2+8\gamma^3)}{8(\gamma^2-\beta-2)^2}$$

$$CS^{(1,2)} = \frac{\alpha^2(6-9\gamma^2+2\beta^2+8\beta-3\beta\gamma^2+4\gamma^3)}{4(\gamma^2-2\beta-2)^2}$$

$$CS^{(1,3)} = \frac{\alpha^2}{8(4-5\gamma^2-\beta^2+2\beta\gamma^2)^2}(48+80\beta\gamma^2-32r-32\beta^2-8\gamma\beta-96\gamma^2+32\gamma\beta^2 \quad (25)$$
$$-14\gamma^2\beta^2-10\gamma\beta^3+8\beta^3-66\gamma^3\beta-2\gamma^2\beta^3-10\beta\gamma^4+20\gamma^3\beta^2+17\gamma^4+64\gamma^3+\beta^4)$$

$$W^* = CS^* + \Pi^* = \frac{\alpha(4\gamma-\beta-6)}{2(\gamma^2-\beta-2)} - \frac{\alpha^2(12-18\gamma^2+\beta^2+12\beta-4\gamma\beta-2\beta\gamma^2+8\gamma^3)}{8(\gamma^2-\beta-2)^2}$$

$$W^{(1,2)} = CS^{(1,2)} + \Pi^{(1,2)} = \frac{\alpha(3\gamma-\beta-5)}{2(\gamma^2-2\beta-2)} - \frac{\alpha^2(6-9\gamma^2+2\beta^2+8\beta-3\beta\gamma^2+4\gamma^3)}{4(\gamma^2-2\beta-2)^2}$$

$$W^{(1,3)} = CS^{(1,3)} + \Pi^{(1,3)} = \alpha\frac{(\gamma-2)(\gamma-2+\beta)+(\beta-2)(3\gamma-\beta-2)+(\gamma-1)(\beta-2-\gamma)}{2(4-5\gamma^2-\beta^2+2\beta\gamma^2)}$$
$$-\frac{\alpha^2}{8(4-5\gamma^2-\beta^2+2\beta\gamma^2)^2}(48+80\beta\gamma^2-32r-32\beta^2-8\gamma\beta-96\gamma^2+32\gamma\beta^2-14\gamma^2\beta^2 \quad (26)$$
$$-10\gamma\beta^3+8\beta^3-66\gamma^3\beta-2\gamma^2\beta^3-10\beta\gamma^4+20\gamma^3\beta^2+17\gamma^4+64\gamma^3+\beta^4)$$

Proposition 3

i. Any profitable merger is harmful to consumers;

ii. Any profitable merger decreases social welfare.

Proof . See Appendix.

Obviously, the consumer surplus is determined by the quantities in the market. In Cournot Model, any bilateral merger would result in price increase of all products, while the outsider possible to increase its output. Any profitable merger is able to decrease the quantities, even if the outsider increase its output, the amount is not enough to supplement the amount decreased by insiders, and thus consumers have fewer products to consume. In the previous analysis, I mention that merging firm is always induced to merge with distant competitor whenever it is profitable to do so and is largely because of the appeal for market share and concentration.

It is not strange to find that social welfare is negative whichever two types of merger occurs since there are no efficiency gain caused by reduction of cost (No cost is discussed in this thesis). The underlying intuition is as follows. Although, merging party gains more profits by merging with distant competitor, they are not sufficient

large enough to make up the loss of consumer welfare. Absence of cost savings, as Williamson (1968) demonstrated, a merger invariably yields a dead-weight loss. Output coordination with a competitor reduces consumer surplus and social welfare.

Chapter 4 Horizontal Mergers under Bertrand Competition

4.1Theoretical Framework

For the Bertrand Competition Model, I also consider three-firm industry and organize the demand system as follows. For firm 1, the firm 2 is still the closer competitor and the firm 3 is the distant competitor. In Bertrand Competition Model, firms compete in price to maximize their own profits. In this section, I formally analyze the effects of mergers on profitability and product dropping. Considering the plausibility of demand system, I develop the price-setting system as follows[5].

$$\begin{aligned} q_1 &= a_0(1-\tau-\varsigma) - p_1 + \tau p_2 + \varsigma p_3 \\ q_2 &= a_0(1-\tau-\varsigma) - p_2 + \tau p_1 + \varsigma p_3, 0 < \varsigma < \tau < 1 \\ q_3 &= a_0(1-\tau-\varsigma) - p_3 + \varsigma p_1 + \varsigma p_2 \end{aligned} \tag{27}$$

Before merger, the equilibrium prices, quantities and profits are represented by $(p_i^{B^*}, q_i^{B^*}, \Pi_i^{B^*})$, i=1,2,3; After the merger between firm 1 and firm 2, the prices, quantities and profits are represented by $(p_i^{B(1.2)}, q_i^{B(1.2)}, \Pi_i^{B(1.2)})$, i=1,2,3; After the merger between firm 1 and firm 3, the prices, quantities and profits are represented by $(p_i^{B(1,3)}, q_i^{B(1,3)}, \Pi_i^{B(1,3)})$.

Similar to the analysis in Cournot Model, I will present how I develop Bertrand Model in this Chapter. To keep the consistency with Cournot Model, the same assumption is made: A monopoly is inhibited but a duopoly after a merger is allowed. To keep later analysis and the results clean, this system does not derive from the Cournto Model, nevertheless, it does not affect the conclusions for Bertrand Model. In this model, the condition $0 < \varsigma < \tau < 1$ has little difference from the one:

[5]To examine the implication of asymmetry in Bertrand Model, I tried different models. To make sure the economic plausibility of this model, the above model is adopted. Although, I could also derive the demand system directly from the previous Cournot Model, the result is intractable and difficult to deal with.

$0<\gamma<\beta\leq 1$ in Cournot Model. The value of τ cannot be one since the maximum influence factor of price on quantity comes from the product itself and the value is one. Even if the Bertrand model is derived from original Cournot model, $\tau=1$ should be removed for the same reason. Thus, the following demonstrations mainly focus on the condition $0<\varsigma<\tau<1$.

Before a merger occurs, each firm maximizes its profits $\underset{(p)}{\Pi_i} = p_i q_i$, the first-order conditions are:

$$\begin{aligned}
\frac{\partial \Pi_1}{\partial p_1} &= a_0(1-\tau-\delta)-2p_1+\tau p_2+\varsigma p_3=0 \\
\frac{\partial \Pi_2}{\partial p_2} &= a_0(1-\tau-\delta)-2p_2+\tau p_1+\varsigma p_3=0 \\
\frac{\partial \Pi_3}{\partial p_3} &= a_0(1-\tau-\delta)-2p_3+\varsigma p_1+\varsigma p_2=0
\end{aligned} \tag{28}$$

The second-order conditions are as follows:

$$\frac{\partial^2 \Pi_i}{\partial p_i^{\,2}} \leq 0 \;\; i,j=1,2,3$$

The equilibrium prices, quantities and profits are as follows:

$$p_1^{B^*} = p_2^{B^*} = \frac{a_0(\varsigma+2)(1-\tau-\varsigma)}{2(-\varsigma^2-\tau+2)}, p_3^{B^*} = \frac{a_0(2\varsigma-\tau+2)(1-\tau-\varsigma)}{2(-\varsigma^2-\tau+2)} \tag{29}$$

$$q_1^{B^*} = q_2^{B^*} = \frac{a_0(\varsigma+2)(1-\tau-\varsigma)}{2(-\varsigma^2-\tau+2)}, q_3^{B^*} = \frac{a_0(2\varsigma-\tau+2)(1-\tau-\varsigma)}{2(-\varsigma^2-\tau+2)} \tag{30}$$

$$\Pi_1^{B^*} = \Pi_2^{B^*} = \frac{a_0{}^2(\varsigma+2)^2(1-\tau-\varsigma)^2}{4(-\varsigma^2-\tau+2)^2}, \Pi_3^{B^*} = \frac{a_0{}^2(2\varsigma-\tau+2)^2(1-\tau-\varsigma)^2}{4(-\varsigma^2-\tau+2)^2} \tag{31}$$

$$\Pi_1^{B^*}+\Pi_2^{B^*} = \frac{a_0{}^2(\varsigma+2)^2(1-\tau-\varsigma)^2}{2(-\varsigma^2-\tau+2)^2}, \Pi_1^{B^*}+\Pi_3^{B^*} = \frac{a_0{}^2(1-\tau-\varsigma)^2\left[(\varsigma+2)^2+(2\varsigma-\tau+2)^2\right]}{4(-\varsigma^2-\tau+2)^2}$$

Before a merger occurs, it is obvious that $p_1^{B^*} = p_2^{B^*} < p_3^{B^*}$ and $q_1^{B^*} = q_2^{B^*} < q_3^{B^*}$ are true, which is quite similar to the market structure in the Cournot model considered earlier. That is, with the most differentiated product, Firm 3 has the greatest market power and thus earns the highest profit.

If firm 1 and firm 2 merge, then they maximize their total profits $\underset{(p_1,p_2)}{\prod} = p_1q_1 + p_2q_2$ .Firm 3 maximizes its profit $\underset{(p_3)}{\prod_3} = p_3q_3$.

The first order conditions are:

$$\begin{aligned}
&\frac{\partial \underset{(p_1,p_2)}{\prod_1}}{\partial p_1} = a_0(1-\tau-\delta) - 2p_1 + 2\tau p_2 + \varsigma p_3 = 0 \\
&\frac{\partial \underset{(p_1,p_2)}{\prod_2}}{\partial p_2} = a_0(1-\tau-\delta) - 2p_2 + 2\tau p_1 + \varsigma p_3 = 0 \\
&\frac{\partial \prod_3}{\partial p_3} = a_0(1-\tau-\delta) - 2p_3 + \varsigma p_1 + \varsigma p_2 = 0
\end{aligned} \tag{32}$$

The second order conditions are:

$$\frac{\partial^2 \prod_i}{\partial p_i^{\,2}} \le 0 \; i = 1,2,3 \; \frac{\partial^2 \prod_i}{\partial p_i^{\,2}} \frac{\partial^2 \prod_j}{\partial p_j^{\,2}} - \frac{\partial^2 \prod_i}{\partial p_i \partial p_j} \frac{\partial^2 \prod_j}{\partial p_i \partial p_j} \ge 0 \; i, j = 1,2 . i \ne j$$

Then it is obtained:

$$p_1^{B(1,2)} = p_2^{B(1,2)} = \frac{a_0(\varsigma+2)(1-\tau-\varsigma)}{2(-\varsigma^2-2\tau+2)}, p_3^{B(1,2)} = \frac{a_0(\varsigma+1-\tau)(1-\tau-\varsigma)}{(-\varsigma^2-2\tau+2)} \tag{33}$$

$$q_1^{B(1,2)} = q_2^{B(1,2)} = \frac{a_0(1-\tau)(\varsigma+2)(1-\tau-\varsigma)}{2(-\varsigma^2-2\tau+2)}, q_3^{B(1,2)} = \frac{a_0(\varsigma+1-\tau)(1-\tau-\varsigma)}{(-\varsigma^2-2\tau+2)} \tag{34}$$

$$\prod_1^{B(1,2)} = \prod_2^{B(1,2)} = \frac{a_0{}^2(\varsigma+2)^2(1-\tau)(1-\tau-\varsigma)^2}{4(-\varsigma^2-2\tau+2)^2}, \prod_3^{B(1,2)} = \frac{a_0{}^2(\varsigma+1-\tau)^2(1-\tau-\varsigma)^2}{(-\varsigma^2-2\tau+2)^2}$$

$$\prod_1^{B(1,2)} + \prod_2^{B(1,2)} = \frac{a_0{}^2(\varsigma+2)^2(1-\tau)(1-\tau-\varsigma)^2}{2(-\varsigma^2-2\tau+2)^2} \tag{35}$$

After the merger (1,2), I have $p_1^{B(1,2)} = p_2^{B(1,2)} > p_3^{B(1,2)}$ and $q_1^{B(1,2)} = q_2^{B(1,2)} < q_3^{B(1,2)}$.

If firm 3 is the target, then firm 1 and 3 maximize their total profits $\underset{(p_1,p_3)}{\prod} = p_1q_1 + p_3q_3$ and firm 2 maximize its own profit $\underset{(p_1,p_2)}{\prod} = p_2q_2$.

The first order conditions are:

$$\frac{\partial \prod_{(p_1,p_3)}}{\partial p_1} = a_0(1-\tau-\delta)-2p_1+\tau p_2+2\varsigma p_3=0$$
$$\frac{\partial \Pi_2}{\partial p_2} = a_0(1-\tau-\delta)-2p_2+\tau p_1+\varsigma p_3=0 \tag{36}$$
$$\frac{\partial \prod_{(p_1,p_3)}}{\partial p_3} = a_0(1-\tau-\delta)-2p_3+2\varsigma p_1+\varsigma p_2=0$$

The second order-conditions are as follows:

$$\frac{\partial^2 \Pi_i}{\partial p_i^{\,2}} \le 0, i, j=1,2,3, \frac{\partial^2 \Pi_i}{\partial p_i^{\,2}}\frac{\partial^2 \Pi_j}{\partial p_j^{\,2}} - \frac{\partial^2 \Pi_i}{\partial p_i \partial p_j}\frac{\partial^2 \Pi_j}{\partial p_i \partial p_j} \ge 0, i, j=1,3. i \ne j$$

It is obtained:

$$p_1^{B(1,3)} = \frac{a_0(\varsigma+2)(\varsigma+\tau+2)(1-\tau-\varsigma)}{2(4-5\varsigma^2-\tau^2-2\tau\varsigma^2)}$$
$$p_3^{B(1,3)} = \frac{a_0(2+\tau)(3\varsigma+2-\tau)(1-\tau-\varsigma)}{2(4-5\varsigma^2-\tau^2-2\tau\varsigma^2)} \tag{37}$$
$$p_2^{B(1,3)} = \frac{a_0(1+\varsigma)(2+\tau-\varsigma)(1-\tau-\varsigma)}{(4-5\varsigma^2-\tau^2-2\tau\varsigma^2)}$$

$$q_1^{B(1,3)} = \frac{a_0(4-5\varsigma^2-3\tau\varsigma^2+\tau\varsigma+2\tau+\varsigma\tau^2)(1-\tau-\varsigma)}{2(4-5\varsigma^2-\tau^2-2\tau\varsigma^2)}$$
$$q_3^{B(1,3)} = \frac{a_0(4-4\varsigma^2-\tau^2-\tau\varsigma^2+2\varsigma+\tau\varsigma-\varsigma^3)(1-\tau-\varsigma)}{2(4-5\varsigma^2-\tau^2-2\tau\varsigma^2)} \tag{38}$$
$$q_2^{B(1,3)} = \frac{a_0(1+\varsigma)(2+\tau-\varsigma)(1-\tau-\varsigma)}{(4-5\varsigma^2-\tau^2-2\tau\varsigma^2)}$$

$$\Pi_1^{B(1,3)} = \frac{a_0^{\,2}(\varsigma+2)(\varsigma+\tau+2)(4-5\varsigma^2-3\tau\varsigma^2+\tau\varsigma+2\tau+\varsigma\tau^2)(1-\tau-\varsigma)^2}{4(4-5\varsigma^2-\tau^2-2\tau\varsigma^2)^2}$$
$$\Pi_3^{B(1,3)} = \frac{a_0^{\,2}(2+\tau)(-\tau+3\varsigma+2)(4-4\varsigma^2-\tau^2-\tau\varsigma^2+2\varsigma+\tau\varsigma-\varsigma^3)(1-\tau-\varsigma)^2}{4(4-5\varsigma^2-\tau^2-2\tau\varsigma^2)^2}$$
$$\Pi_2^{B(1,3)} = \frac{a_0^{\,2}(1+\varsigma)^2(2+\tau-\varsigma)^2(1-\tau-\varsigma)^2}{(4-5\varsigma^2-\tau^2-2\tau\varsigma^2)^2} \tag{39}$$

$$\Pi_1^{B(1,3)}+\Pi_3^{B(1,3)} = \frac{a_0^{\,2}(\varsigma+2)(\varsigma+\tau+2)(4-5\varsigma^2-3\tau\varsigma^2+\tau\varsigma+2\tau+\varsigma\tau^2)(1-\tau-\varsigma)^2}{4(4-5\varsigma^2-\tau^2-2\tau\varsigma^2)^2}$$
$$\text{.....} + \frac{a_0^{\,2}(2+\tau)(3\varsigma+2-\tau)(4-4\varsigma^2-\tau^2-\tau\varsigma^2+2\varsigma+\tau\varsigma-\varsigma^3)(1-\tau-\varsigma)^2}{4(4-5\varsigma^2-\tau^2-2\tau\varsigma^2)^2}$$

It follows that $p_1^{B(1,3)} > p_2^{B(1,3)} > p_3^{B(1,3)}$ and $q_2^{B(1,3)} > q_1^{B(1,3)} > q_3^{B(1,3)}$.

4.2 Dropping Product Line

Here I consider whether the merging party has incentive to drop a (competing) product line. When merger between firm 1 and firm 2 occurs, dropping product 1 or product 2 is the same. After dropping product 1, merging entity and firm 3 maximize their own profits respectively, the first order conditions are:

$$\begin{aligned} \frac{\partial \Pi}{\partial p_2} &= a_0(1-\varsigma) - 2p_2 + \varsigma p_3 = 0 \\ \frac{\partial \Pi}{\partial p_3} &= a_0(1-\varsigma) - 2p_3 + \varsigma p_2 = 0 \end{aligned} \tag{39}$$

The second order conditions are as follows:

$$\frac{\partial^2 \Pi_{d1}}{\partial p_2^{\,2}} < 0, \frac{\partial^2 \Pi_{3d1}}{\partial p_3^{\,2}} < 0$$

The profit functions of merging entity and the outsider are obtained:

$$\Pi_{d1}^{B(1,2)} = \frac{a_0^{\,2}(1-\varsigma)^2}{(2-\varsigma)^2}, \Pi_{3d1}^{B(1,2)} = \frac{a_0^{\,2}(1-\varsigma)^2}{(2-\varsigma)^2} \tag{40}$$

$\varsigma = \varsigma^{(1,2)d}(\tau)$ is uniquely defined such that:

$$\begin{cases} \Pi_1^{B(1,2)} + \Pi_2^{B(1,2)} > \Pi_{d1}^{B(1,2)}, \varsigma \in (0, \varsigma^{(1,2)d}(\tau)) \\ \Pi_1^{B(1,2)} + \Pi_2^{B(1,2)} = \Pi_{d1}^{B(1,2)}, \varsigma = \varsigma^{(1,2)d}(\tau) \\ \Pi_1^{B(1,2)} + \Pi_2^{B(1,2)} < \Pi_{d1}^{B(1,2)}, \varsigma \in (\varsigma^{(1,2)d}(\tau), \tau) \end{cases} \tag{41}$$

When merger between firm 1 and firm 3 occurs and the merging party chooses to drop product 1, merging entity and firm 2maximize their own profits respectively, the first order condition are:

$$\begin{aligned} \frac{\partial \Pi_{d1}}{\partial p_2} &= a_0(1-\varsigma) - 2p_2 + \varsigma p_3 = 0 \\ \frac{\partial \Pi}{\partial p_3} &= a_0(1-\varsigma) - 2p_3 + \varsigma p_2 = 0 \end{aligned} \tag{42}$$

The second order condition:

$$\frac{\partial^2 \Pi_{d1}}{\partial {p_2}^2} < 0, \frac{\partial^2 \Pi_{3d1}}{\partial {p_3}^2} < 0$$

The profit functions of merging entity and outsider are obtained:

$$\Pi_{d1}^{B(1,3)} = \frac{{a_0}^2(1-\varsigma)^2}{(2-\varsigma)^2}, \Pi_{2d1}^{B(1,3)} = \frac{{a_0}^2(1-\varsigma)^2}{(2-\varsigma)^2} \tag{43}$$

When merger between firm 1 and firm 3 occurs and the merging party chooses to drop product 3, merging entity and firm 2maximize their own profits respectively, the following profits are obtained by repeating the similar steps as above.

$$\Pi_{d3}^{B(1,3)} = \frac{{a_0}^2(1-\tau)^2}{(2-\tau)^2}, \Pi_{2d3}^{B(1,3)} = \frac{{a_0}^2(1-\tau)^2}{(2-\tau)^2} \tag{44}$$

Since $\tau > \varsigma$, the merging firm would choose to drop product 1 when merger between firm 1 and firm 3 occurs.

$\varsigma = \varsigma^{(1,3)d}(\tau)$ is uniquely defined such that:

$$\begin{cases} \Pi_1^{B(1,3)} + \Pi_3^{B(1,3)} > \Pi_{d1}^{B(1,3)}, \varsigma \in (0, \varsigma^{(1,3)d}(\tau)) \\ \Pi_1^{B(1,3)} + \Pi_3^{B(1,3)} = \Pi_{d1}^{B(1,3)}, \varsigma = \varsigma^{(1,3)d}(\tau) \\ \Pi_1^{B(1,3)} + \Pi_2^{B(1,3)} < \Pi_{d1}^{B(1,3)}, \varsigma \in (\varsigma^{(1,3)d}(\tau), \tau) \end{cases} \tag{45}$$

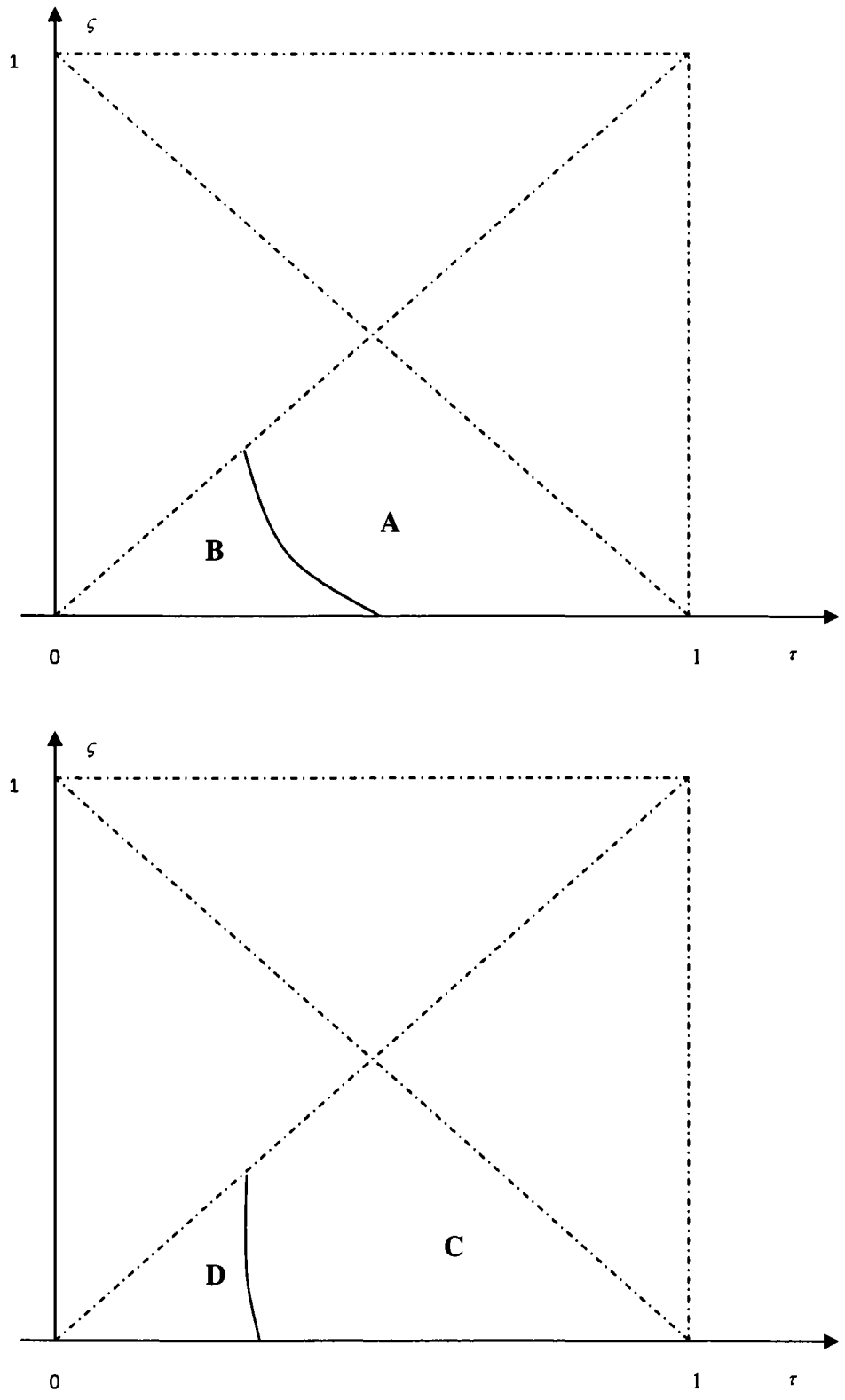


Figure B1: Dropping Product Line after Merger

Lemma 5

i. *Under the merger (1,2), dropping occurs in region A but not occur in region B.*

ii. *Under the merger (1,3), dropping occurs in region C but not occur in region D.*

Although, it is quite time consuming and expensive for the merging parties to drop products after a merger, for convenience, the assumption is made here that drop products after a merger is costless[6].

The result is consistent with our intuition. The merging party is not willing to drop the product line when both the two substitute parameters are small since cannibalization is not large that the merging party has no strong incentive to drop product line. Greater substitutability between the products combined by the merger presumes more competition internalized by the merger (See Gandhi, Froeb, Tschantz, and Werden (2008)). To reduce cannibalization, the merging party is willing to drop one of product line and keep one product line to compete with the outsider.

4.3Asymmetric Substitutability

Having examining the incentive of dropping product line, now I turn to the issue of merger profitability.

[6]Gandhi, Frobe, Tschantz and Werden (2008) also assume that firms' products repositioning after a merger are instantaneous and costless.

4.3.1 Merger Profitability

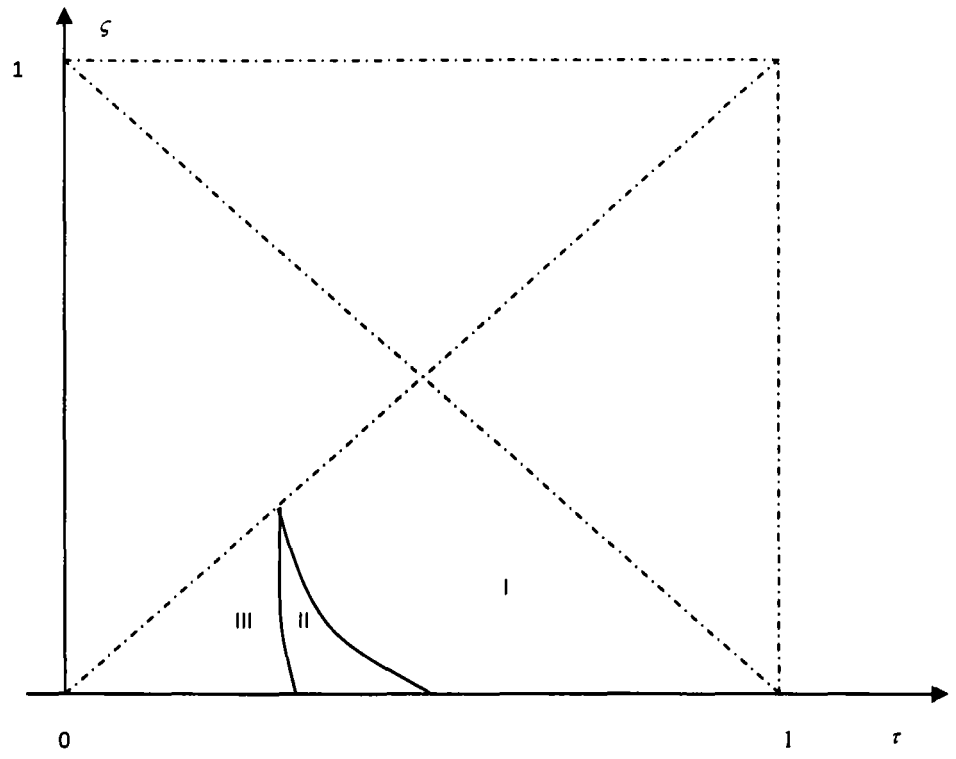


Figure B2: Profitable Mergers and Optimal Mergers in Bertrand Model

I. (1,2) dropping and (1.3) dropping are more profitable than not dropping, and they are the optimal strategies(they are equivalent in fact)

II.(1,3) dropping product 1 is more profitable than not dropping,

(1,2) no dropping product is the optimal strategy

III.(1,3) no dropping product is more profitable than dropping,

(1,2) no dropping product is the optimal strategy

Figure B2 provides straightforward interpretation of following results in Bertrand Model.

Proposition 4

Under the condition $0 < \varsigma < \min\{1-\tau, \tau\} < 1$, *all mergers (1,2) without dropping and (1,3) without dropping product line are profitable.*

Proof. See Appendix

This proposition does not contradict with the conclusion made by Deneckere and Davidson (1985).Under symmetric differentiated price-setting model, a merger is

always beneficial and any size of merger is profitable. When the plausible conditions on the demand are satisfied in asymmetric model, any merger is profitable (since firm 1 and firm 2 are the same to firm 3, merger between firm 2 and firm 3 could be reviewed as the merger between firm 1 and firm 3). Even without cost saving, the incentive to merger in non-cooperative oligopoly model still exists. The reason given by them is the upward sloping reaction functions, therefore it is not surprising to find in my model that whichever the merging firm choose to merge with, they are profitable and merger paradox the issue raised in quantity-setting games is not found in the asymmetric differentiated Bertrand Model.

Note that not all the mergers with dropping are profitable. When the products in the market are very distant (small substitute parameters), the price competition is not so fierce and there is no need to drop product line to reduce cannibalization between products of merging entity. Only when the price competition is so competitive, the merging party has incentive to drop product line.

4.3.2 Target Optimal Strategy and Equilibrium

Proposition 5

Under Bertrand Competition, (1,2) is always the optimal strategy although it is equivalent to (1,3) in region I of figure B2.

Scenario 1: Under the condition $\varsigma^{(1,2)d}(\tau) < \varsigma < \min\{1-\tau, \tau\} < 1$, *merger (1,2) with dropping product 1(or 2) and merger (1,3) with dropping product 1 would result in similar equilibrium and are the optimal strategies for the merging firm.*

Under the given condition, merger (1,2), (1,3) with or without dropping are all profitable and a merger with dropping product is more profitable than a merger

without dropping. To reduce cannibalization between merger products, the merging firm is willing to drop product 1 (or 2) when merger (1,2) occurs and to drop product 1 when merger (1,3) occurs. When the market reaches equilibrium, only firm 2 (or firm1) and firm 3 are left to compete. But there are differences, the merging firm produces product 1 or product 2 when it chooses the merger (1,2) while the merging firm produce product 3 when the merger (1,3).

Scenario 2: Under the condition $\varsigma^{(1,3)d}(\tau) < \varsigma < \varsigma^{(1,2)d}(\tau)$, *merger (1,3) with dropping is more profitable than merger (1,3) without dropping, merger (1,2) without dropping product 1(or 2) is the optimal strategy for merging firm.*

Under the given condition, merger (1,2) with dropping product line is the optimal. There are only firm 2(or firm 1) and firm 3 competing, which is the same with the above equilibrium. Nevertheless, quite differently, merger (1,3) would not occur even if merger (1,3) is a profitable merger. The merged entity gains more benefits by reducing competition between merged products.

Scenario 3: Under the condition $0 < \varsigma < \varsigma^{(1,3)d}(\tau)$, *both mergers (1,2) and (1,3) without dropping product line are profitable than with dropping, the merger (1,2) without dropping is the optimal strategy for merging firm.*

This result suggests significant insights: although there is some competition between merger products, the competition is not so harmful when the products are initially quite vey distant to each other, the merger is less anticompetitive than when the products are very close in price-competition model. The close competitor, firm 2, is always the best target for the merging firm. Under this scenario, a close competitor decreases the firm's ability to charge higher price and, intuitively, a merging firm has

incentive to merge with the competitor involving the fiercest competition with merging firm. Not surprisingly found, merger with close competitor is the optimal for merging firm.

4.3.4 Unilateral effects

Similar to the analysis in Cournot Model, I measure the unilateral effect of a merger by the ratio of the post-merger price and the pre-merger price. For example, the unilateral effect of merger (1,2) for product i is measured by: $\frac{p_i^{B(1,2)}}{p_i^{B*}}$, since merger between firm 1 and firm 2 is more profitable than merger between firm 1 and firm 3, I consider only the unilateral effects for this merger. Note that by symmetry, when firm 1 and firm 2 merges, the unilateral effect on product 1 and 2 are the same. The measures of unilateral effect of merger (1,2) on three products are given by:

$$\frac{p_1^{B(1,2)}}{p_1^{B*}} = \frac{p_2^{B(1,2)}}{p_2^{B*}} = \frac{2-\tau-\varsigma^2}{2-2\tau-\varsigma^2}, \frac{p_3^{B(1,2)}}{p_3^{B*}} = \frac{(2+2\varsigma-2\tau)(2-\tau-\varsigma^2)}{(2+2\varsigma-\tau)(2-2\tau-\varsigma^2)} \qquad (46)$$

It is not difficult to show that prices all go up after the merger.

$$\frac{\partial \frac{p_1^{B(1,2)}}{p_1^{B*}}}{\partial \tau} > 0, \frac{\partial \frac{p_1^{B(1,2)}}{p_1^{B*}}}{\partial \varsigma} > 0$$

$$\frac{\partial \frac{p_3^{B(1,2)}}{p_3^{B*}}}{\partial \tau} > 0, \frac{\partial \frac{p_3^{B(1,2)}}{p_3^{B*}}}{\partial \varsigma} > 0$$

The response of outsider is beneficial to insiders in Bertrand Model, which tends to harm insiders in Cournot Model. Price-setting competitors reinforce price increase and this is reason why merger paradox does arise in the above.

Next, I will consider the unilateral effects of merger (1,2) when product deletion occurs and merger (1,3) when product deletion occurs.

$$\frac{p_{2d1}^{B(1,2)}}{p_2^{B*}}=\frac{2(1-\varsigma)(2-\tau-\varsigma^2)}{(4-\varsigma^2)(1-\tau-\varsigma)},\frac{p_{3d1}^{B(1,2)}}{p_3^{B*}}=\frac{2(1-\varsigma)(2-\tau-\varsigma^2)}{(2-\varsigma)(2+2\varsigma-\tau)(1-\tau-\varsigma)} \quad (47)$$

$$\frac{p_{2d1}^{B(1,3)}}{p_2^{B*}}=\frac{2(1-\varsigma)(2-\tau-\varsigma^2)}{(4-\varsigma^2)(1-\tau-\varsigma)},\frac{p_{3d1}^{B(1,3)}}{p_3^{B*}}=\frac{2(1-\varsigma)(2-\tau-\varsigma^2)}{(2-\varsigma)(2+2\varsigma-\tau)(1-\tau-\varsigma)} \quad (48)$$

Unilateral effects of merger (1,2) with dropping product line and merger (1,3) with dropping product line are as follow:

$$\frac{\partial\frac{p_{2d1}^{B(1,2)}}{p_2^{B*}}}{\partial\tau}=\frac{\partial\frac{p_{2d1}^{B(1,3)}}{p_2^{B*}}}{\partial\tau}>0,\frac{\partial\frac{p_{2d1}^{B(1,2)}}{p_2^{B*}}}{\partial\varsigma}=\frac{\partial\frac{p_{2d1}^{B(1,3)}}{p_2^{B*}}}{\partial\varsigma}<0$$

$$\frac{\partial\frac{p_{3d1}^{B(1,2)}}{p_3^{B*}}}{\partial\tau}=\frac{\partial\frac{p_{3d1}^{B(1,3)}}{p_3^{B*}}}{\partial\tau}>0,\frac{\partial\frac{p_{3d1}^{B(1,2)}}{p_3^{B*}}}{\partial\varsigma}=\frac{\partial\frac{p_{3d1}^{B(1,3)}}{p_3^{B*}}}{\partial\varsigma}<0$$

When a merger involves dropping product line, close substitute products in the market create strong incentive to decrease prices in Bertrand model. The unilateral effects of post-merger involving dropping product line are decreasing functions of substitute parameter between firm 2 and firm 3.

4.3.5 Impacts on Consumer Surplus and Social Welfare

To find the corresponding inverse demand functions in the Bertrand Model, I rewrite the original system as follows:

$$\begin{aligned}
p_1 &= (\mathrm{H}+\mathrm{I}+\mathrm{K})(1-\tau-\varsigma)a_0-\mathrm{H}q_1-\mathrm{I}q_2-\mathrm{K}q_3\\
p_2 &= (\mathrm{H}+\mathrm{I}+\mathrm{K})(1-\tau-\varsigma)a_0-\mathrm{H}q_2-\mathrm{I}q_1-\mathrm{K}q_3\\
p_3 &= \Lambda(1-\tau-\varsigma)a_0-(\Lambda-2\mathrm{K})q_3-\mathrm{K}q_1-\mathrm{K}q_2
\end{aligned} \quad (49)$$

Where

$$H = \frac{(1-\varsigma^2)}{(1+\tau)(1-\tau-2\varsigma^2)} > 0$$

$$I = \frac{(\tau+\varsigma^2)}{(1+\tau)(1-\tau-2\varsigma^2)} > 0$$

$$K = \frac{\varsigma(1+\tau)}{(1+\tau)(1-\tau-2\varsigma^2)} > 0$$

$$\Lambda = \frac{(1+\tau)(2\varsigma+1-\tau)}{(1+\tau)(1-\tau-2\varsigma^2)} > 0$$

$$(\Lambda - 2K) > 0$$

And the above condition implies that:

$$(1-\tau-2\varsigma^2) > 0$$

At equilibrium, the utility function of a given consumer can be rewritten as,

$$U(q_i) = a_0(1-\tau-\varsigma)[(H+I+K)q_1 + (H+I+K)q_2 + \Lambda q_3]$$
$$+\frac{1}{2}[Hq_1^2 + Hq_2^2 + (\Lambda-2K)q_3^2 + 2Iq_1q_2 + 2Kq_1q_3 + 2Kq_2q_3]$$

The consumer surplus function is then as follows,

$$CS(q_i) = \frac{1}{2}[Hq_1^2 + Hq_2^2 + (\Lambda-2K)q_3^2 + 2Iq_1q_2 + 2Kq_1q_3 + 2Kq_2q_3] \quad (50)$$

The social welfare function is as follows,

$$W(q_i) = a_0(1-\tau-\varsigma)[(H+I+K)q_1 + (H+I+K)q_2 + \Lambda q_3]$$
$$+\frac{1}{2}[Hq_1^2 + Hq_2^2 + (\Lambda-2K)q_3^2 + 2Iq_1q_2 + 2Kq_1q_3 + 2Kq_2q_3] \quad (51)$$

Proposition 6

Any profitable merger (with or without product dropping) is harmful to consumer surplus and social welfare;

Consumers unambiguously suffer from a profitable merger in the price setting model considered above. Absence of cost-saving, however distant the outsider is away from the insiders, prices for all products increase and quantities of insiders decrease more than the increasing amount of outsider after a merger. A profitable merger with dropping is more harmful to consumers that the merger without dropping. When dropping occurs, the market moves from triopoly to duopoly, which causes market concentration and consumers harms more.

Chapter 5 A Comparison of Bertrand and Cournot

5.1 Comparison of Asymmetric Bertrand and Cournot Competition Model

To capture better interpretation of the above analysis, I would continue to compare the two models in this chapter. Although Bertrand Competition Model does not derive from Cournot Competition Model, they are consistent in my analytical framework.

Table 1: Comparison of Asymmetric Bertrand and Cournot Model

	PM	EM	When EM	Price	Quantity	CS	W
	(1,2)	(1,2)	Insider	+	-	-	-
Cournot			Outsider(firm 3)	+	+		
	(1,2),(1,3)	(1,3)	Insider	+	-	-	-
			Outsider(firm 2)	+	+		
Bertrand	All(1,2),(1,3)	(1,2)	Insider	+	+	-	-
	Some	wd and	Outsider	+	+		
	(1,2)wd,	(1,3)wd					
	(1,3)wd						
Bertrand	All(1,2),(1,3)	(1,2)	Insider	+	-	-	-
	Some		Outsider	+	+		
	(1,2)wd,						
	(1,3)wd						

PM: Profitable Merger; EM: Equilibrium Merger; CS: Consumer Surplus; W: Social Welfare; (1,i) in this table refers the merger between firm 1 and firm j without dropping;(1,i)wd refers the merger between firm 1 and firm j with dropping.

When the acquirer accepts the optimal strategy and the state of market reaches to equilibrium, any bilateral merger increases prices in both models. The increasing

price in Cournot Model comes from the concentration of market share and decreasing output and the resulting prices come from the tradeoff between concentration of market share and improving competition ability. The outsider makes use of this opportunity to expand its output. Although sharing the similar merger characteristics with Cournot, insiders in Bertrand make price choice and increase their prices to maximize profits. Without exception, any optimal bilateral merger in both Cournot and Bertrand Model would definitely trigger all firms' increasing price.

In the two types of merger, different changes of quantity are resulted in. In a market competing by quantity, horizontal mergers will only lead to the decreasing of insiders' outputs in the market; in a market competing by price, horizontal merger will also bring outputs decreasing. In Bertrand model, when a merger without dropping occurs, the concentration will decrease the output, however the competition with outsiders will increase the output. Such tradeoff influences firming firm's merger direction and makes close competitor the target as the favorite all along when both are profitable. When a merger with dropping occurs, the market becomes a duopoly and both the insider and outsider increase their quantities.

Theoretically, for a merging firm in Cournot Model, to merge with a close competitor may be a profitable and optimal choice; nevertheless, its most favorite target should be distant competitor whenever it is profitable to do so. The reasons behind this should stem from the firm's seeking of market concentration or market share. At this point, I could conclude that a merging firm would like to merge with a distant competitor whenever it is profitable.

In my thesis, consumer surplus largely depends on the outputs of market and, thus, it is not surprising that consumer surplus change in the same direction of output. If the competition between firms is price-oriented, although the merger without dropping bring the decrease of output but the competition with outsider raise more output and consumers consume less outputs, and the merger with dropping would result much larger increasing quantities, consumer are not so hurtful. If the competition between firms is quantity-oriented, output will be largely cut down, consumer surplus is largely reduced.

Although the previous analyses are not enough to completely explain the mergers in reality, they provide worthwhile perspectives of interpretation. From the above analysis, it is concluded that the acquirer would like to merge with distant competitor when it is profitable to do so. As it is known, in Cournot Competition Model, firms compete by choosing quantity and by merging with distant competitor, the acquirer is able to increase its market power by expand market share.

Although for some substitute parameters the acquirer would choose distant competitor or close competitor as a merger target, the close competitor is the 'favorite' target for the merging firm. To capture the intuitive understanding of this conclusion, I would like to go back to the characteristic of Bertrand Model. Price is tool of firms to compete with others and the most horrible threatens come from other competitors' impacts on their prices. Therefore, the first priority for a merging firm is to eliminate the one which threatens the price of merging firm most. The closer a firm is to the merging firm, the more possible the consumers transfer from the output of merging firm to the competitor if the merging firm charge larger price. Obviously,

the close competitor is the one which threatens the price of merging firm most and that is reasons why the acquirer would like to merge with close competitor in Bertrand Competition Model.

5.2 Comparisons with others Researches: Asymmetric and Symmetric

Table 2: Comparison of Asymmetry and Symmetry

	Asymmetry		Symmetry	
	Cournot	Bertrand	Cournot	Bertrand
Merger Paradox	True	False	True	False
Strategy	Merger with distant competitor	Merger with close competitor	NA	NA
Dropping	Non-dropping	Dropping is possible	NA	NA

Look at the merger paradox first. Merger paradox exists in both asymmetric and symmetric Cournot model and is not true in both asymmetric and symmetric Bertrand model. However, the merger strategy is quite different in asymmetric Cournot and Bertrand model, in quantity-setting oligopoly, a distant competitor is the best target when it is profitable in Cournot model and a close competitor is the favorite in Bertrand model. In a quantity-setting game, dropping a product after a merger is a not necessary and as a matter of fact different brand products is helpful to compete with outsider and occupy market share even if there is some competition between the merged brand products. That is why the non-dropping situation occurs in Cournot oligopoly. Nevertheless, in a price-setting game, price competition is the priority for the firms and the merging firms would balance brand products competition and market power. When the merged products are very close, brand competition hurts the merging party and tends to benefit more to the outsider and

therefore, to drop is able to prevent the cannibalization of merged brand products.

Chapter 6 Policy Implication and Conclusion

6.1 Policy Implication

Merger Guidelines in European Union and United States, all mention product substitutability. Although, it is difficult to identify precise products substitutability between two firms, these guidelines try to find the evidence to show how the two products are correlated before a merger. When prices, before a merger occurs, are positively related, the two products are close substitutes. And when prices fail to work as a signal, the authorities measure the substitutability by the relationship of market share. If the market share is negatively correlated, then there are evidences of close competition. When the insiders of a merger are very close competitor, by the Merger Guidelines, they will increase prices and eliminate competition in the market and should be forbidden.

My analysis and the main results actually support the reasoning behind these guidelines, which demonstrate that a merger between close competitors would increase price and decrease competition. Firstly, in my analysis, when a merger occurs in asymmetric oligopoly, a merger with distant competitor cause more harm than the merger with close competitor, the merger with a distant competitor is able to increase price most, decrease quantity most and harms consumers most. Thus, it is not justifiable to declare the proposed merger just because of the evidences of close substitutes. In another words, when the merging parties are distant competitor, the governments are suggested not to let down their guard. Even if the insiders are very distant (in related market), they could lead to competition pressure and increase price. Secondly, in a market with Cournot characteristics, policy makers might pay more attention to the distant competitor which tends to be a target for the merging firm;

and in a market with Bertrand characteristics, they might be care of close competitor which tends to be the optimal merger target.

It is possible that a merger with close competitor which harms less is refused while the merger with distant competitor which tends harm more is accepted following the original merger guidelines. Antitrust authority is suggested to be care of distant competitor in an asymmetric differentiated market when a merger is proposed. How asymmetric the market is and the characteristics of market competition should be factors the government and authority pay attention to.

6.2 Concluding Remarks

In this thesis, I studied how merger incentives depend on product substitutability in asymmetric oligopoly. It is more likely that merger paradox exists for transactions involving the firm offering the most differentiated product in the Cournot model. For the Cournot model, for most portfolios of substitute parameters, merging firm is expected to merge with close competitor. Nevertheless, whenever it is profitable to merge with a distant competitor, the merging firm's optimal strategy is to merge with distant competitor. For the Bertrand competition model, it is more profitable to acquire a close competitor.

This thesis expands the analysis from the strand of literature focusing on homogenous or symmetric differentiate model to asymmetric differentiate model for both Cournot and Bertrand Models. The analysis and interesting results prove the expansion to be a worthwhile job. Besides, some insights are provided for the governments and the guideline makers when they judge a merger and make

corresponding policies.

6.3 Future Extensions

In previous analysis, I build an industry with three firms and develop my train of analytical thought. Although, the following consideration, perhaps, is not perfect because of some limitations, it gives some possible directions and ideas for later research. The analysis enables us to see more exciting characteristics of horizontal mergers and how the merger moves.

When expanding the symmetric to Asymmetric market assumption, I assume the cost to be zero, which is one of the limitations of this thesis. Under the assumption of my thesis, there is not cost efficiency improvement after a merger. In other words, a firm still has incentives to propose a merger even if a merger could not bring cost saving. In future researches, to consider mergers in asymmetric market under the assumption of cost saving tend to be a good point to continue with. On the other hand, in my model, I consider only three firms and it is a worthwhile job to continue to expand the tri-industry to N-industry and see what may hold.

Appendix

Proofs of Lemma 1:

Since,

$$\frac{\Pi_1^{(1,2)}+\Pi_2^{(1,2)}}{\Pi_{d1}^{(1,2)}}=\frac{\alpha^2(\gamma-2)^2(\beta+1)}{2(\gamma^2-2\beta-2)^2}\frac{(2+\gamma)^2}{\alpha^2}=\frac{(\beta+1)(\gamma^2-4)^2}{2(\gamma^2-2\beta-2)^2}$$

$$>\frac{(\beta+1)}{2}(\frac{4-\gamma^2}{2+2\beta-\gamma^2})^2>\frac{(\beta+1)}{2}(\frac{4-\gamma^2}{2+2\beta-\gamma^2})=\frac{4+4\beta-\gamma^2-\beta\gamma^2}{4+4\beta-2\gamma^2}>1$$

Thus,

$$\frac{\Pi_1^{(1,2)}+\Pi_2^{(1,2)}}{\Pi_{d1}^{(1,2)}}>1$$

From the proof of proposition 2 below, it is known, when A1 and A2 hold:

$$\Pi_1^{(1,3)}+\Pi_3^{(1,3)}>\Pi_1^{(1,2)}+\Pi_2^{(1,2)}$$

Then,

$$\Pi_1^{(1,3)}+\Pi_3^{(1,3)}>\Pi_{d1}^{(1,2)}=\Pi_{d1}^{(1,3)}$$

Thus, when a merger with distant competitor or close competitor occurs, the merging party would not drop its product line in Counot.

Proofs of Proposition 1:

i.

When merger between firm 1 and firm 2 is profitable, then it is required that:

$$\Pi_1^{(1,2)}+\Pi_2^{(1,2)}>\Pi_1^*+\Pi_2^*$$

Namely,

$$\frac{(\alpha-c)^2(\gamma-2)^2(\beta+1)}{2(\gamma^2-2\beta-2)^2}>\frac{(\alpha-c)^2(\gamma-2)^2}{2(\gamma^2-\beta-2)^2}$$

Combining the condition,

$$0<\gamma<\beta<1$$

Solving this inequality,

$$0<\gamma<\min\{\tilde{\gamma}(\beta),\beta\}<1$$

Where $\gamma=\tilde{\gamma}(\beta)$ is uniquely obtained from $\Pi_1^{(1,2)}+\Pi_2^{(1,2)}=\Pi_1^*+\Pi_2^*$ when $0<\gamma<\beta<1$

Thus, when $0 < \gamma < \min\{\tilde{\gamma}(\beta), \beta\} < 1$ is satisfied, the merger between firm 1 and firm 2 is profitable.

ii.

Solving the point when

$$\Pi_1^{(1,3)} + \Pi_3^{(1,3)} = \Pi_1^{(1,2)} + \Pi_2^{(1,2)} = \Pi_1^* + \Pi_3^*, 0 < \gamma < \beta < 1$$

$$(\gamma, \beta) = (\phi, \phi) = (0.5550, 0.5550)$$

Solving the curve $\gamma = \hat{\gamma}(\beta)$ when

$$\Pi_1^{(1,3)} + \Pi_3^{(1,3)} = \Pi_1^* + \Pi_3^*$$

As,

$$\frac{\partial((\Pi_1^{(1,3)} + \Pi_3^{(1,3)}) - (\Pi_1^* + \Pi_3^*))}{\partial \beta} = \frac{\partial(\Pi_1^{(1,3)} + \Pi_3^{(1,3)})}{\partial \beta} - \frac{\partial(\Pi_1^* + \Pi_3^*)}{\partial \beta} < 0, 0 < \beta < 0.5550$$

Thus, when $0 < \beta < arc\hat{\gamma}(\beta) < 0.5550$,

$$\Pi_1^{(1,3)} + \Pi_3^{(1,3)} > \Pi_1^* + \Pi_3^*$$

Combining the condition,

$$0 < \gamma < \beta < 1$$

Thus when

$$\hat{\gamma}(\beta) < \gamma < \beta < arc\hat{\gamma}(\beta) < \phi = 0.5550$$

$$\Pi_1^{(1,3)} + \Pi_3^{(1,3)} > \Pi_1^* + \Pi_3^*$$

Merger between firm 1 and firm 3 is profitable.

Proofs of Proposition 2:

i

From proposition 1 i, since when $0.5550 < \tilde{\gamma}(\beta) < \gamma < \beta < 1$ which violates the required conditions in proposition 1 i and proposition 1 ii.

Thus, both mergers with firm 2 and with firm 3 could not be profitable and firm 1 is not lured to merge.

ii

Since $arc\hat{\gamma}(\beta) \in (0, \beta)$, and thus $\min\{\tilde{\gamma}(\beta), arc\hat{\gamma}(\beta)\} \in \min\{\tilde{\gamma}(\beta), \beta\}$

Thus the condition $0 < \gamma < \min\{\tilde{\gamma}(\beta), arc\hat{\gamma}(\beta)\} < 1$ satisfies the condition in proposition 1 i $0 < \gamma < \min\{\tilde{\gamma}(\beta), \beta\}$

The profitability of merger with firm 2 is proved.

Since the condition in corollary ii is $0 < \gamma < \min\{\tilde{\gamma}(\beta), \hat{\gamma}(\beta)\} < 1$ implies that β could be any value from zero to one, which definitely violates the requirement $0 < \beta < 0.5550$

Thus the merger with firm 3 is non-profitable.

Therefore, the firm would choose to merge with firm 2.

iii

From the proposition i and ii in proposition 1, when both $0 < \gamma < \min\{\tilde{\gamma}(\beta), \beta\}$ and $\hat{\gamma}(\beta) < \gamma < \beta < arc\hat{\gamma}(\beta) < \phi = 0.5550$ are both satisfied, the profitability with firm 2 and with firm 3 could be proved.

Combine the two conditions, it is obtained

When $\hat{\gamma}(\beta) < \gamma < \beta < arc\hat{\gamma}(\beta) < \phi = 0.5550$, both the mergers between firm 1 and firm 2 or firm 3 are profitable:

$$\Pi_1^{(1,3)} + \Pi_3^{(1,3)} > \Pi_1^* + \Pi_3^*$$

And since,

$$\Pi_1^* + \Pi_3^* = \frac{\alpha^2[(2-\gamma)^2 + (2+\beta-2\gamma)^2]}{4(2+\beta-\gamma^2)^2} = \frac{\alpha^2[2(2-\gamma)^2 + 2(\beta-\gamma)(2-\gamma)]}{4(2+\beta-\gamma^2)^2}$$

$$> \frac{\alpha^2[2(2-\gamma)^2 + 2(\beta-\gamma)(2-\gamma)]}{4(2+2\beta-\gamma^2)^2}$$

$$> \frac{\alpha^2[(2-\gamma)^2(\beta+1)]}{4(2+2\beta-\gamma^2)^2}$$

$$= \Pi_1^{(1,2)} + \Pi_2^{(1,2)}$$

Thus,

$$\Pi_1^{(1,3)} + \Pi_3^{(1,3)} > \Pi_1^{(1,2)} + \Pi_2^{(1,2)}$$

To merge with firm 3 is more profitable.

Proofs for Proposition 3:

Consumer surplus is:

$$CS = U(q_1, q_2, q_3) - p_1 q_1 - p_2 q_2 - p_3 q_3 = \frac{1}{2}(q_1^2 + q_2^2 + q_3^2 + 2\beta q_1 q_2 + 2\gamma q_1 q_3 + 2\gamma q_2 q_3)$$

From proposition 1, when $0 < \gamma < \min\{\tilde{\gamma}(\beta), \beta\} < 1$, to merge with firm 2 is profitable

$$\Delta CS^{(1,2)} = CS^{(1,2)} - CS^* = \frac{\alpha^2 \beta(2-\gamma)Y(\gamma,\beta)}{8(2+2\beta-\gamma^2)^2(2+\beta-\gamma^2)^2}$$

Where, $Y(\gamma,\beta) = 4\gamma^5 - 12\gamma^4 - 7\gamma^3\beta - 8\gamma^3 + 26\gamma^2\beta + 32\gamma^2 + 2\gamma\beta + 2\gamma\beta^2 - 12\beta - 16 - 28\beta < 0$

The reason behind this is simple: even if the outsider could increase its output, it will not increase too much since the insiders is unable to increase prices by decreasing quantity and a merger would not occur if outsider increase its output too much. In Cournot model, a merger is aimed at output coordination even the outsider obeys this rule, which definitely harms consumers.

Similar proof and intuitive explanation apply to the merger with firm 3.

Thus $CS^{(1,3)} - CS^* < 0$

It is conclude that any profitable merger is harmful to consumer surplus.

Similar process apply to social welfare, I obtain $W^{(1,2)} < W^*$ and $W^{(1,3)} < W^*$.

Proofs of Proposition 4:

The implicit condition is required for the Bertrand Model, I have:

$$0 < \varsigma < \tau, 1 - \tau - \varsigma > 0$$

Rewrite this condition as:

$$0 < \varsigma < \min\{\tau, 1-\tau\} < 1$$

Then,

$$\frac{\Pi_1^{B(1,2)}+\Pi_2^{B(1,2)}}{\Pi_1^{B^*}+\Pi_2^{B^*}}=\frac{(1-\tau)(-\varsigma^2-\tau+2)^2}{(-\varsigma^2-2\tau+2)^2}=(1-\tau)(1+\frac{\tau}{2-\varsigma^2-2\tau})^2>1$$

$$\frac{\partial(\Pi_1^{B(1,2)}+\Pi_2^{B(1,2)})/(\Pi_1^{B^*}+\Pi_2^{B^*})}{\partial\varsigma}>0$$

Thus,

$$\frac{\Pi_1^{B(1,2)}+\Pi_2^{B(1,2)}}{\Pi_1^{B^*}+\Pi_2^{B^*}}=(1-\tau)(1+\frac{\tau}{2-\varsigma^2-2\tau})^2>(1-\tau)(1+\frac{\tau}{2-2\tau})^2=\frac{4-4\tau+\tau^2}{4-4\tau}>1$$

Merger between firm 1 and firm 2 without dropping is profitable.

And since when the distant competitor is more close to merging firm, the merged entity could charge higher price and the increase the possibility of larger profits:

$$\frac{\partial((\Pi_1^{B(1,3)}+\Pi_3^{B(1,3)})-(\Pi_1^{B^*}+\Pi_3^{B^*}))}{\partial\varsigma}>0$$

Thus,

$$(\Pi_1^{B(1,3)}+\Pi_3^{B(1,3)})-(\Pi_1^{B^*}+\Pi_3^{B^*})$$

$$>a_0^2(1-\tau)^2(\frac{2(2+\tau)(4+2\tau)+(2+\tau)(2-\tau)(4-\tau^2)}{4(4-\tau^2)^2}-\frac{4+(2-\tau)^2}{4(2-\tau)^2})$$

$$=a_0^2(1-\tau)^2(\frac{1}{(2-\tau)^2}+\frac{1}{4}-\frac{1}{(2-\tau)^2}-\frac{1}{4})=0$$

Merger between firm 1 and firm 3 without dropping is profitable.

For small numeric substitute parameters, for example, they are equal to 0.2 and 0.1 respectively, it can be shown that:

$$\Pi_1^{B(1,2)}+\Pi_2^{B(1,2)}>\Pi_{d1}^{(1,2)},\Pi_1^{B(1,3)}+\Pi_2^{B(1,3)}>\Pi_{d1}^{(1,3)}$$

While for some larger numeric substitute parameters, for example, they are equal to 0.8 and 0.2 respectively, it can be shown that:

$$\Pi_1^{B(1,2)}+\Pi_2^{B(1,2)}<\Pi_{d1}^{(1,2)},\Pi_1^{B(1,3)}+\Pi_2^{B(1,3)}<\Pi_{d1}^{(1,3)}$$

Therefore, not all mergers with dropping are profitable.

Proofs of Proposition 5:

It is shown that:

$$\frac{\partial((\Pi_1^{B(1,3)}+\Pi_3^{B(1,3)})-(\Pi_1^{B(1,2)}+\Pi_2^{B(1,2)}))}{\partial\varsigma}>0$$

Define the following equation:

$$f(\tau,\varsigma)=(\prod_1^{B(1,3)}+\prod_3^{B(1,3)})-(\prod_1^{B(1,2)}+\prod_2^{B(1,2)})$$

Thus,

$$f(\tau,\varsigma)<f(\tau,\tau)$$

$$=\frac{a_0{}^2 2(\tau+2)(\tau+1)^2(1-\tau)(\tau+2)(1-2\tau)^2}{4(\tau+1)^2(2-2\tau-\tau^2)^2}-\frac{a_0{}^2(\tau+2)^2(1-\tau)(1-2\tau)^2}{2(-\tau^2-2\tau+2)^2}=0$$

Thus,

$$(\prod_1^{B(1,3)}+\prod_3^{B(1,3)})-(\prod_1^{B(1,2)}+\prod_2^{B(1,2)})<0$$

Merger with close competitor is always more profitable than the merger with distant competitor.

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