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## Strategic Price Competition and Price Disperion in the Airline Industry;a Conceptual Framework and Empirical Analysis

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STRATEGIC PRICE COMPETITION AND PRICE DISPERSION IN THE  
AIRLINE INDUSTRY: A CONCEPTUAL FRAMEWORK  
AND EMPIRICAL ANALYSIS

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## **DEDICATION**

To my wife, Patricia, and daughters, Patty, Cori, and Gail, who have provided continual encouragement and support. This dissertation, which is the culmination of my doctorate, would not have been achieved without Patricia's willingness to sacrifice along with Cori and her husband, Bob, providing me the opportunity to pursue this monumental task. I am eternally grateful to all.

## **ACKNOWLEDGEMENT**

I wish to thank all those who helped me complete this dissertation. Special appreciation to Dr. Ashutosh Dixit who provided me guidance, support and encouragement throughout the process. He spent countless hours reviewing my work, making outstanding suggestions in a positive, constructive manner. I would also like to thank my other committee members, Dr. Thomas Whipple who provided extremely useful written comments at critical stages, Dr. Raj Javalgi, who provided insightful conceptual comments, and Dr. Yuping Wu, who provided critical reviews of my analytical methodology. I would also like to express my appreciation to all of the Cleveland State University, Nance School of Business faculty and staff that provided knowledge, ideas, suggestions, and support to me in this endeavor. I would also like to express my appreciation to Dean Richard Harvey, Fairmont State University, who facilitated and encouraged my timely completion of this dissertation.

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**ABSTRACT**

It is a generally accepted belief in marketing literature that variation in prices, i.e. price dispersion, is a critical, strategic factor that influences product demand, profitability, and social welfare. While there is a substantial amount of research on price dispersion, prior research has mainly studied price dispersion in the context of consumer heterogeneity, and not comprehensively studied the effects of competition on price dispersion. According to the structure-conduct-performance (SCP) paradigm, market structure and firm conduct are important indicators of firm performance and long-term sustainable competitive advantage.

A greater understanding of the influences of market structure and competition on price dispersion provides valuable insights and extends the stream of research on price dispersion. Therefore, the main objective of this dissertation is to increase the understanding of the effects of strategic price competition on price dispersion. Specifically, this research encompasses an evaluation of the effects of strategic price competition in a multi-market context on price dispersion by focusing on market and competition characteristics. The

effects of strategic price competition on price dispersion of airline ticket prices are empirically evaluated based on an extensive database from the U.S.

Department of Transportation. The results of this study show that multi-market contact between rival firms and the interaction of multi-market contact and market concentration have a significant effect on price dispersion. These results have important academic and managerial implications.

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## **CHAPTER I**

### **INTRODUCTION**

Variation in prices, i.e. price dispersion, is a critical, strategic factor that influences product demand and social welfare. Price dispersion is typically defined as the variation in prices of homogeneous products sold by competing firms (Stigler 1961; Borenstein and Rose 1994; Sorensen 2000; Zhao 2006).

Price dispersion is also explained as the distribution of prices of an item with the same measured characteristics across sellers in a specific time period (Pan, Ratchford, and Shankar 2004).

Price dispersion was first described in Stigler's (1961) seminal article on the economics of information. Since then, price dispersions of a wide range of products have been studied by economic researchers and in the last decade by marketing researchers. Some of the products studied include music CDs, books (including textbooks), consumer electronics, cameras, computers (both desktop and laptop), software, keyboards, scanners, PDAs, refrigerators, grocery items, flowers, gasoline, coffee, prescription drugs, automobiles, mortgage interest rates, and airline tickets (Pan, Ratchford, and Shankar 2004; Baye, Morgan, and

Scholten 2006). Some of the price dispersion studies by economists evaluated the effects on society (e.g., social welfare), as well.

From an economic perspective, price levels are a particularly useful measure of market efficiency. Within the classic economic model of social welfare, setting a single price above the theoretical equilibrium price causes some consumers to forego socially efficient exchanges. As a result, firms lose the opportunity to receive the sales revenue from those exchanges. Therefore, variation in prices leads to an increase in social welfare as more welfare-enhancing exchanges are allowed to occur (Rob 1985; Borenstein and Rose 1994; Brynjolfsson and Smith 2000). When considering the economic perspective, one also needs to consider the structure of the industry and characteristics of the firms competing within the markets.

The purpose of this study is to expand the understanding of how competition influences price dispersion. Prior research has not comprehensively studied the effects of competition on price dispersion. The effects on price dispersion of some important aspects of competition, such as the number of competitors in a market and market concentration have been studied (e.g., Borenstein and Rose 1994). However, the degree to which competitors compete in different markets, referred to as multi-market contact, and strategic similarity between different types of competing firms affect price dispersion have not been studied. This current research expands the growing field of research by including these new, important variables and providing a conceptual framework.

Most modern markets are not purely competitive markets, where competition is fierce due to many firms selling similar products and many buyers with ‘perfect’ product information. It is much more common to find markets where oligopolistic competition occurs due to there being a few, large firms and buyers with less than perfect product information, especially price. Although the product can be homogenous in either type of market conditions, the limited number of firms in the oligopoly provides the firms selling the products far more influence over determining market prices.

Oligopoly theory is concerned with the relationships between the few, large firms in an oligopoly market (Ulph 1987). The firms recognize their interdependency and may act in a coordinated manner affecting prices and competitive strategy. According to oligopoly theory, collusion, either tacit or purposive, among the firms may occur because firms recognize their mutual dependence (Baum and Korn 1996).

Oligopolistic competition is common in service industries with a small number of large firms with high fixed costs, such as airlines, hotels, entertainment companies, and energy firms. Mookherjee and Rigdon (2005) describe this oligopolistic setting in which the firms each have an objective to maximize revenue. They suggest that customers typically see the service provided to be homogenous. Oligopolistic competition among service providers with fixed capacity lends itself to revenue management, where the price is adjusted (resulting in price dispersion) to maximize demand and revenue. Research findings on factors that influence price dispersion and that are

divergent from perfect competition have lead to further research focused on market conditions, such as competition.

Price dispersion in the airline industry has been selected for this study because airline tickets are homogenous and fully describable (e.g., city-pair routes and the number of passengers). The market for airline tickets is interesting to evaluate in relation to competition because of the aggressive, competitive behavior demonstrated by the airlines (e.g., price wars) and the variability of competitive contact within and across local markets.

The results of this study may be generalizable to other service industries with similar characteristics. The results can provide major benefits to future research but it is important to stress that when applying the results of this study, future researchers need to be careful that the characteristics of the industry or market being studied has similar characteristics to the airline industry. Key characteristics that affect the results are; the level of multi-market contact, the presence of multiple identifiable differences in strategies, and of course, the perishable nature of the service product.

Extensive research has shown that markets for many homogeneous products are characterized by considerable price dispersion (e.g., Stigler 1961; Salop and Stiglitz 1982; Pan, Ratchford, and Shankar 2004; Baye, Morgan, and Scholten 2006). There is an emerging stream of research that suggests that specific types of market imperfections influence price dispersion, such as customer learning (Johnson et al, 2000) brand loyalty (Chen and Hitt 2001), and systematic variations in the nature of products offered over the Internet versus traditional



channels (Lee 1998). Understanding the presence or absence of exploitable imperfections in markets and their implications for pricing strategy is critical for the long-term viability not only for retailers, but also firms that must compete in environments with increasingly informed customers (Clemons, Hann, and Hitt 2002). This current study examines the airline ticket market, which has increasingly informed customers, for the purpose of seeking greater understanding of competitive forces on price dispersion.

This study contributes to this stream of research by: 1. providing a conceptual framework on the variables affecting price dispersion in a complex, service product (i.e., airline ticket) market, 2. examining the influence of two important, new variables; multi-market contact and strategic similarity, 3. presenting an empirical-based evaluation of price dispersion and influencing factors, and 4. contributing insight to managers working in these types of service industries. The effects of multi-market contact and strategic similarity on price dispersion have not been studied. This current research expands the growing field of research by including these new, important variables and providing a conceptual framework. This study investigates how these competition-related variables along with market concentration affects price dispersion of airline ticket prices.

In the rest of this chapter, price dispersion is discussed in greater detail, covering the relevance of price dispersion to marketing, sources of price dispersion, strategic price competition and the purpose of this study.

## **Relevance of Price Dispersion to Marketing**

Price dispersion is influential from the viewpoint of consumers, sellers, and the market in general (Pan, Ratchford, and Shankar 2004). For consumers, price dispersion characterizes the alternative product offerings in the market and affects search activities and purchase behavior. As a result, price dispersion influences demand for products. For sellers, it reflects the pricing strategy of competitors and their coordinated actions. For the market as a whole, it is a central measure of information efficiency. Price dispersion influences the actions taken by sellers and consumers within a market and affects market efficiency.

Price dispersion is important in marketing because it has been demonstrated to affect many of the factors that influence consumer demand. As an example, Burman and Biswas (2004) demonstrated the potential of price dispersion in strengthening the impact of implausible reference prices on consumer evaluations. Burman and Biswas (p. 387) state that "...marketers must be wary of the fact that if consumers perceive the reference price as very high, which is more likely to happen for a product with narrow price dispersion in the market, chances of reference pricing not being effective also will be high".

### ***Price Dispersion in Traditional and Internet Markets***

Brynjolfsson and Smith (2000) compared price dispersion between Internet and traditional retailers for two categories of homogeneous products; books and CDs. Their study produced several key findings with regard to price dispersion. First, prices on the Internet were 9-16% lower than prices in traditional outlets, depending on whether taxes, shipping and shopping costs are included in the

price. Second, they found that Internet retailers' price adjustments were up to 100 times smaller than traditional retailers' price adjustments; reflecting lower menu costs in Internet channels. Third, levels of price dispersion depend on the measures employed. The prices posted by different Internet retailers exhibited substantial dispersion. Internet retailer prices differ by an average of 33% for books and 25% for CDs. However, when weighting these prices by proxies for market share, Brynjolfsson and Smith found that dispersion is lower in Internet channels than in traditional channels, reflecting dominance of certain heavily branded retailers.

Biswas, Dutta, and Pullig (2006) studied the moderating role of perceived price dispersion on low price guarantees. Price dispersion was evaluated as a signal for lowest price in a retail environment using mock ads for a branded DVD player. The results show that price guarantee effects are attenuated when consumers perceive price dispersion to be high for a given product. The results also indicate that a low price guarantee with progressively higher levels of penalty leads to incrementally more favorable effects on key consumer outcomes when perceived price dispersion is high. The effect of increasing the penalty level had no such incremental benefit on consumer outcomes in the situation of low perceived price dispersion.

### ***Price Dispersion in Airline Markets***

The airline industry is a traditional market, but it is being influenced by the Internet due to online ticket price comparison services and ticket selling. Price dispersion in service industries (e.g., airlines) is pervasive and the effect of strategic price competition on price dispersion is not well understood. Variation

of prices even occurs in markets that seem particularly conducive to economic competition, such as the airline ticket market (Sorensen 2000). Many people have experienced price variations in airline tickets for the same route, even the same airline and same ticket characteristics (e.g., seating class, departure and arrival times). The wide range of airline ticket pricing for the same route is a prime example of price dispersion.

Price dispersion of airline ticket prices has been studied from different perspectives by Borenstein and Rose (1994), Dana (1999), and Clemens, Hann, and Hitt (2002). Borenstein and Rose (1994) studied airline ticket prices of eleven major U.S. airlines. The strongest and most striking finding was the significant effect of competition on price dispersion. Price dispersion increased on routes with more competition. Dana (1999) extended Prescott's (1975) model to monopoly and imperfect competition. Dana shows that the model predicts equilibrium with intra-firm price dispersion in which each firm offers its output at multiple prices (as opposed to random prices). As competition increases, the average price level falls and the degree of price dispersion increases. Clemens, Hann, and Hitt examined the presence of price dispersion in the airline ticket offerings of online travel agents (OTAs). They found that different OTAs offer tickets with substantially different prices and characteristics when the OTAs were given the same customer request. After accounting for the differences in ticket characteristics, there was considerable price dispersion.

Some of this variation appeared to be due to product differentiation, i.e., different OTAs specialize by systematically offering different trade-offs between ticket price and ticket quality (minimizing the number of connections, matching requested departure, and return time). However, even after accounting for differences in ticket quality, ticket prices varied (i.e., price dispersion) by 18% across OTAs.

### **Sources of Price Dispersion**

Researchers have investigated and identified a number of potential sources of price dispersion. Three major sources of price dispersion are: (1) consumer heterogeneity (e.g., education, income), (2) consumer search costs, and (3) competition (including market structure factors, such as market concentration and market share) (Borenstein and Rose 1994; Pan, Ratchford, and Shankar 2003; Zhao 2006). Appendix 1 describes some of the research related to each of these three sources of price dispersion.

Zhao's (2006) study evaluated these three important sources of price dispersion and demonstrated that price dispersion of grocery products is positively correlated with greater consumer heterogeneity, higher consumer search costs, and more intense competition. Zhao's exploratory research studied the various degrees of price dispersion in supermarkets and checked for consistency with the existing theories of price dispersion due to consumer search costs, consumer heterogeneity, and competition. Zhao found price dispersion to

be positively correlated with consumer search costs, consumer heterogeneity, and competition, which is consistent with generally accepted theory.

As appendix 1 shows, researchers have examined the influence of consumer heterogeneity on price dispersion from various aspects. Some of the aspects of consumer heterogeneity that have been evaluated are: differences in consumers' perceptions of price dispersion, demographics, value perceptions, shopping intention, time sensitivity, price sensitivity, willingness to pay for attributes, and types of consumers (e.g., business or personal, informed or uninformed). There is overlap between consumer heterogeneity and consumer search costs. One aspect of consumer heterogeneity is the differences in the cost of search for consumers. However, there are numerous other aspects of consumer heterogeneity as mentioned above. While all three major sources have been studied, research on competition's influence on price dispersion has been limited. Next, these three sources of price dispersion are discussed.

### ***Consumer Heterogeneity***

Consumer heterogeneity, the diverseness of consumer preferences, affects price dispersion in several ways. Firms are able to exercise price discrimination based on differences among consumers' price elasticities, preferences, or willingness to pay for quality or product offering variations. A seller's motivation for price discrimination is likely to increase with the variation of attributes in the population that reflect buyers' price elasticities or preferences (Shepard 1991).

Shepard (1991), Burman and Biswas (2004), and Biswas, Dutta, and Pullig (2006) represent a few of the important studies on the relationship between consumer heterogeneity and price dispersion. Shepard (1991) evaluated retail

gasoline prices. She developed a test that discriminates between price structures associated with price discrimination and with cost-driven, competitive differentials. A second test applied by Sheppard was based on profitability variations and rejected a competitive, peak-load pricing explanation for the observed price dispersion. Shepard showed that price dispersion can occur in multi-firm markets due to price discrimination when consumer heterogeneity exists related to differences in consumers' willingness to pay.

Burman and Biswas (2004) examined the moderating role price dispersion for a product category in influencing consumer evaluation of reference prices. Reference prices are the price that buyers use to evaluate an offered price (Monroe 2003). A reference price may be in the consumers' memory or the price of an alternative product. Consumer heterogeneity was evaluated on the basis of differences in consumers' value perceptions and shopping intentions. Burman and Biswas's study demonstrated the potential of price dispersion in strengthening the impact of implausible reference prices on consumer evaluations. Findings show that when price dispersion is narrow, the consumer's reference price is more likely to be high, thereby reducing the effectiveness of reference pricing.

Biswas, Dutta, and Pullig (2006) studied the moderating effect of price dispersion on consumers' pre-purchase evaluations of low price guarantees and purchase behavioral intentions. Consumer heterogeneity was evaluated on the basis of differences in perceived price dispersion. Their study showed that when

price dispersion is perceived by consumers to be high, low price guarantee effects are attenuated.

The following topic, consumer search costs, is related to consumer heterogeneity, in some circumstances. A few of the effects of consumer search costs are related to consumer characteristics. For instance, some consumers are more able (e.g., level of literacy) to search for product information or have a greater interest in collecting product information (e.g., people who enjoy shopping in the interest of finding bargains).

### ***Consumer Search Costs***

As stated by Rob (1985), when a consumer's perceived search costs (time, lost opportunities, etc.) exceed the anticipated price reduction, the consumer will stop searching for lower prices. The effect of consumer search costs on price dispersion has been evaluated by a numerous researchers (e.g., Stigler 1961; Salop and Stiglitz 1977, 1982; Varian 1980; Rob 1985; Zhao 2006). Literature indicates that price dispersion can persist in markets where there is imperfect information and consumers incur search costs to obtain price information. As consumers incur search costs to get information, some consumers engage in price searching and others make purchases randomly. Therefore, sellers are able to charge different prices, and price dispersion develops in the market.

Stigler (1961) coined the term 'consumer search' and initiated a study of the subject. He advocated that advertising is a key factor in reducing consumer search costs. Stigler argued that reducing search costs should reduce price dispersion and therefore, the advertising of prices should reduce price dispersion. Salop and Stiglitz (1977) analyzed the industry equilibrium for an



economy in which imperfectly informed consumers can only become perfectly informed at a cost. Their theoretical evaluation was based on a durable commodity and led to a monopolistically competitive equilibrium and price dispersion. Salop and Stiglitz (1982) showed that price dispersion could also result from consumers with heterogeneous search costs, if there are a large number of consumers with zero search costs.

The heterogeneous search costs of consumers can also cause price dispersion over time for a specific product (Varian 1980). Varian provides a theoretical explanation of motivation for stores to randomize prices in an attempt to price discriminate between informed and uninformed consumers, who have different levels of search costs and opportunity costs. Rob (1985) evaluated search costs for a model with a variety of stores and consumers. Rob's theoretical analysis demonstrates how price dispersion can persist in a stable market with imperfect information.

Zhao (2006) studied sources of price dispersion in the grocery market. He focused on three conditions: across stores, across UPCs (universal product code) within a product category, and overtime for a certain brand. Zhao's study found support for the positive correlation between search costs and price dispersion for all three conditions. A number of research studies, including Zhao's (2006) study, have also evaluated competition as major influence on price dispersion and are now discussed.

### ***Competition***

Research has shown that competition among firms affects price dispersion. Theory predicts that price dispersion among sellers should decrease with

increased competition, if industry elasticities are the more prevalent basis for segregation (monopoly-type discrimination), and it should increase with increased competition, if heterogeneity in cross elasticity is the more common source of discrimination (competitive-type discrimination) (Borenstein 1985; Holmes 1989).

There is some empirical evidence suggesting that price dispersion is an outcome of competition, for example, in the U.S. airline industry (Borenstein and Rose 1994) and in the Irish grocery market (Walsh and Whelan 1999). Borenstein and Rose found that competition has a strong, positive effect on price dispersion. With regard to market characteristics, price dispersion is affected by the characteristics of competition within specific markets as well as across markets.

Walsh and Whelan utilized the methodology developed by Borenstein and Rose and confirmed that 'competitive type' pricing among brands of grocery items affects price dispersion. Their results suggest that brand pricing tactics across consumer segments induce varying degrees of localized imperfect price competition. This finding provides evidence that limited consumer brand switching abilities become relatively more elastic in some consumer segments compared to other consumer segments in response to competitive forces.

As competition across firms increases, firms may choose to be more vertically differentiated (i.e., based on perceived quality differences) from each other to relax the price competition (Iyer 1998). If firms were positioned too close to each other, then consumers would choose among them on the basis of

price, which would create the incentive to compete on price, and the net result would be lower profits for all the firms (Moorthy 1988). Firms may choose to be differentiated on dimensions, such as services and product assortment to soften price competition. Price dispersion for the same product across firms may increase as firm competition increases and as firms are more vertically differentiated from one another because of the competition.

Understanding the causes of price dispersion among a wide range of products is a challenge to marketing and economic researchers. The purpose of this study is to provide greater understanding of the causes of price dispersion that are related to competition and strategy. How does competition among rival firms within and across markets affect the degree of price dispersion in markets? How do the firms' strategies affect price dispersion in markets? How significant are the effects of competition-based and strategy-based variables on price dispersion? Recent research has identified competition and strategy as factors that influence price dispersion without much investigation of the underlying causes. The intention of this study is to provide information to fill this gap in price dispersion research. In the following section, strategic price competition and a few of the key variables that affect strategic price competition are discussed.

This study focuses on the causes of price dispersion that emanate from the third source, competition, but from a more comprehensive perspective. In a competitive environment, variables that have been found to affect price dispersion include market concentration, market share, market density, and the

number of competitors in the market. A major gap in the research related to competition's effect on price dispersion is the influence that contact in other markets and differences in rivals' strategies have on pricing.

### **Strategic Price Competition**

Strategic price competition in multiple markets has been shown to affect price dispersion. Strategic price competition ensues when the competing firms employ different pricing tactics based on their overall competitive strategies. For example, research has shown that entry of a limited-service, low-fare competitor may affect the price levels and relative profits of full-service, high-fare incumbents (Chintagunta and Desiraju 2005). Research on multi-market competition indicates that the complexity of pricing strategy increases as firms compete in several markets. Price dispersion may reflect the level of competition within an airport (Ancarani and Shankar 2004).

Even though there is a growing body of research on multi-market competition, there is no integrated framework to help explain its influence on price dispersion. This study develops an integrated, conceptual framework based on an evaluation of the effects of strategic price competition on price dispersion in a multi-market context. The effects of strategic price competition on price dispersion of airline ticket prices are empirically evaluated based on an extensive database of the Department of Transportation (DOT) from the first quarter of 1999.

Developing a multi-market strategy in the presence of strategic price competition emphasizes the importance of considering inter-firm relations within and across-markets and strategic price competition's influence on price dispersion. Recent marketing research has emphasized the importance of price dispersion as a key strategic variable that is applied by firms to influence demand for their products. Increasing the understanding of the effects of key variables of service industries (e.g., the airline industry) is very important and useful to marketing researchers and marketing practitioners in order that they may be better able to positively influence the financial performance of these firms.

Strategic price competition has a major impact on the economic performance of the airline industry (Rubin and Joy 2005). Chintagunta and Desiraju (2005) studied strategic price competition and focused on three determinants of price levels effect across geographic markets; within market response to each variable, the nature of inter-firm relations, both within the market and across markets. The authors argue that when determining its marketing mix, a firm needs to consider the following three issues: (1) the role of within-market strategic coordination among the firms in any given geographic market, (2) the role of across-market strategic exchanges when the same firms compete with each other in several distinct markets, and (3) heterogeneity of aggregate market response across markets. This study evaluates similar effects on the domestic airline industry and the markets served.

There are two additional key constructs that have not been applied to price dispersion that may provide important insight into the strategic influences of strategic pricing; multi-market contact and strategic similarity. Multi-market contact is the contact a firm has with rival firms (in a focal market) in other markets (Karnani and Wernerfelt 1985; Baum and Korn 1996). Multi-market contact indicates the level of competition among firms within specific markets. Strategic similarity is the degree of similarity of the overall strategic plans (i.e., independent of the specific market served by the firm) of competing firms (Gimeno and Woo 1996; Fuentelsaz and Gomez 2006).

### ***Multi-Market Contact***

Multi-market contact measures the potential for contacts among competing firms in multiple markets (Karnani and Wernerfelt 1985; Baum and Korn 1996). These contacts affect the level of competition among firms within specific markets. Multi-market contact (sometimes referred to as multipoint competition, Fuentelsaz and Gomez 2006) influences the potential for mutual forbearance at the firm-market level (i.e., one market in a firm's market domain). Mutual forbearance is the tempering of aggressiveness that occurs as the degree of multi-market contact among firms in a given market increases (Edwards 1955). This tempering of aggressiveness occurs due to the possibility of multi-market retaliation.

Theories of inter-firm competition agree that, in general, the greater the overlap between a firm's market domain and the market domains of other firms, the greater the intensity of competition the focal firm experiences (Hannan and Freeman 1977, 1989; Porter 1980; Scherer and Ross 1990; Tirole 1988).

However, firms with high market domain overlap frequently encounter each other simultaneously in multiple markets. As an example, airlines frequently compete for customers on multiple routes. Mutual forbearance theory implies that rivalry will be less among multi-market competitors. As a result, firms that are close competitors may not be intense rivals (Baum and Korn 1996).

### ***Strategic Similarity***

Strategic similarity is the degree of similarity of the strategies of competing firms independent of the specific market served by the firm (Gimeno and Woo 1996; Fuentelsaz and Gomez 2006). In the case of this study, two considerably different strategies are considered; full-service, high-fare (e.g., American Airlines) and limited-service, low-fare (e.g., Southwest Airlines). Caves and Porter (1977) argue that the structural similarity among firms (e.g., R&D, advertising, cost structures) may lead these firms to closely recognize their interdependences and anticipate the moves of rivals accurately, making tacit collusion easier. Recent research has offered further evidence in favor of collusive behavior (Young, Smith, Grimm, and Simon 2000; Peteraf 1993a). However, the hypothesis that more similar firms experience less rivalry has been challenged.

Cool and Dierickx (1993) argue that it is not clear why rivalry among strategically similar firms should be less intense than competition coming from other firms. Although strategically similar firms tend to recognize more closely their interdependencies, the existence of these groups of firms could also help to identify the set of rivals more capable of negatively affecting performance should tacit cooperation break (Fuentelsaz and Gomez 2006). Firms with

similar strategies would likely have similar underlying resource endowments that could be used more effectively to face aggressive rivals (Peteraf 1993b; Gimeno and Woo 1996).

### **Objective of this Research**

The purpose of this study is to expand the understanding of effects of strategic price competition on price dispersion. The following research questions are addressed by this study.

1. How does multi-market contact affect price dispersion? Research on multi-market contact indicates that at some level of multi-market contact's affect on rivalry intensity is mixed and therefore the effect on price dispersion is mixed. It is also possible that multi-market contact's affect on that price dispersion may be an inverted-U relationship.
2. How does strategic similarity of rival firms affect price dispersion?  
Research indicates that firms with similar strategies are more likely to have more similar pricing (i.e., less price dispersion than firms with dissimilar strategies.
3. How does market concentration within local markets affect price dispersion? Market concentration can be evaluated at various market levels.  
Research indicates that within local markets, as market concentration increase, price dispersion will decrease, as few firms have larger market shares.



4. How does a firm's dominance within a market affect price dispersion? In the context of the airline industry this is related to whether the firm is operating in a hub or non-hub airport. The level of dominance in the national market of the hub airline may also affect price dispersion.

To accomplish these objectives, this study evaluated the data to find answers to the research questions. The rest of this paper is organized into the following chapters. In Chapter 2, prior research on price dispersion and the key constructs (multi-market contact and strategic similarity) is reviewed. In Chapter 3, the conceptual framework and the development of the hypotheses are presented and explained. In Chapter 4, the methodology that is applied in the analysis and the data set are described. In Chapter 5, the results of the analysis are presented. In Chapter 6, conclusions of this study are drawn, the limitations of this study are stated, and the direction of possible future research is discussed.

## **CHAPTER II**

### **LITERATURE REVIEW**

Marketing and economic researchers have extensively studied the dispersion of prices from many perspectives. In this chapter, the relevant research on price dispersion is discussed. First, research on the major sources of price dispersion (i.e., consumer heterogeneity, consumer search costs, and competition) is reviewed. Second, research related to price dispersion in the airline market is examined. Third, research on key independent variables related to strategic price competition's effect on price dispersion is discussed.

#### **Price Dispersion**

In order to better understand price dispersion, researchers have investigated and evaluated sources of price dispersion. Economic research typically explains price dispersion as a violation of one of the Bertrand assumptions; (1) perfectly informed consumers (a requirement of consumer homogeneity), (2) zero search costs, or (3) product homogeneity (Brynjolfsson and Smith 2000). Bertrand competition is a model of price competition among duopoly firms, which set prices as though there was of perfect competition. In a duopoly, two firms

dominate the market and in economic research, duopoly is the most common form of oligopoly studied. The Bertrand assumptions rarely occur in real markets and research has explored the common exceptions to Bertrand competition. Appendix 2 describes selected articles grouped by the authors' research area of interest related to price dispersion; (1) competition, (2) consumers, and (3) market structure.

### ***Sources of Price Dispersion***

Some of the early economic research evaluated the effect of product homogeneity on price dispersion (e.g., Griliches 1961; Chow 1967). This research considers products to be bundles of characteristics, with price dispersion resulting from the combination of characteristics of a particular product. In more recent studies product homogeneity is an assumption of price dispersion research. On the other hand, consumer heterogeneity has regularly been demonstrated to be a major source of price dispersion.

Consumer Heterogeneity - One aspect of consumer heterogeneity is the differences in the level of product information that individual consumers have available when making purchase decisions. Price dispersion arising from consumers who are differentially informed of prices has been analyzed by economic researchers (see Salop and Stiglitz 1977 and Varian 1980). In these models some consumers are informed of all prices and other consumers know only one price (and do not search for other prices). The informed consumers purchase from the retailer with the lowest price; the uninformed consumers purchase from the retailer, if the price they are aware of is lower than their reservation price. This typically results in some firms charging low prices in an

attempt to attract informed consumers while other firms charge high prices to sell to uninformed consumers.

Salop and Stiglitz (1977) studied consumer heterogeneity between two groups of consumers. They provide a conceptual model and a theoretical analysis of the industry equilibrium for an economy in which imperfectly informed consumers can only become informed at a cost. Salop and Stiglitz's assumption leads to a monopolistically competitive equilibrium and generally to price dispersion, even though the produce is homogenous. Salop and Stiglitz found that price dispersion depends on the magnitude of information costs between two consumer groups and degree of scale economies. In the following section, other research (e.g., Stigler 1961, Salop and Stiglitz 1982) is discussed, which shows that consumer search costs have a major effect on price dispersion.

Consumer Search Cost - Price dispersion arising from differences in consumer search cost has been analyzed by many researchers. Stigler (1961), in his seminal article on price dispersion, stated that price dispersion is ubiquitous even for homogeneous products. He referred to price dispersion as "the measure of ignorance in the market" (p. 214). Stigler argued that advertising is a "powerful instrument for the elimination of ignorance" (p. 220). He also stated, "Dispersion is a biased measure of ignorance because there is never absolute homogeneity in the commodity if we include the 'terms of sale' within the concept of the commodity" (p. 214). Stigler's conclusion was that price dispersion was caused by consumers' lack of information due to search costs

and variation in ‘terms of sale’ (including customer service and stocking of products) even for homogeneous products.

Dahlby and West (1986) evaluated automobile insurance premiums over a seven-year period (1976-1981) and found that price dispersion existed in all driver classes (e.g., age, gender, marital status), for all territories, and years. They investigated consumer search costs, policy quality differences, and restriction on competition. Dahlby and West concluded that in this market price dispersion was based primarily on consumer search costs. Bakos (1997) theoretically analyzed the role of electronic marketplaces (e.g., Internet) in lowering search costs. He focused on airline reservation systems, Internet-based electronic storefronts, and financial markets. Bakos concluded that that lower search costs should lead to lower and less price dispersion.

Sorensen (2000) studied consumer search as a source of price dispersion of prescription drugs. He studied prices across two distinct markets and within the two markets. Sorensen found that most of the price dispersion could be attributed to imperfect information, search costs, and motivation to search for lowest price. Prices for drugs that are regularly purchased exhibited less price dispersion. This was expected as consumer benefits of search increase over one-time purchases. Also, cross-sectional patterns in price variation were consistent with models based on consumer search. In addition to the sources of price dispersion discussed in this section, the effect of competition among rival firms on price dispersion has only been studied to a limited degree.

Competition - Borenstein and Rose (1994) analyzed pricing of U.S. airlines to evaluate the effect of competition on price dispersion. They state, “The strongest and most striking result in our work is the significant positive effect of competition on price dispersion” (p. 672). Borenstein and Rose found competition to affect price dispersion across and within markets. Their results are consistent with the predictions of competitive-type price discrimination models and they reject monopoly-type discrimination as the dominant source of airline price dispersion. The variables used by Borenstein and Rose to evaluate the construct ‘competition’ include market concentration, market share, market density, endpoint dominance, and market structure (i.e., monopoly, duopoly, or competitive market).

Walsh and Whelan (1999) investigated effects of competition on price dispersion of related brands within product categories sold by independent shops in the Irish Grocery market. They examined whether price dispersions of related brands is an outcome of brand pricing across different localized monopolies of an oligopolistic market. Price dispersions of related brands could indicate differences in the prices of brands averaged over different shops with consumers having heterogeneous willingness to pay. In this situation, price dispersion is driven by each brand exercising third-degree price discrimination, ‘monopoly type’ pricing, across the different groups of shops in which they retail. Walsh and Whelan (1999) referred to ‘monopoly type’ pricing as each brand exercising third-degree price discrimination (i.e., varying prices by location or customer

segment) across the different groups of shops in which they retail (i.e., price dispersion within the brand).

As mentioned above, third-degree price discrimination is sometimes referred to as monopoly type pricing. Third-degree discrimination takes place when a firm sells its product to different consumers at different prices. This is the most common form of price discrimination (Varian 1996). Second-degree price discrimination takes place when a firm sells different amounts of its product at different prices, regardless of the consumer type (e.g., quantity discounts). Second-degree discrimination is very commonly practiced. First-degree price discrimination takes place when a firm sells different amounts of its product at different prices and prices may vary by consumer type. First-degree discrimination maximizes the firm's profit, but is very difficult to implement because the firm must know the customer's willingness to pay and be able to prevent resale.

As Walsh and Whelan pointed out, research by Borenstein (1985) and Holmes (1989) suggest that brand pricing across shops could also reflect heterogeneous price competition environments. Pricing within shops in this scenario is determined by the consumer's willingness to pay and the offsetting impact of price competition that is induced by consumer willingness to switch between related brands. Overall, Walsh and Whelan found "brand distribution structures and their interaction with competition structures contribute significantly to price dispersion" (p. 342) across product categories.

Walsh and Whelan applied the empirical methodology of Borenstein and Rose (1994) and found indirect evidence of ‘competitive type’ affecting price dispersion, rather than ‘monopoly type’ brand pricing over heterogeneous consumer segments. Their results support brand pricing across consumer groups that induce varying degrees of localized imperfect price competition. This finding provides indirect evidence that deficient consumer switching abilities become relatively more elastic in some consumer segments compared to others in response to competitive forces.

As competition across firms increases, firms may choose to be more vertically differentiated (i.e., based on perceived quality differences) from each other to relax competition based on price. If firms were positioned too close to each other, then consumers would choose between them on the basis of price, which would create the incentive to compete on price, and the net result would be lower profit for both firms (Moorthy 1988). Firms may choose to be differentiated in dimensions, such as services and product assortment to soften price competition.

### ***Selected Marketing Research on Price Dispersion***

Marketing researchers have studied price dispersion in traditional markets, as well as in Internet markets. Researchers have shown that the Internet provides sellers with speed and flexibility to change prices that have impacted price dispersion. In the following sections, some important marketing research is discussed that focuses on traditional markets and Internet markets.

*Traditional Markets* - Scholars in marketing have investigated the effects of price dispersion on key marketing variables as well as the causes of price



dispersion. Burman and Biswas's (2004) study examined the moderating roles of contextual variable-market price dispersion for a product category (DVD payers), and that of an individual level variable-need for cognition, in influencing consumer evaluation of reference prices across two experiments. While most marketing researchers studied the causes of price dispersion (e.g., Borenstein and Rose 1994; Brynjolfsson and Smith 2000; Clemens, Hann, and Hitt 2002; Zhao 2006), a study by Burman and Biswas's (2004) is an example where the effect of price dispersion on consumer evaluation, an important marketing construct, is analyzed.

The results of Burman and Biswas's study suggest that in situations where the price dispersion of a product category in a market is wide, consumers' expected price range becomes larger. Similarly, when the price dispersion in the market is narrow, consumers do not expect large variations in prices of the product. As a consequence, an implausible reference price is less likely to be discounted in the wide market price dispersion situation. Consistent with assimilation-contrast theory, Burman and Biswas posited that an implausible reference price is more likely to have a positive effect on consumer evaluation when market price dispersion is wide than when it is narrow.

Biswas (2004) examined how price dispersion and search efficiency, two key aspects of the economics of information theory, may be impacted differentially by the characteristics of the Internet. An important implication of this study is that higher price dispersion on the Internet is due to versioning (i.e., different versions of products or information based on individual customer

needs) (Shapiro and Varian 1998; Whinston, Stahl, and Chio 1997). Even though Biswas's study focuses on the Internet, airlines have been applying versioning to sell the same product at different prices to different customer classes (e.g., business and tourist) for many years.

Zhao (2006) studied of price dispersion in the grocery market and checked for the consistency of evidence of price dispersion with the existing theories of price dispersion due to costly consumer heterogeneity, consumer search, and competition. The three dimensions of price dispersion studied were; price dispersion for a certain brand across stores, price dispersion within a category in a store across brands, and price dispersion over time for a certain brand. Results of the Zhao study showed price dispersion to be positively correlated with consumer search costs, competition, and consumer heterogeneity. These results are consistent with the existing theories cited by Zhao.

Internet Markets – The Internet provides new and interesting opportunities to evaluate the effects of dramatic changes in price transparency and consumers search cost on price dispersion. The following are a few examples of major articles that investigate these changes. Some of the Internet research compares and contrasts the influence of the Internet on price dispersion and adds to the understanding of both traditional and Internet markets.

Bailey (1998) performed one of the earliest empirical research studies on Internet price dispersion. He evaluated whether the Internet market was more efficient than the traditional market. Bailey (1998) evaluated prices of books, music CDs, and software titles in 1996 and 1997 sold through Internet and

traditional outlets. He found that price dispersion among e-tailers was at least as great as that among the traditional retailers. This finding is contrary to the expectation that online markets are closer to purely competitive markets due to reduced consumer search cost. Bailey's (1998) study was exploratory and comprised only low-involvement product categories.

In the classic Bertrand model of price competition, products are perfectly homogenous, retailers are afforded no spatial advantages in attracting consumers, and consumers are informed of all prices (Brynjolfsson and Smith 2000). The result is that competition occurs only in price, consumers buy from the lowest priced retailer, and retailers all set the same price, a price equal to marginal cost. In reality, the existence of price dispersion is one of economics' most replicated findings (see Dahlby and West, 1986, and Sorensen, 2000 as examples).

Considering these factors alone, only a small degree of price dispersion on the Internet was expected by Brynjolfsson and Smith (2000). With regard to product homogeneity, Brynjolfsson and Smith intentionally selected products (books and CDs) whose physical characteristics are entirely homogeneous. Considering search costs, they expected lower search costs on the Internet than in traditional channels. Similarly, they expected the role of informed and uninformed consumers to be less a factor in dispersion among Internet prices than it is among traditional prices.

Brynjolfsson and Smith (2000) compared pricing behavior at Internet and traditional retail outlets. A key finding related to price dispersion was that levels

of price dispersion depend importantly on the measures employed. When they compared the prices posted by different Internet retailers, they found substantial price dispersion. Internet retailer prices differ by an average of 33% for books and 25% for CDs. However, when Brynjolfsson and Smith weighted these prices by proxies for market share, they found that price dispersion is lower in Internet channels than in traditional channels, reflecting dominance of certain heavily branded retailers.

Because the Internet is a multifaceted market, Brynjolfsson and Smith stated that it is worth looking at the question of dispersion from a variety of perspectives. First they analyzed several aspects of price dispersion by looking at posted prices. Then they repeated the analysis after weighting all the price observations by a proxy for market share in each channel. Each of the measures highlights different aspects of Internet commerce, and both measures are useful in characterizing Internet markets. Dispersion in posted prices corresponds to the price difference consumers would find, if they were equally likely to observe prices from any store, e.g., after using a price comparison intermediary or some other listing of retailers, or if they searched among all the retailers in their sample without revisiting the same store repeatedly. Dispersion in weighted prices corresponds roughly to the prices one would observe by recording the prices consumers actually pay for goods on the Internet and in traditional outlets. They analyzed dispersion resulting from posted and weighted prices.

Brynjolfsson and Smith created both absolute and relative measures to analyze dispersion in posted prices. Both measures reveal higher than expected

dispersion in Internet prices. Absolute dispersion statistics show a substantial range of prices available on the Internet for the same book or CD in the same period. Brynjolfsson and Smith considered two tests of relative dispersion in posted prices across channels. First they compared measures of price range, trimmed range, and standard deviation between the Internet and traditional channels. Second, they used kernel density plots to graphically analyze the dispersion of prices across their mean.

Anacarani and Shankar (2004) evaluated price dispersion of books and music CDs across Internet-only retailers (pure-play e-tailers), traditional retailers (bricks-and-mortar), and multi-channel retailers (bricks-and-clicks) retailers. Their results, based on 13,720 price quotes, showed that multi-channel retailers had higher price dispersion, with or without shipping costs. Traditional retailers had the second highest price dispersion and Internet-only retailers had the lowest price dispersion. These findings indicate that the online markets offer opportunities for retailers to differentiate prices within and across the retailer types, similar to traditional markets.

Next, price dispersion in the airline industry is discussed. Airline ticket prices are well known for price dispersion. The data collected on a wide range of variables and the availability of data makes it a market that has drawn the attention of both economic and marketing researchers. This study focuses on the effect of competition on price dispersion in the airline industry.

## **Price Dispersion in the Airline Industry**

Price dispersion in the airline industry has been a topic of research among academic scholars for several decades. It is a fixed capacity, service industry that has seen momentous changes (e.g., entrance of low-fare airlines, the advent of Internet ticket sales). The follow sections provide a brief review of articles representing the perspective of economic researchers and the effect that revenue management systems has on price dispersion.

### ***Economic Perspective***

Economic scholars study price dispersion in the airline industry to gain understanding of the drivers of price dispersion. A major study in this area of research is the work by Borenstein and Rose (1994), who analyze price dispersion of airline ticket fares charged to different passengers on the same route. They found that price dispersion increases on routes with more competition or lower flight density, consistent with discrimination based on customers' willingness to switch to alternative airlines or alternative flights. Borenstein and Rose argue that the data support models of price discrimination in monopolistic, competitive markets.

Borenstein and Rose (1994) show empirically that price dispersion is greater on city-pair routes that are served by a larger number of carriers. They attribute this result to price discrimination and argue that point using a monopolistic-competition model with certain demand. Borenstein and Rose (1994) place the sources of price dispersion in two broad categories; discriminatory pricing and costs of serving different customers. Within the discriminatory pricing category, they evaluate market structure variables (e.g.,

market concentration), population attributes (e.g., passenger types), and product characteristics (e.g., frequent flyer plans). Within the ‘cost of serving different customers’ category are two types of peak-load pricing strategies; systematic and stochastic.

Dana (1999) evaluates the situation when capacity is costly and prices are set in advance. He suggests that firms facing uncertain demand will sell output at multiple prices and limit the quantity available at each price. Dana shows that the optimal price strategy of a monopolist and the unique, pure-strategy Nash equilibrium of oligopolists both exhibit intra-firm price dispersion. Moreover, as the market becomes more competitive, prices become more dispersed, a pattern documented in the airline industry. While generating similar predictions, the model differs from the revenue management literature because it disregards market segmentation and fare restrictions that screen customers.

Dana’s (1999) article was the first to extend Prescott’s (1975) model to monopoly and imperfect competition. By expanding firms’ strategy sets to include price distributions, i.e., sets of prices and quantity limits at each price, he showed that there exists a unique, pure-strategy equilibrium in price distributions when no pure-strategy equilibrium exists in prices. In other words, the model predicts equilibrium with intra-firm price dispersion in which each firm offers its output at multiple prices (as opposed to random prices). The oligopoly equilibrium is symmetric and the market price distribution converges to Prescott’s competitive equilibrium as the number of firms approaches infinity.

As competition increases, the average price level falls and the degree of price dispersion increases.

The inverse correlation between price dispersion and market concentration has been observed in the airline industry. Borenstein and Rose (1994) show empirically that price dispersion is greater on city-pair routes that are served by a larger number of carriers. Borenstein and Rose attribute this result to price discrimination and argue that point using a monopolistic-competition model with certain demand. However, their empirical results are also consistent with this article's theory that price dispersion is due to capacity costs (i.e., perishable assets) and demand uncertainty. Furthermore, this model is consistent with other characteristics of the airline industry, characteristics that the price discrimination theory does not address.

Another major study in this area of research is the work by Clemens, Hann, and Hitt (2002), who evaluated price dispersion of airline tickets offered by online travel agents (OTAs). They considered the presence or absence of price dispersion in airline tickets, a complex product with multiple, quality attributes. Most previous work on price dispersion in Internet markets has been done on commodities, such as books and CDs. Their results suggest that in markets with low search costs and strong incentives for consumer search, there is persistent price dispersion across service providers.

Klein and Loebbecke (2003) compared online and offline pricing strategies with a particular focus on airline ticket sales. The basis of their study was a setting of structural changes in the airline industry and changing customer



behavior. They took a critical look at predictions about the proliferation and success of flexible pricing schemes that were made at the end of the 1990s. Interpretive analysis and empirical evidence of Web-based pricing mechanisms, which aim at giving customers access to lower prices, lead to a method for developing pricing strategies that reflect the competitive environment of the online market space.

As stated by Klein and Loebbecke “In the real world, few sellers act under conditions of either perfect competition or monopolistic markets. Instead of having to accept the market price, sellers have to develop their own pricing strategies and revenue management” (p. 47). Strategies that try to optimally match various customers’ desires are based on market research insights (Dolan and Simon 1996). Empirical data shows that differential pricing is already widespread in industries that exhibit large fixed costs like airlines, telecommunications, or publishing (Varian 1996). Some market segments could not be served without differential pricing and it can even be shown that differential pricing contributes to economic efficiency (Dolan and Simon 1996, Varian 1996).

Revenue management has been applied in a number of markets where the product is a service with fixed capacity in the short term and is a market that can be segmented. Examples of these types of services where revenue management have been applied are airlines, passenger trains, car rental, hotels, casinos, electric power distribution, and broadcasting. This study focuses on the airline

market where revenue management has been used extensively for over 20 years. The next section describes how revenue management affects price dispersion.

### ***Revenue Management's Influence on Price Dispersion***

Revenue management (also referred to as yield management) began in the early 1970s in the airline industry to manage capacity sold at discounted fares. These discounted fares were targeted at leisure travelers and simultaneously minimizing the dilution of revenue from business travelers who were willing and able to pay full fares. The term 'revenue management' is commonly used to describe most aspects of airlines pricing and seat-inventory control decisions; but in reality, revenue managers primarily practice seat-inventory control (Dana 1999). Revenue management is an analytical process developed to manage capacity and maximize profitability (Talluri and Ryzin 2004). Improvements in computer technology made it practical for statistical forecasting techniques and mathematical optimizing methods to be applied dynamically to determine optimal prices that result in revenue and profit maximization. Also, when applied properly, revenue management can help organizations achieve high levels of allocation efficiency, innovative product differentiation, and unique positioning. A study by Hendler and Hendler (2004) provides an excellent example of how revenue management can be applied successfully to improve allocation efficiency, product differentiation, and positioning. Furthermore, research has shown that after revenue management has been implemented, revenues of firms have improved 3 to 7 percent and profits have increased 50 to 100 percent (Cross 1997).

From the economic perspective, revenue management increases airlines' profits three ways. First, it implements peak-load pricing. Second, it implements third-degree price discrimination. That is, fare restrictions screen customers and segment them by their sensitivity to price (i.e., willingness to pay) and potentially by their demand uncertainty. And third, it implements an inventory control system for coping with uncertain demand for a perishable asset. Revenue management has proven to be effective improving the revenue and profitability of airlines. The success of revenue management has led to it being widely adopted throughout the airline industry.

In practice, revenue management has traditionally described several separate functions within an airline's organization (Cross 1997). First, the collection of sales data used to generate a sales forecast. Second, the fare setting department, which determines the restrictions that passengers, meets and sets the prices of tickets. Fares apply to many flights, and any limits on departure dates or times are specified as restrictions on the fare. These departments closely monitor competitors' fares on computer reservation systems and quickly match any of their price changes. Third, a computerized system determines, given demand forecasts and fares, the optimal limit on the number of seats sold at each fare and then transmits that info to a computer reservation system. With the increasing power on information technology, revenue management has improved in efficiency of collecting data and adjusting discounts to optimize revenue.

Belobaba (1987) reported the results of a survey of airline revenue management practices. The subsequent development and adoption of better tools for demand forecasting and computerized dynamic seat-inventory control have drastically changed airline competition. However, one-shot selection of prices and quantities early in the history of revenue management does seem to closely mirror the pricing assumption in the model presented here. Although the model has obvious limits, it is nevertheless consistent with stylized facts about airlines. In particular, capacity utilization rates are higher for seat-inventory allocations of low-fare seats. While info about capacity utilization by fare (i.e., price) within an airline is proprietary (because seat-inventory control is proprietary), this is a direct consequence of the algorithms used by the revenue management computers.

Next the effects of strategic price competition on price dispersion are discussed. This is a gap in the research that needs to be understood. The focus of this research is to evaluate and explain the influence of key competition-related variables on price dispersion in a major service industry, airlines.

### **Strategic Price Competition**

“Pricing is possibly the market’s most important economic variables” (Hansen and Solgaard 2004, p. 99). Price is the only marketing mix variable that provides income to the seller, as the others (i.e., product, place, and promotion) are costs to the seller. From the buyer’s perspective, price is a fundamental factor that is assessed by a potential customer when appraising the value of a

product. Two recently developed competition-related variables that are evaluated in this study are multi-market contact and strategic similarity.

### ***Multi-Market Contact***

Some of the articles in this section discuss both multi-market contact and strategic similarity because the research studied the relationship between these two constructs. Gimeno and Woo (1996) performed an empirical analysis of data from over 3,000 city-pair markets of the U.S. airline industry. Their paper focuses on the effects of changes in multi-market contact and strategic similarity in a city-pair market on the prices charged by airlines in that market. Other important factors which influence prices, such as service attributes, market characteristics, cost positions, market structure and firm-specific advantages, are rigorously controlled. The methodology used for the empirical analysis, a panel data regression with fixed-effect intercepts, also serves as a control for other sources of stable differences across airlines and city-markets.

The results of the Gimeno and Woo study showed that multi-market contact strongly decreases the intensity of rivalry, whereas strategic similarity moderately increases it. Interestingly, the findings suggest that the effect of strategic similarity on intensity of rivalry may be biased if the effect of multi-market contact is not explicitly accounted for. This is due to the fact that strategic similarity may capture some of the strong de-escalation effect of multi-market contact when this variable is not controlled. This finding explains and challenges prior literature, which found that strategic similarity reduces rivalry.

The findings of Gimeno and Woo have important theoretical implications. For strategic group theory, they suggest two distinct dimensions of strategic

heterogeneity (strategic similarity, multi-market contact), which should not be aggregated because they have opposite effects on the intensity of rivalry. These two dimensions should be separately considered to produce more rigorous analysis of rivalry within and between strategic groups. For hyper-competition theory, the findings indicate that hyper competition in the cost-quality arena and stronghold invasion arena may lead in the future to greater competitive restraint. If hyper-competition in the cost-quality arena leads to greater differentiation in the market positions of firms, this could de-escalate competition. In addition, if hyper-competition in the stronghold invasion arena leads firms to obtain a broader multi-market overlap with their rivals, this condition could also provide the basis for deterrence and hyper-competitive de-escalation.

Baum and Korn (1996) examined how firm-specific competitive conditions influence firms' pattern of market entry and exit, focusing on two features of firms' competitive conditions: market domain overlap, which measures the potential for competition, and multi-market contact, which gages the potential for mutual forbearance. An analysis of commuter airlines showed that increases in market domain overlap raised airlines' rates of market entry and exit, but increases in multi-market contact lowered them, especially in markets clearly dominated by a single airline. Thus, paradoxically, close competitors are not the most intense rivals; airlines that meet in multiple markets are less aggressive toward each other than those that meet in one of a few markets.

### ***Strategic Similarity***

The construct, strategic similarity, evolved from research on strategic groups. The term strategic group was coined by Hunt (1972). A strategic group is a

cluster of firms within an industry that have similar characteristics, including similar overall business strategies (i.e., strategic similarity) (Porter 1979). Cool and Schendel (1987) studied strategic groups in the U.S. pharmaceutical industry over the period 1963-1982. They identify six strategic groups having strategic similarity. Also, performance differences between the strategic groups were found to correlate with market share.

Fiegenbaum and Thomas's (1990) study found significant differences over time across strategic groups in five out of nine performance measures. Mehra (1996) studied strategic groups in the U.S. banking industry. He found significant profitability and productivity differences between market-based, strategic groups. The market-based, strategic groups in the Mehra (1996) study are similar in formation to the groups of strategically similar firms applied in this current study.

### ***Market Concentration***

Like mutual forbearance theory, oligopoly theory is concerned with inter-firm coordination (Baum and Korn 1996). In oligopoly theory, collusion, either tacit or purposive, among firms is viewed as occurring because firms recognize their mutual dependence. However, in oligopoly theory, coordination derives from greater market concentration (i.e., small number of sellers, each with market power), not from multi-market contact (Scherer and Ross 1990).

Linked oligopoly theory (Solomon 1970) presents a view more similar to mutual forbearance (Baum and Korn 1996). It suggests that an important determinant of performance in oligopolistic market is the degree of linkage between markets or firms' presence in multiple markets. Solomon argued that

markets must be viewed as linked clusters if the behavior of multi-market firms is to be understood. Therefore, like mutual forbearance, linked oligopoly theory assumes that multi-market firms coordinate their operations across markets and that this coordination affects the intensity of rivalry. Consequently, considering only the structure of individual markets may be misleading because multi-market contact will likely reduce rivalry, even in concentrated markets (Heggstad and Rhoades 1978).

These theories suggest that the structure of particular markets within which firms engage, especially the level of concentration in those markets, is likely to affect the relationship between multi-market contact and mutual forbearance (Baum and Korn 1996). In particular, it seems likely that mutual forbearance will be more influential in concentrated markets. The rationale for this is that it is easier for oligopolists who are multipoint rivals to collude and forbear from intense rivalry, even easier than it is for multi-point rivals in less concentrated markets to do so. Thus, multi-market contact can potentially strengthen oligopolistic coordination within specific markets. Theoretical analysis (Bernheim and Whinston 1990), empirical research (Scott 1982, 1991), and experimental research (Phillips and Mason 1992) support the idea that mutual forbearance will be greatest when market concentration is high.

In the next chapter, the conceptual framework that is applied in this study to examine the relationship between the independent variables related to competition and the dependent variable, price dispersion are introduced and explained.



### **CHAPTER III**

#### **CONCEPTUAL FRAMEWORK**

Economists often mention the “law of one price”, which suggests that supply and demand will determine a single price for a homogenous product, regardless of the number of sellers and buyers. In reality, it is well known by marketing scholars and economists that this rarely, if ever, occurs in real markets.

Homogeneous products are often sold at widely differing prices by competing firms, even in markets that are highly competitive, such as the U.S. airline ticket market. It is widely known and accepted that a wide range of prices can exist for the same airline ticket. Price dispersion may be further expanded by the ticket prices of rival airlines, which may have different strategies that may affect their pricing. This study explores some key factors that may influence price dispersion and evaluates the consistency with theories, which provide direction on the factors that may affect price dispersion. This research is the first study, known to the author, to focus on evaluating multi-market contact and strategic similarity as influencers of price dispersion.

The effects of variations in consumer heterogeneity on price dispersion have been studied by such scholars as Diamond (1987), Shepard (1991), Borenstein and Rose (1994), Clemons, Hann, and Hitt (2002), and Zhao (2006). Consumer heterogeneity can be based on such consumer differences as their price sensitivity, preferences, or willingness to pay. In the case of the airfare market, consumer heterogeneity is typically evaluated on the basis of business traveler versus vacation traveler. Borenstein and Rose (1994) studied the effects of difference in business passengers versus vacation passengers on price dispersion of airline tickets sold on 521 domestic routes served by major airlines. Clemons, Hann, and Hitt (2002) studied the effects of difference in time-sensitive travelers (i.e., business travelers) versus price-sensitive travelers (i.e., vacation travelers) on price dispersion of airline tickets sold online. Both of these studies found consumer heterogeneity to be a contributing factor to price dispersion.

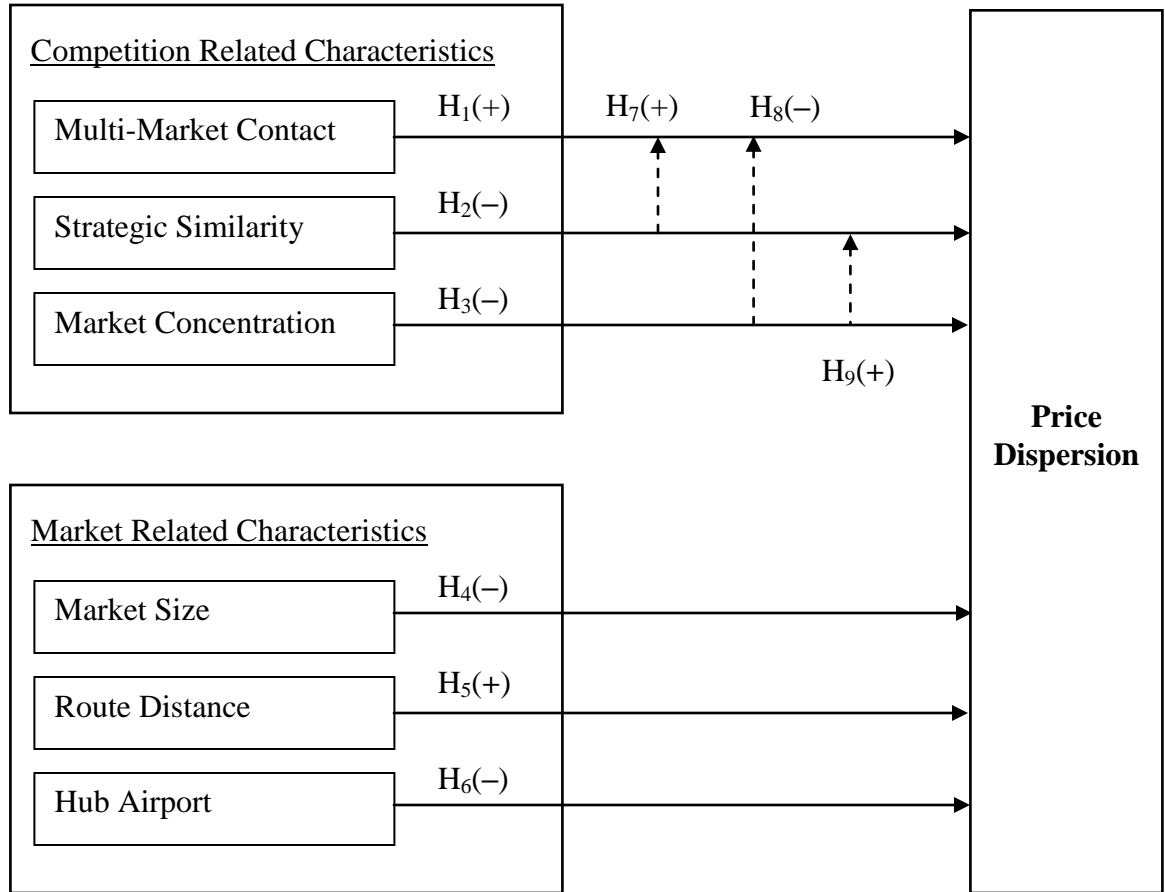
The effects of variations in consumer search costs on price dispersion have been extensively studied, going back to Stigler's (1961) seminal article on price dispersion. Appendix 1 provides a list of selected articles that study consumer search costs affects on price dispersion. In the case of the airline ticket market, consumer search costs have been low compared to most markets due to independent travel agents and more recently online travels agents (Clemons, Hann, and Hitt 2002). The economic theory of search implies that when customers have low search costs, equilibrium prices will converge to marginal cost, eliminating price dispersion. Even though research has shown search costs

in the airline ticket market to be extremely low, price dispersion is relatively high. Therefore, other factors must be creating price dispersions. In this current study, the focus is on competitive factors and local market conditions that may contribute to price dispersion.

The effects of competition have been applied to evaluate a number of factors that relate to firm performance, such as intensity of rivalry, market entry and exit rates, price levels, and price dispersion. Empirical research, notably Borenstein and Rose 1994, Walsh and Whelan 1999, and Zhao 2006, indicates that price dispersion is influenced by competition, but the effects of competition on price dispersion have not been thoroughly evaluated. For instance, the effects of competition in complex industries, such as the U.S. airline industry, where there are numerous competitors competing in a wide range of local markets with different strategies, are not well understood. The effects of price dispersion of two very important factors, multi-market contact and strategic similarity, have not been evaluated. As a result, there is a major gap in the research on competition's potential effects on price dispersion. The purpose of this study is to fill the gap in this important line of research.

The conceptual framework is illustrated in 1. As shown in the diagram, price dispersion is influenced by two groups of independent variables; one group of competition related characteristics and another group of local market related characteristics. The following conceptual framework indicates the expected relationships between the independent variables and the dependent variable, price dispersion.

**Figure 1 - Price Dispersion Framework**



Note: Dotted lines indicate interactions between variables.

In this chapter the above proposed conceptual framework is explained, the theories related to price dispersion are examined, and the development of the hypotheses explained. Since George J. Stigler's 1961 article first described how price dispersion is affected by advertising's influence on consumer search costs, price dispersion has been the focus of many economic and marketing researchers. Both economic and marketing researchers have conducted many studies related to price dispersion. Recent marketing research has continued to expand the understanding of the causes of price dispersion (e.g., Borenstein and

Rose 1994; Brynjolfsson and Smith 2000; Clemens, Hann, and Hitt 2002; Zhao 2006 and its affects on consumers (e.g., Burman and Biswas 2004). See appendixes 1 and 2 for more information on these studies.

### **Price Dispersion – Theoretical Background**

Price dispersion is generally defined as the variation in prices of a specific product. Stigler (1961, p. 214) stated that “Price dispersion is a manifestation---and, indeed, it is the measure---of ignorance in the market.” What Stigler was referring to as “ignorance” was that lack of knowledge of the prices in the marketplace increases price dispersion because some customers lack the opportunity or information to compare prices.

In this current study, price dispersion is the variation in airline ticket prices for the same city pair route offered by competing airlines. Price dispersion is determined by many factors. The focus of this study is to understand the influences of competition on price dispersion given a range of market conditions.

One may ask why it is important to understand how competitive forces and market characteristics impact price dispersion. Price dispersion has been studied by marketing researchers for decades because of the impact that pricing has on consumers, as well as sales revenue and profitability of firms and industries. If the forces affecting price dispersion are better understood, managers may be able to develop better business strategies and plans.

Firms, such as airlines, competing in many local markets and against competitors with distinctly different strategies may be able to improve their financial performance by applying additional knowledge of how competition and firms with different strategies impact their pricing options. For example, if prices of an airline ticket for a route are different between two airlines as often occurs. Then, if a manager at the higher priced airline knows and understands that the price difference is due to identifiable characteristics of the competitor and the local market, the firm does not need to lower the price to match the competitor's price and can be more profitable.

While some causes of price dispersion have been thoroughly researched, there remain theoretical and practical issues of interest, specifically regarding competition. Of specific interest is how the levels of multi-market contact and the differences in strategic similarity affect price dispersion. By providing new insight into answering this question, this research may provide managers with more information to make more effective decisions when developing marketing strategies.

### ***Theories Related to Price Dispersion***

The article by Burman and Biswas (2004) provides an excellent discussion of the theories related to price dispersion. Adaptation-level theory implies that the magnitude of impact of a price depends on the consumer's adaptation level, and in most cases this adaptation level is not the price that physically appears on the product but the price that consumers form in their minds due to past experience or knowledge (Kalyanaram and Little 1994; Janiszewski and Lichtenstein 1999;

Burman and Biswas 2004). The price range that consumers evoke in their minds is used to determine the attractiveness of the market price.

The evoked price range is not only influenced by the advertised selling and reference prices (Della Bitta, Monroe, and McGinnis 1981), but also by the variability in the prices (i.e., price dispersion) in the marketplace (Kalyanaram and Little 1994). Based on the above implications, Burman and Biswas's (2004) research showed that in situations when price dispersion of a product category in the market is wide, consumers' expected price range becomes larger. Similarly, when the price dispersion in the market is narrow, consumers do not expect large variations in prices of the product.

As an example of adaptation-level theory, when purchasing airline tickets, consumers expect a wide range of prices due to differences in the type of airline (e.g., network or low fare) and amount of seats available on the flight.

However, when consumers purchase a Big Mac at McDonalds, they expect the price to be within a narrow band of prices. Consumers adapt to the prices they have encountered in their recent past. Price dispersion within local markets affects the price variations that consumers expect and adapt to when considering a purchase.

Range theory has been applied to price dispersion when considering a consumers' range of expected prices (Janiszewski and Lichtenstein 1999). Range theory is based on consumers' sensory perceptions that the range of values of the stimuli determines the perceived value of any one stimulus in the range. Furthermore, range theory suggests that consumers use the range of

remembered price experiences to set a lower and upper bound of price expectations and the attractiveness of a market price is a function of its relative location within the range. This implies that the attractiveness of a price is affected by consumers' evaluations in relation to the end points of their evoked, acceptable price range (i.e., price dispersion range). For example, when purchasing airline tickets, consumers have a range in mind that they expect they may have to pay for the ticket. The consumer perceives the value based to the actual price relative to the upper and lower bound of the expected price range. This price range is influenced by the actual price dispersion within the city-pair route that the consumer is traveling.

Assimilation-contrast theory is related to price dispersion in that prices that fall within the range of a consumers' acceptance are assimilated. Those prices falling outside the range of acceptance are rejected and become a contrast to the acceptable price range (i.e., price dispersion). Assimilation-contrast theory has been applied to consumers' integration of pricing information by such academic scholars as Sherif (1963), Monroe (1971), Monroe and Petroschius (1981), and Diamond and Campbell (1989). In the case of airline tickets, a consumer's knowledge of the price dispersion for a given city-pair route will influence the endpoints of the range of acceptance. Prices outside the range will seem to be unreasonably high or surprisingly low. Also, prices slightly outside the range of acceptance can result in a movement of the acceptable range in the direction of the new price.

"Signaling theory is based on the premise that often information asymmetry exists between two parties to a transaction such that one party possesses



information the other party lacks but desires to possess (Spence 1974, 2002). In the context of market exchanges, sellers often possess information the buyers do not have easy access to, such as true product quality or the location of retailers' offer prices in the actual dispersion of market prices" (Biswas, Dutta, and Pullig 2006, p. 246). Consumers use signals, such as price as an indicator of product quality and firm reliability (Spence 1974, Srivastava and Lurie 2004, Dixit and Chintagunta 2007). For example, consumers normally expect higher service levels from network airlines, typically charging higher prices, than they do from the low-fare airlines. The various prices in this situation are signaling the service levels that may be provided.

In summary, consumers typically have a range of prices in mind for a given product. The service levels associated with various supplies of the product can influence the range of prices (i.e., price dispersion). In the case of the airline industry, the range of acceptable prices may be influenced by the number of airlines (i.e., suppliers) on the city-pair route and the level of services provided, which is related to the product delivery strategy. From the airlines perspective, the consumers' willingness to accept a variety of prices for the same route provides an opportunity to adjust prices based on the prevailing conditions at the time of sale. Both the supply variability and the demand variability result in price dispersion. This current study provides insight into the various influencing factors that affect price dispersion, which can be important and useful for airlines when developing and evaluating competitive strategy and tactics.

### **Competition, Market Characteristics, and Price Dispersion**

According to the structure-conduct-performance (SCP) paradigm, market

structure and firm conduct could be important indicators of firm performance and long-term sustainable competitive advantage (Bain 1956, Porter 1985). The SCP paradigm is a central model in the study of ‘industrial organization’, a field of economics, which focuses on the strategic behavior of firms, structures of markets, and between firm relationships. Caves (1972) and Scherer (1980) argue that market performance is dependent upon the behavior of firms pertaining to matters such as product and pricing strategy. The behavior of firms’ is influenced by the structure of the market, which includes features that characterize the relevant market (Alashban, Hayes, Zinkhan, and Balas 2001).

One outcome of a firm having a sustainable competitive advantage is often higher prices than those of firms without a sustainable competitive advantage (Porter 1985). A simple example that demonstrates a clear connection between sustainable competitive advantage and price levels is patented pharmaceutical drugs. The patent provides the sustainable competitive advantage that creates a monopolistic condition that results in higher than normal prices. Consumers who value the competitive advantage are typically willing to pay for additional benefit provided. The diversity of competitive advantages that sometimes occur between competing firms and the resulting benefits to consumers, likely contribute to price dispersion.

The purpose of this study is to evaluate the influence of multi-market contact, strategic similarity and other key competition and market related variables on price dispersion. A distinguishing aspect of this study is the integration of multi-market contact and strategic similarity in the analysis of

price dispersion. Multi-market contact has been shown to be an important influence on competitive intensity. An extension of the line of research is to gain understanding of the potential affect on price dispersion.

Research on strategic similarity has shown it to be an important consideration when evaluating how firms interact. In the case of the airline industry, one of the major strategic differences between competing firms is their pricing strategy. The expected effects of these variables and other competition and market related variables are discussed next.

### ***Multi-Market Contact***

Multi-market contact is defined as the level of competitive contact, which firms in an industry have in multiple markets (Bernheim and Whinston 1990; Karnani and Wernerfelt 1985; Evans and Kessides 1994; Baum and Korn 1996; Gimeno and Woo 1996). For any pair of rivals in a market, multi-market contact represents the number of other markets in which the same pair of firms meets as competitors. Thus, multi-market contact between two competing firms in a given market reflects the degree of market overlap between those firms in the other markets.

The theory of multi-market competition (Jayachandran, Gimeno, and Varadarajan 1999) implies that multi-market contact between two rival firms will reduce the intensity of rivalry between them in each market where they compete (Edwards 1955; Bernheim and Whinston 1990). Even though multi-market contact indicates that firms are competitors across sub-markets, the theory suggests that the intensity of rivalry in each of the mutually contested markets will be low. The reason for such an effect, according to the theory, is

that firms with high multi-market contact have an extended scope for retaliation to actions taken by the rival (Feinberg 1984), because the possibility for cross-market retaliation is a likely possibility (Gimeno and Woo 1996).

The development of multi-market contact may induce periods of intense rivalry, as firms enter each other's markets (Karani and Wernerfelt 1985). However, once multi-market contacts are in place, and as firms mutually recognize that actions taken on one market may have implications in other markets, firms will forbear from additional disruption (Edwards 1955). This rationale has been indicated by theoretical predictions of Karani and Wernerfelt (1985) and Bernheim and Whinston (1990). Empirical evidence has been provided by the studies of Scott (1982), Phillips and Mason (1992), Evans and Kessides (1994), Baum and Korn (1996), and Gimeno and Woo (1996)

Evans and Kessides (1994) studied the influence of multi-market contact on price levels in the U.S. airline industry. Their analysis determined that there is a statistically significant influence on price levels. Fares were found to be higher in city-pair routes served by airlines with extensive multi-market contact. Evans and Kessides considered the U.S. airline industry to be an "ideal candidate" for testing multi-market contact because the airline industry; (1) has been identified as having potential gains from multi-market contact, (2) has clearly identifiable sub-markets (i.e., city-pair routes), and (3) there is precise data available. The Evans and Kessides study supports the notion that multi-market contact may increase with multi-market contact in markets where there are airlines with low levels of multi-market contact competing along with airlines with high levels of

multi-market contact. This would support the notion of an inverted-U relationship between multi-market contact and price dispersion.

Baum and Korn (1996) studied how firm-specific competitive conditions influence firms' likelihood of entering and exiting markets. They applied multi-market contact as an independent variable to evaluate the entry and exit of California commuter airlines from 1979 to 1984. Baum and Korn demonstrated that firms that meet in many markets compete less aggressively than firms meeting in only a few markets. Baum and Korn found that as multi-market contact increased, the entry and exit rates decreased, indicating that competitiveness reduced as multi-market contact increased. This study supports the premise that if firms feel less need to compete aggressively, they have more latitude in pricing, therefore increasing price dispersion as multi-market contact increases.

Gimeno and Woo (1996) studied the effects of multi-market contact and strategic similarity on intensity of rivalry in the airline industry. Gimeno and Woo performed an empirical analysis of over 3,000 city-pair markets of the U.S. airline industry. They focused on the effects of changes in multi-market contact in a city-pair market on the prices charged by airlines in that market. Other important factors which influence prices, such as service attributes, market characteristics, cost positions, market structure and firm-specific advantages, were rigorously controlled. Their findings support their hypothesis that average multi-market contact will strongly decrease the intensity of rivalry experienced by a firm.

Although there are differing views on the influence that multi-market contact may have on competition, the conclusions of most research supports the premise that as multi-market contact increases, intensity of rivalry will decrease. This decrease in competitive rivalry is expected to result in increased price dispersion due to firms feeling less pressure to match or be close to competitors' prices. The theoretical predictions are consistent with the rivalry-decreasing effect of multi-market contact on price dispersion and are represented in the following hypothesis:

H<sub>1</sub>: The degree of multi-market contact among firms competing in a local market is positively related to price dispersion in the local market.

### ***Strategic Similarity***

Strategic similarity is defined as similarity in the general pattern of resource deployment and competitive orientations independent of the specific market served by the firm (Hatten and Hatten 1987). In the airline industry, the key competitive orientation is the difference in pricing strategies employed and service amenities provided.

The predictions in the literature about the effect of strategic similarity on the intensity of rivalry are mixed. While research on hyper-competition and product differentiation predict that strategic similarity will likely increase rivalry, strategic group theory proposes that strategic similarity may lead to lower rivalry. Recent research tends to support the view that high levels of strategic similarity will likely increase rivalry.

D'Aveni (1994) in his discussion of hyper-competition suggests that similarly positioned rivals are most likely to engage in intense price wars with little restraint, but also explicitly recognizes that differentiated rivals may in some cases be just as active and disruptive as similar rivals. Cool and Dierickx (1993) argue that it is not clear why rivalry among group members should be less intense than competition coming from firms in other groups. The empirical studies of Shepard (1991), Gimeno and Woo (1996), and Fuentelsaz Gomez (2006) provide support to the position that higher levels of strategic similarity lead to increased rivalry, not less rivalry.

The counter theoretical view of the relationship between strategic similarity and intensity of rivalry is an outgrowth of the Harvard approach to strategic groups (Hunt 1972; Porter 1976; Caves and Porter 1977). In this stream of research, strategic distance (the inverse of strategic similarity) is seen as a hindrance to inter-firm tacit coordination. When inter-firm tacit coordination fails because of lack of strategic similarity, strong rivalry ensues that eventually drives down firm performance. The less the strategic similarity, other things being equal, the more difficult tacit coordination becomes and the more vigorous is rivalry likely to be in the industry. This reasoning has become known as the Caves-Porter hypothesis.

The hypothesis that strategic similarity leads to reduced rivalry has been subject to major caveats and challenges. Even Porter (1976) warned that strategic similarity per se does not have a determinant effect on rivalry because increased strategic similarity is often associated with increased market

interdependence (the product offerings of the firms are closer substitutes). Such reasoning agrees with the predictions of industrial organization (IO) models of product differentiation (Hotelling 1929; Beath and Katsoulakos 1991), which suggest that a critical advantage of product differentiation is the relaxation of price competition (D'Aspremont, Gabszewicz, and Thisse 1979). Thus, strategic similarity in intra-market positioning could actually be associated with more intense rivalry in that the effect of lack of product differential outweighs the effect of increased coordination.

A study of gasoline prices by Shepard (1991) evaluated price dispersion and price discrimination in the context of two groups of gasoline retailers; full-service and low-service, as well as consumer heterogeneity related to differences in consumers' willingness to pay. She found that price dispersion can occur in multi-firm markets due to full-service gasoline retailers having sufficient local market power to allow them to price discriminate, maintaining price differentials approximately twice as large as the differential at low-service gasoline retailers. This implies that strategic dissimilarity among competing firms will likely increase price dispersion and that network airlines in a market should have greater price dispersion than in markets served only by low-fare airlines.

Gimeno and Woo (1996) studied the effects of multi-market contact and strategic similarity on intensity of rivalry in the airline industry. Gimeno and Woo perform an empirical analysis of over 3,000 city-pair markets in the U.S. airline industry. They focused on the effects of changes in strategic similarity in a city-pair market on the prices charged by airlines in that market. Other



important factors which influence prices, such as service attributes, market characteristics, cost positions, market structure and firm-specific advantages, were rigorously controlled. Their findings support the hypothesis that strategic similarity will increase the intensity of rivalry experienced by a firm, which in turn leads to less price dispersion. These empirical studies in support of the research on hyper-competition and product differentiation lead to the following hypothesis:

H<sub>2</sub>: The degree of strategic similarity among firms in a local market is negatively related to price dispersion in the local market.

Note: The smaller the STS value, the more airlines of dissimilar strategy are competing on the route and as a result, price dispersion is expected to be larger.

### ***Market Concentration within a Local Market***

Market concentration is the degree of dominance of firms selling similar products within a specific market. The number of firms in a market and the market share distribution has long been viewed as an indicator of rivalry and profitability by industrial organization (IO) economists. Greater concentration of market share provides the dominant firms market power. In the extreme case of concentration, a single firm totally dominates the market. In this monopolistic condition, the firm's high level of market power typically results in higher prices than occur when there is substantial competition in the market.

The concept that greater market concentration leads to increased market power of dominant firms and resulting in higher prices, has been well documented and is one of the main reasons for the U.S. Government monitoring and limiting industry concentration.

Market concentration is typically measured by the Herfindahl index (also referred to as the Herfindahl-Hirshman index), which is the market share for each firm competing within a market, squared. Market concentration is one of the independent variables applied by Borenstein and Rose (1994), Hayes and Ross (1998), and Zhao (2006) to evaluate the causes of price dispersion. In the Borenstein and Rose (1994) study, the Herfindahl index was calculated based on the number of flights of specific flights on a given city-pair route, which they then applied to evaluate price dispersion among airline passengers on a limited number of routes. Hayes and Ross (1998) calculated the Herfindahl index based on the number of passengers served by airlines within the terminal. They used this measure of market concentration to evaluate price dispersion. Zhao (2006) calculated the Herfindahl index based on the sales of brands of specific product categories, which she then applied to evaluate price dispersion among airline passengers on a limited number of routes. All three of these studies found the expected result that price dispersion is inversely related to concentration. Simply stated, the more concentrated the market, price dispersion tends to be reduced.

In this study, the city-pair route is the sub-market of interest and therefore, concentration of airlines is calculated using the Herfindahl index methodology

on each city-pair route. The following hypothesis reflects the expected and important inverse relationship between market concentration (city-pair routes in this study) and price dispersion.

H<sub>3</sub>: The degree of market concentration in a local market is negatively related to price dispersion in the local market.

### ***Market Size***

Market size has been measured in several ways, such as the number of customers or sales volume (monetary value or units sold). In this current study, market size is the volume of passengers on a city-pair route relative to the most frequently traveled route. In essence, market size measures how many passengers travel on the route, regardless of the number of airlines on the route.

Stigler's (1961) classic, conceptual article on price dispersion briefly discussed market size as a potential source of price dispersion. He made the point that as markets grow, there is a greater likelihood of there being a common source for the collection and selling of information (e.g., trade journal of specialized broker). If this information includes price data, increased availability of information should reduce price dispersion. By applying this rationale to this study, it seems logical that in larger markets where there are more customers, there is a greater incentive to provide information to customer about the choices (including prices) that are available, thereby encouraging firms to compete more aggressively on price, which should reduce price dispersion.

In Borenstein and Rose's (1994) study, they measured market size (referred to as market density) by the total number of flights on the route. Borenstein and Rose found that in larger markets, there is less price dispersion. This finding is consistent with models of monopolistic competitive price discrimination (Borenstein, 1985; Holmes, 1989), as well as this current study. The rationale of this finding is that in larger markets there are more customers, who increase the competitive pressure on the airlines, resulting in less price dispersion.

Gimeno and Woo (1996) studied the U.S. airline industry with the focus on variables that might affect the yield (i.e., fare divided by route distance). They evaluated several passenger density variables. One of those passenger density variables measured market size of hubs. Gimeno and Woo found hub density to be positive related to yield. Higher levels of yield result in higher average prices, which some prior research (e.g., Ancarani and Shankar 2004; Xing, Yang, and Tang 2006) has shown to result in larger price dispersion. This rationale is based on the reasoning that larger markets attract more airlines, which are likely to result in greater variation in prices. This rationale is counter to the expectation of market size in this study and may be due the measurement of passengers at the hub airport rather than the city-pair route. However, the results of Gimeno and Woo's study lend support to the hypothesis regarding hubs (hypothesis 6 below) of this study.

Borenstein and Rose found larger market size to lower individual airlines' price dispersion. This is counter to the Gimeno and Woo results, which may have been due to Gimeno and Woo's measurement of market size and may be

correct for price dispersion at hub airports. Fundamentally, the differences in the outcomes of these studies may lie in who has greater market power, the sellers or the buyers. If the sellers have more power, there is greater price dispersion. Conversely, if the buyers have more power, there is less price dispersion. In the case of the airline ticket market, in larger markets, the consumers seem to have more power and therefore, price dispersion tends to decrease.

The Borenstein and Rose study is more similar to the situation in this current study and therefore greater market size is expected to decrease price dispersion. Stigler's rationale and Borenstein and Rose's findings support the hypothesis that market size will increase the intensity of rivalry experienced by a firm. These empirical studies and this rationale support the following hypothesis:

H<sub>4</sub>: The size of the local market is negatively related to price dispersion in the local market.

### ***Route Distance***

Route distance is the linear distance between the cities at each end of the city-pair route. This variable was applied as an independent variable by several researchers (e.g., Borenstein 1989; Evans and Kessides 1994; Hayes and Ross 1998) to evaluate pricing related dependent variables. Borenstein (1989) evaluated the importance of route and airport related variables on price levels on

airline routes. One of the route variables is route distance and they found route distance to be positively related to the price level on city-pair routes.

Evans and Kessides (1994) also studied the effects of numerous variables including route distance on price levels on airline routes. Their finding was that route distance is positively related to the price level on city-pair routes. Route distance was applied by Hayes and Ross (1998) to evaluate the causes of price dispersion and scaled route distance. Their research found that dispersion is greater on longer route distances. This leads to the following hypotheses that on longer route distances there tends to be greater price dispersion.

H<sub>5</sub>: The distance of a city-pair route is positively related to price dispersion on the route.

### ***Hub Airport***

In 1978, the U.S. Congress enacted the Airline Deregulation Act, which transformed the domestic airline industry from extensive government regulation to a new era of competition (Nannes 2000). Airlines were permitted to enter and leave domestic markets without government authorization and to set prices and conditions of service. These actions would be subject to antitrust laws, the Civil Aeronautics Board (CAB) retained jurisdiction over mergers and acquisitions and its authority to prohibit unfair practices.

Prior to the Airline Deregulation Act, carriers largely provided point-to-point service. Following deregulation, the airlines began to consolidate their operations at specific airports, forming what came to be known as hubs. A

“hub” airline combines “local” passengers (i.e., those originating at or destined to the hub) with “connecting” passengers (i.e., those passing through the hub) on the same flight. The approach, referred to as hub-and-spoke, allows “hub” airlines to serve more cities from their hubs (known as spoke routes) and offer greater frequency of service with its aircraft than had been possible with point-to-point service.

Notwithstanding the benefits, the dominance of spoke routes by hub airlines raises concern about the exercise of market power on those routes. Research has shown that airlines can and do charge higher prices on routes connected to hubs than on non-hub routes where they face more competition. Hub control is a measure of market power (Borenstein 1989). Borenstein found that airlines had greater market power in their hubs and as result, price levels were higher and price dispersion was less on routes. In the current study, the focus is on price dispersion that occurs on the city-pair route for all of the airlines in the study and not the pricing of individual airlines, as is the case with Borenstein (1989). Hayes and Ross (1998) applied this variable and found that price dispersion was less in hub airports than in non-hub airports. This leads to the following hypotheses that less price dispersion is expected at hub routes.

H<sub>6</sub>: When a city-pair route is connected to a hub airport, there is a negative effect on price dispersion on the route.

### ***Multi-Market Contact and Strategic Similarity Interaction***

The effect of multi-market contact on price dispersion is expected to be moderated by strategic similarity. Strategic management literature that is based on the Harvard approach to strategic groups (Hunt 1972; Porter 1976; Caves and Porter 1977) argues that strategically similar firms tend to compete less aggressively. A common rationale as implied by Caves and Porter (1977) is that firms that are structurally similar lead these firms to recognize their interdependencies and anticipate their tactical moves, allowing tacit collusion. Conversely, strategically dissimilar firms require more information and more accuracy to achieve the same level of tacit collusion as the strategically similar firms. Researchers have found evidence of this collusive behavior between strategically similar firms (e.g., Peteraf 1993b, Young, Smith, Grimm, and Simon 2000).

Based on the arguments of the Harvard approach, Young, Smith, Grimm, and Simon 2000 consider multi-market contact and strategic similarity as alternative means of gaining information that facilitates mutually beneficial cooperation. Therefore, in relationships between firms with high levels of strategic similarity in a market, the impact of multi-market contact is small given that the strategic similarity provides sufficient mutual forbearance to encourage cooperation as reduced competitiveness. Conversely, the reduction in informational exchange between strategically dissimilar firms would increase the influence of multi-market contact.

Fuentelsaz and Gomez (2006) studied the influence of multi-market contact and strategic similarity on market entry decisions in the Spanish banking market.



One of the interactions evaluated in their study is the effect of multi-market contact on mutual forbearance when considering differences in strategic similarity between rival firms. Fuentelsaz and Gomez (p. 491) determined that “the effect of multi-market contact on mutual forbearance becomes more intense (lower entry rates) as multi-market rivals are [more] strategically dissimilar” (i.e., less strategically similar). Stated more simply, they found that increasing multi-market contact lowers market entry rates when rivals are less similar. Lower entry rates indicate less interest in competing in markets where a strong, competitive retaliation by incumbent firms with different strategies is anticipated.

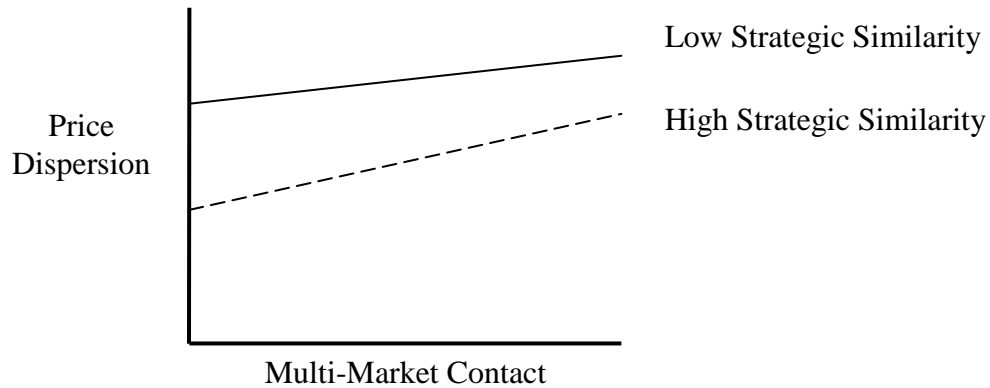
Prior research on multi-market contact shows that as competitive pressure among rival firms is reduced, price dispersion increases. Therefore, in the context of price dispersion, it is predicted that when the degree of strategic similarity between competing firms is greater, multi-market contact has a greater effect on price dispersion. The following hypothesis reflects this rationale.

H<sub>7</sub>: When the degree of strategic similarity in a market is greater, the effect of multi-market contact on price dispersion increases.

Figure 2 (below) is a graphical representation of this hypothesis. The figure shows that at high levels of strategic similarity, multi-market contact has a greater effect on price dispersion. Notice that the ‘high strategic similarity’ is below the ‘low strategic similarity’ line. When strategic similarity in a market is greater (‘high strategic similarity’ in the graph), the effect of multi-market

contact on price dispersion is greater than when strategic similarity is less ('low strategic similarity' in the graph), as stated in the hypothesis.

**Figure 2 – Graphical Representation of  $H_7$**



***Multi-Market Contact and Market Concentration Interaction***

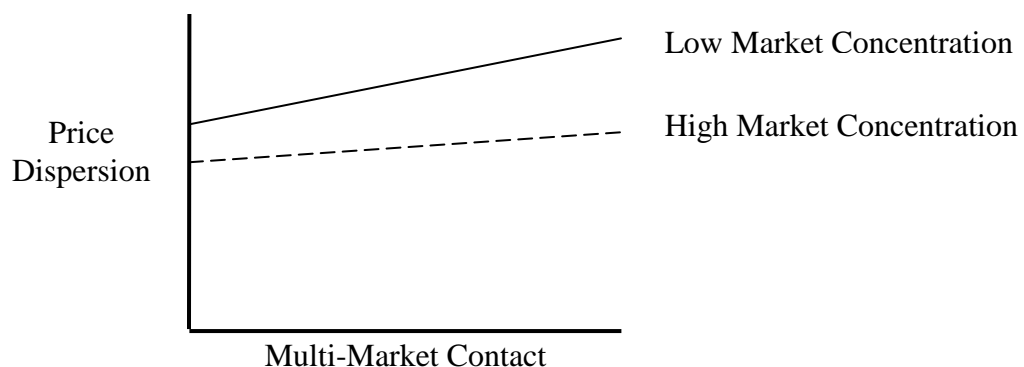
The effect of multi-market contact on price dispersion is also expected to be moderated by market concentration (Jayachandran, Gimeno, and Vanadarajan 1999). The market share distribution (i.e., market concentration) of firms competing in a market has been shown to indicate intensity of rivalry, price levels, and profitability by industrial organization (IO) economists (Fuentelsaz and Gomez 2006). Based on this research and other research focused on price dispersion, market concentration is expected to be an influencing factor on price dispersion, as explained in the main effect hypothesis ( $H_3$ , above) that relates to market concentration. The effect that market concentration can have on mutual forbearance and tacit collusion has also been explained in prior multi-market contact literature, which emphasizes its moderating influence.

Fuentelsaz and Gomez (2006) hypothesized that the effect of multi-market contact on mutual forbearance would decrease in more concentrated markets. In the price dispersion context, it is predicted that when there is greater concentration of the firms in a market, the effect of multi-market contact on price dispersion is reduced. The following hypothesis reflects this rationale.

H<sub>8</sub>: When market concentration is greater, the effect of multi-market contact on price dispersion decreases.

Figure 3 (below) is a graphical representation of this hypothesis. The figure shows that at high levels of market concentration, multi-market contact has a lesser effect on price dispersion. Notice that the ‘high market concentration’ is below the ‘low market concentration’ line. When market concentration in a market is greater (‘high market concentration’ in the graph), the effect of multi-market contact on price dispersion is less than when market concentration is less (‘low market concentration’ in the graph), as stated in the hypothesis.

**Figure 3 – Graphical Representation of H<sub>8</sub>**



### ***Strategic Similarity and Market Concentration Interaction***

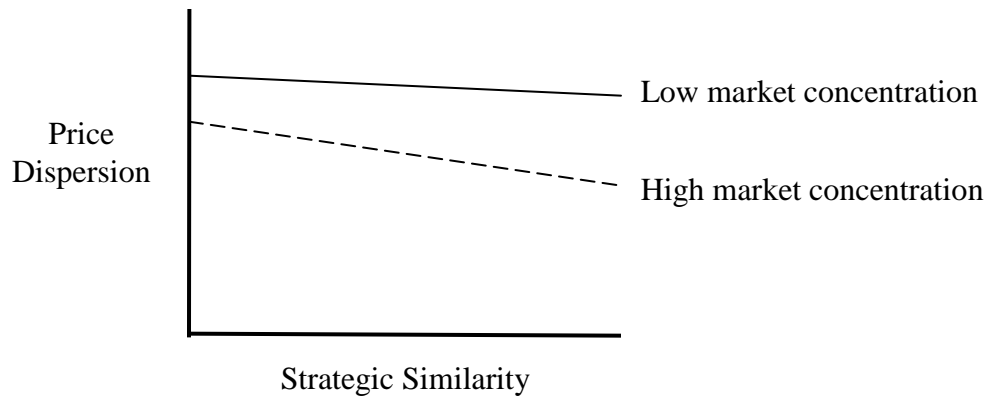
After an extensive review of relevant literature, the author is not aware of any research on the interaction of strategic similarity and market concentration. Fuentelsaz and Gomez (2006) studied the effect on price dispersion of two related interactions; multi-market contact with strategic similarity and multi-market contact with concentration, but they did not study the interaction of strategic similarity and market concentration. However, this would be a logical consideration given these two interactions evaluated by Fuentelsaz and Gomez. Similar to the rationale for multi-market contact, the effect of strategic similarity on price dispersion is expected to be moderated by market concentration.

As stated previously, market concentration has been shown to indicate intensity of rivalry, price levels, and profitability by economists, and is expected to influence price dispersion. Since strategic similarity and multi-market contact are considered alternative means of explaining mutually beneficial cooperation (i.e., mutual forbearance) (Young, Smith, Grimm, and Simon 2000), it is a reasonable expectation that market concentration will moderate strategic similarity's affect on price dispersion in a comparable, although opposite in direction, manner, as it moderates multi-market contact. For this reason, it is predicted that in markets where there is greater market concentration, the effect of strategic similarity on price dispersion increases. The following hypothesis reflects this rationale.

H<sub>9</sub>: When market concentration is greater, the effect of strategic similarity on price dispersion increases.

Figure 4 (below) is a graphical representation of this hypothesis. The figure shows that at high levels of market concentration, strategic similarity has a greater effect (i.e., more negative) on price dispersion. Notice that the ‘high market concentration’ is below the ‘low market concentration’ line. When market concentration in a market is greater (‘high market concentration’ in the graph), the effect of strategic similarity on price dispersion is less than when market concentration is less (‘low market concentration’ in the graph), as stated in the hypothesis.

**Figure 4 – Graphical Representation of H<sub>9</sub>**



## **CHAPTER IV**

### **METHODOLOGY & DATA**

This chapter begins by presenting background on the U.S. airline industry. Then, the data used for testing the hypotheses are discussed. This is followed by the empirical model and a description of each of the variables and the method of calculation. Finally, multiple regression, the multivariate analysis technique applied to evaluate the variables in this study, is discussed.

#### ***U. S. Airline Industry***

The airline industry in the U.S. is a relatively new industry, dating back to the early twentieth century. The Civil Aeronautics Board was created in 1938 to regulate the airline industry and it existed until 1984. The airline industry was a heavily regulated industry until 1978 when the U.S. government “deregulated” (i.e., dramatically reduced regulations) the airline industry. These reduced regulations resulted in greater price competition and the creation of the hub-and-spoke system (Rubin and Joy 2005).

The airline market is characterized by an oligopoly market structure, a form of imperfect competition in which a limited number of firms dominate the industry (Rubin and Joy 2005). Oligopoly firms have market power in setting

prices for their products. Firms in oligopoly market structures may produce homogeneous or heterogeneous products. Airlines competing in the airline market produce homogeneous products and competitors readily know their prices. Therefore, the airlines are interdependent and recognize that their market power is vulnerable to erosion by competitors.

### ***Data Description***

The data used in this study are from the Origin and Destination Survey of Air Passenger Traffic. The Origin and Destination database consists of a 10% random sample of all airline passenger tickets issued by all airlines on a quarterly basis. This study focuses on routes of seven network and ten low-fare airlines during the first quarter of 1999. Data are available for each city-pair route. For cities with multiple airports, the data are at the airport level.

The data set consists of several, very large spreadsheets of data. One spreadsheet contains average prices paid by consumers for each city-pair route and each airline on the route on a quarterly basis. There are approximately 38,000 rows of data. There are approximately 7,000 city-pair routes in the U.S. in this data set. In this study, only the routes with two or more airlines on a route are included. As a result, 5,974 routes are included in this study. The range of airlines on a route is from one to twelve with an average of 5.4 airlines per route.

A second spreadsheet contains the number of passengers that purchased tickets for each city-pair route and each airline on the route on a quarterly basis in the same format as the first spreadsheet. There are approximately 38,000 rows of data. A third spreadsheet contains the route distances for each city-pair

route. These spreadsheet contain the data that is used in this study to evaluate the effects of competition and market structure on price dispersion.

### ***Method – Multiple Regression***

Multiple regression analysis is applied in this study since it is the appropriate method of analysis when the research problem involves a single, metric dependent variable believed to be related to two or more independent variables (Hair, Anderson, Tatham, and Black 1998); with some of the independent variables being metric. In this study, the dependent variable is price dispersion and the independent variables are shown in the model and described below. Hair, Anderson, Tatham, and Black identify four major assumptions underlying multiple regression; (1) linearity of the phenomenon being measured, (2) constant variance of the error terms, (3) independence of the error terms, and (4) normality of the error distribution. “The principal measure of prediction error for the variate is the residual---the difference between the observed and predicted values for the dependent variable (Hair, Anderson, Tatham, and Black 1998, p. 172).

1. *Linearity of the phenomenon* represents the degree to which the change in the dependent variable is related to change in independent variable. In order to examine the effect of an individual independent variable on the dependent variable, partial regression plots can be performed. There are numerous mathematical techniques (e.g., logarithms) that can be applied to linearize non-linear relationships between variables.

In multiple regression, an examination of the residuals shows the combined effects of all independent variables, and therefore, the effect of



individual independent variables cannot be examined. To do this, partial regression plots are used to show the relationship of a single independent variable to the dependent variable. In the partial regression plots, a curvilinear pattern of residuals indicates a nonlinear relationship between the independent variable and the dependent variable. Also, evaluating one independent variable at a time facilitates the identification of outliers or influential observations.

2. *Constant variance of the error terms* means that the variance of the error terms is uniform over the range of values of the variables in the analysis. Heteroscedasticity occurs when the residual variance varies with the values of an independent variable. This can be detected when examining residual plots. If the distribution of residuals is uniform as the value of the independent variable changes, then there is little or no heteroscedasticity, also called homoscedasticity. On the other hand, if the distribution of residuals is not uniform as the value of the independent variable changes, then there is heteroscedasticity. The less uniform that the distribution is, the greater the heteroscedasticity. Heteroscedasticity weakens the predictive capability of a regression model (Wang and Akabay 1994).

The three most common causes of heteroscedasticity are (Wang and Akabay 1994):

- a. Where the database of one or more independent variables contains a large range of values.

- b. Where the parity between the growth rate of dependent variables and independent variables varies appreciably during the modeling process. This is only applicable to time series data.
- c. Where there exists heterogeneity in the data. This is more likely to occur with cross-sectional data than with time series. As an example, data of price levels on different routes will not likely be uniform. If such data were pooled together in regression modeling using the OLS (ordinary least squares) method, the problem of heteroscedasticity would arise. In estimating the coefficients of the model, the OLS method gives equal weight to each data point, resulting in heteroscedasticity.

According to Hair, Anderson, Tatham, and Black 1998 (p. 174), “the presence of unequal variances (i.e., heteroscedasticity) is one of the most common assumption violations”. Two possible remedies for heteroscedasticity are available. If the problem occurs with a single independent variable, the procedure of weighted least squares can be employed. If the problem is more general, variance-stabilizing transformations can be performed on the independent variables.

- 3. *Independence of the error terms* - It is assumed in regression that each predicted value is independent. In other words, individual predicted values are not sequenced by any variable. Violations of this assumption are identified by a consistent pattern in the residuals, for example, a shift in residuals due to changes in season when there is no seasonality variable.

Data transformations, such as inclusion of independent variables to tackle the shift in residuals, can fix this problem.

4. *Normality of the error distribution* - Non-normality of the error term can be identified by a visual check for normal distribution of a histogram of the residuals or normal probability plots. If non-normality of the error term exists, transformations can be performed on the independent variables to improve normality.

### ***Multicollinearity and Multiple Regression***

Multicollinearity is the “extent to which a variable can be explained by the other variables in the analysis. As multicollinearity increases, it complicates the interpretation of the variate as it is more difficult to ascertain the effect of any single variable owing to the interrelationships” (Hair, Anderson, Tatham, and Black 1998, p. 2). “Multicollinearity represents the degree to which any variable’s effect can be predicted or accounted for by the other variables in the analysis. As multicollinearity rises, the ability to define any variable’s effect is diminished” (Hair, Anderson, Tatham, and Black 1998, p. 24).

Multicollinearity occurs when intercorrelations among the independent variables are very high (Malhotra 1999, p. 548). “When multicollinearity is present, special care is required in assessing the relative importance of independent variables. In applied marketing research it is valuable to determine the relative importance of the [independent variables]. In other words, how important are the independent variables in accounting for the variation in the dependent variable” (Malhotra 1999, p. 549). Unfortunately, there is no

unambiguous measure. However, several approaches are commonly used to assess the relative importance.

1. *Statistical significance.* If the partial regression coefficient of a variable is not significant, as determined by the  $F$  test, that variable is judged to be unimportant.
2. *Square of the simple correlation coefficient.* The measure,  $r^2$ , represents the proportion of the variation in the dependent variable explained by the independent variable in a bivariate relationship.
3. *Square of the partial correlation coefficient.* The measure,  $R^2_{yxixj\backslash k}$ , is the coefficient of determination between the dependent variable and independent variable, controlling for the effects of the other independent variables.
4. *Square of the part correlation coefficient.* This coefficient represents an increase in  $R^2$  when a variable is entered into a regression equation that already contains the other independent variable.
5. *Measures based on standardized coefficients or beta weights.* The most commonly used measures are the absolute values of the Beta weights or squared values.

### ***Empirical Model***

The following equation is the empirical model for the conceptual model described above and evaluated in this study.

$$\begin{aligned} PRD_{ij} = & \beta_0 + \beta_1 MMC_{ij} + \beta_2 STS_{ij} + \beta_3 HHI_{ij} + \beta_4 MSZ_{ij} + \beta_5 DST_{ij} \\ & + \beta_6 HUB_{ij} + \beta_7 MMC_{ij} \times STS_{ij} + \beta_8 MMC_{ij} \times HHI_{ij} \\ & + \beta_9 STS_{ij} \times HHI_{ij} + \varepsilon_{ij} \end{aligned}$$

where;  $i$  and  $j$  are the city pairs.

$PRD$  = price dispersion

$MMC$  = multi-market contact

$STS$  = strategic similarity

$HHI$  = market concentration

$MSZ$  = market size

$DST$  = route distance

$HUB$  = hub airport

$\varepsilon_{ij}$  = error term

The following Table I briefly describes the dependent variable, price dispersion, and each independent variable. The measurement and type of data for each variable is also provided. All of the variables are metric with the exception of hub airport, which is dichotomous. A detailed explanation of these variables follows Table I.

***Table I – Variable Measurement and Data Summary***

<b>Variable</b>	<b>Measurement</b>	<b>Type of Data</b>
<b>Price Dispersion</b>	Gini Coefficient (see p. 85-90 for description and formula)	Average Quarterly Price and Average Quarterly Number of Passengers on Routes and Airlines
<b>Multi-Market Contact</b>	Multi-Market Contact (see p. 91-92 for description and formula)	Routes and Airlines
<b>Strategic Similarity</b>	Level of Strategic Similarity (see p. 92-94 for description and formula)	Airline Classification, Routes, and Airlines
<b>Concentration</b>	Herfindahl-Hirschman Index (see p. 94-95 for description)	Airline, Route, and Average Quarterly Number of Passengers on Routes and Airlines
<b>Market Size</b>	Number of Passengers on Route Relative to Most Traveled Route (see p. 95 for description)	Average Quarterly Number of Passengers on Routes
<b>Route Distance</b>	Length of Route Relative to the Longest Route (see p. 95 for description)	Route Distances
<b>Hub Airport</b>	Route Connected to Hub = 1, Route with No Hub = 0 (see p. 95-96 for description)	Hub Airports

### ***Dependent Variable - Price Dispersion***

Economists have been measuring inequalities of factors, such as income and price, for decades. Income inequality was one of the earliest variables to be evaluated by economics researchers. Price inequality (i.e., price dispersion) has been given attention by researchers in more recent times. The Gini coefficient, which is applied to price dispersion in this current study, was originally developed for use in evaluating income equalities across populations of people, but Gini is equally effective in evaluating price differences across populations of customers.

Price dispersion has been measured in many ways. Some of the ways price dispersion has been measured are; the Gini coefficient (e.g., Borenstein and Rose 1994; Hayes and Ross 1998; Restuccia and Urrutia 2001), range (e.g., Stigler 1961, Brynjolfsson and Smith 2000), trimmed range (e.g., Brynjolfsson and Smith 2000), standard deviation (e.g., Stigler 1961; Brynjolfsson and Smith 2000), coefficient of variation (e.g., Zhao 2006), the Atkinson measure (e.g., Hayes and Ross 1998), the entropy index (e.g., Hayes and Ross 1998), kernel density plots (e.g., Brynjolfsson and Smith 2000), and percentage gap (e.g., Baye, Morgan, and Scholten 2004).

The Gini coefficient measures the degree of inequality of a variable in a distribution of its elements (Rodrique, Comtois, and Slack 2009). The Gini coefficient has been selected as the measure of price dispersion in this current study because it has been shown to be very effective in evaluating price dispersion in studies by Borenstein and Rose 1994; Hayes and Ross 1998; Restuccia and Urrutia 2001. Other similar measures have produced similar

results (e.g., Restuccia and Urrutia 2001) supporting the validity of the Gini coefficient as a measure of price dispersion. As explained by Borenstein and Rose (1994, p. 656), “Multiplying the Gini coefficient by two gives the expected absolute difference in prices as a proportion for the mean price for two customers drawn at random for a population. A Gini of 0.10 therefore implies an expected absolute price difference of 20 percent of the mean fare”.

Gini is calculated from the average price charged to customers by each airline for each city-pair route per quarter. The Gini coefficient (also referred to as Gini index or Gini ratio) is the most widely used statistical measure of income inequity and is derived from the Lorenz curve (Abounoori and McCloughnan 2003). When used to evaluate income inequalities, the Lorenz curve is a function of the cumulative proportion of income receivers relative to the corresponding cumulative proportion of income received. When applied to price dispersion, the Lorenz curve is a function the cumulative proportion of price payers (i.e., consumers) relative to the corresponding cumulative proportion of prices paid.

When an equation for the Lorenz curve can be derived, integration can be applied to calculate the relative proportion of the area between the straight, 45-degree line (i.e.; perfect equality) and the Lorenz curve. The Gini coefficient is a positive index of inequality, with values closer to unity associated with higher inequality. The Gini coefficient is expressed as (Abounoori and McCloughan, 2003, p. 505):

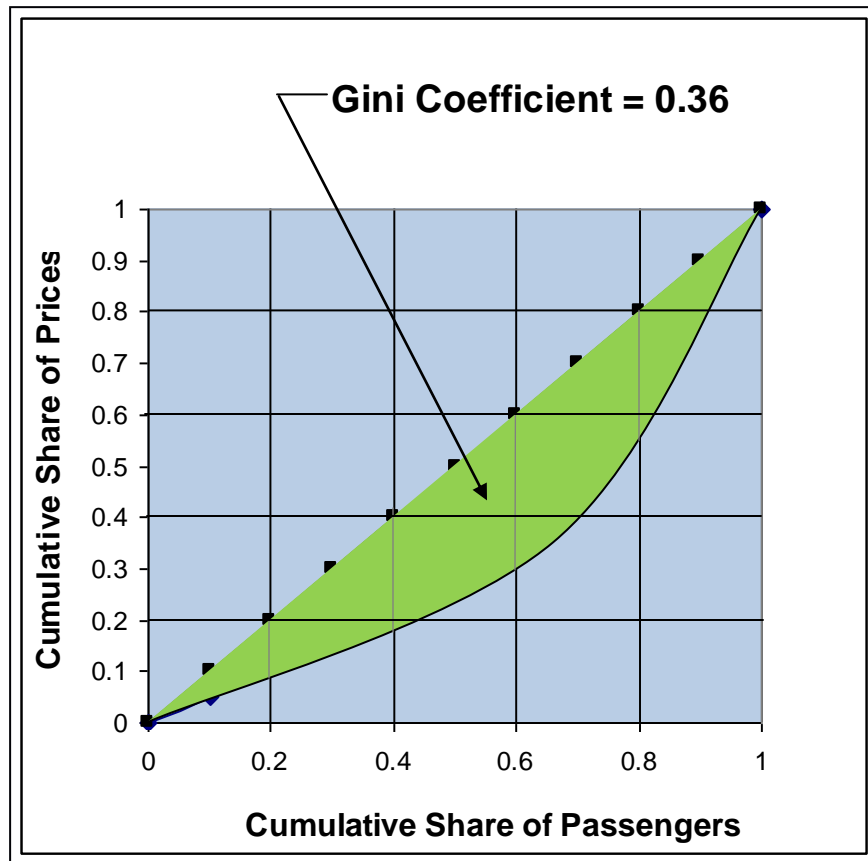


$$G = 1 - 2 \int_0^1 l(z)dz$$

where  $z$  in the context of price dispersion is the cumulative proportion of price payers (i.e., customers) and  $l$  is the corresponding cumulative proportion of prices paid.

Figure 5 provides an example of the Gini coefficient measurement of price dispersion. The Gini coefficient is based on comparing the cumulative share of price paid (vertical axis) relative to the cumulative share of passengers (horizontal axis). The curved line is a graphical representation of price dispersion. The area between the curved line and the  $45^\circ$  is the Gini coefficient; in this case 0.36. When there is less price dispersion, the Gini coefficient decreases and the price dispersion line approaches the  $45^\circ$  line. When there is more price dispersion, the Gini coefficient increases and the price dispersion line approaches the lower right corner.

**Figure 5 – Gini Coefficient Example**



However, with most large amounts of discrete data, such as the prices paid for airline tickets by customers, the Lorenz curve is a series of straight lines and several methods to accurately calculate the Gini coefficient have been developed (e.g., Lorenz 1905; Pyatt, Chen, and Fei 1980; Corwell 1995; Milanovic 1994, 1997). An article by Abounoori and McCloughan (2000) evaluates methods of calculating the Gini coefficient from both grouped and ungrouped data. Abounoori and McCloughan determined that the most accurate method for calculating the Gini coefficient from grouped data is the Malanovic (1994) method, which is applied in this research. See Abounoori and McCloughan,

2003, p. 507, equation 13 for calculating Gini for grouped data. Table 3 (p. 508) in the Abounoori and McCloughan articles shows an example of the Malanovic (1994) method.

The Gini coefficient is superior in this application to the other measures of inequality mentioned above, due to its inclusion of the measurement of non-normal (and non-uniform) distributions and the potential for calculated values to be continuous, range from zero to one, and ratio data. A value of zero value occurs when there is uniform prices, which means that there is zero price dispersion. The value of zero is referred to as 'perfect equality' and occurs on one route in this data set when there are two airlines with identical average prices. The value of one is referred to as 'perfect inequality' and does not actually occur because it would mean that all passengers except one pay nothing and one passenger pays something. In this data set, the largest Gini coefficient is 0.467.

A few other studies have applied standard deviation (e.g., Brynholfsson and Smith (2000) and Ancarani and Shankar (2004)). These studies are focused on comparing price dispersion of Internet retailers to traditional brick-and-mortar retailers with the product typically being books or CDs. An underlying assumption in applying standard deviation to price dispersion is that the prices are normally distributed. In the case of the airline prices in this study, prices are typically not uniformly distributed.

Another measure of inequality based on the standard deviation that has been applied to evaluate price dispersion is the coefficient of variation (Zhao 2006).

One of the benefits of using the standard deviation and coefficient of variation is the ease of calculation compared to calculation the Gini coefficient. However, it has some limitations and with current computational technology, it is possible to calculate the Gini coefficient for large data sets in a reasonable time.

A major limitation of applying standard deviation and coefficient of variation to price dispersion in some applications is the lack of comparable reference from one situation to another, as in the case of airline routes. Unlike the price of a specific book or a specific CD, the standard deviation from one route to another is often quite different, thereby precluding a simple direct comparison between the two routes. In contrast, the Gini coefficient is directly comparable from one route to another because it is calculated on the basis of the difference between the cumulative share of passengers and the cumulative share of prices paid to the line of ‘perfect equality’.

### ***Independent Variables***

The following is a description and calculation method for each of the independent (i.e., predictor) variables applied in this study.

**Multi-market contact** is a measure of the potential for strategic market encounters between airlines (Baum and Korn 1996). Baum and Korn (1996) developed a methodology for evaluating the level of competition between firms that compete in many different local markets. In an earlier study, Evans and Kessides (1994) used average route contact as their measure of multi-market contact, resulting in values from 0 to over 400. Baum and Korn’s methodology is based on calculating (for only the firms competing in a sub-market) the number of other sub-markets where the firms compete and then divides this

number by the maximum number of potential sub-markets where the firms could compete. The range of values for the Baum and Korn approach to measuring multi-market contact is zero to one. This study applies the Baum and Korn methodology.

The multi-market contact for firm  $i$  in a focal market  $m$  is measured using the number of contacts that firm  $i$  has with the competitors in market  $m$  competing in markets different from focus market  $m$  at time  $t$  as follows:

$$MMC_{int} = [\sum_{j \neq i} \sum_m (D_{imt} \times D_{jmt})] / [\sum_m D_{imt} \times N_{MMCt}], \text{ for all } j \sum_m (D_{imt} \times D_{jmt})] > 1$$

where;  $D_{imt}$  is an indicator variable set equal to one if firm  $i$  is active in a market  $m$  at time  $t$  and to zero otherwise.

$N$  is the number of firms  $j$  that contact the focal firm  $i$  in market  $m$  that are multi-market contacts (i.e., that firm  $i$  encounters in at least one market other than  $m$ ) and all other terms are as defined above.

As stated above, the range of values of multi-market contact using the Baum and Korn approach is zero to one. Multi-market contact can vary from zero, when there is no multi-market contact, to one, when firm  $i$  engages all other firms in market  $m$  in all of  $M$  in its own markets. Given that similar indices have been previously used (e.g., Baum and Korn 1996, Gimeno and Woo 1996, Young, Smith, Grimm, and Simon 2000; Fuentelsaz and Gomez

2006), this approach to measuring multi-market contact provides the possibility of comparing the results of this study with those of the earlier studies.

**Strategic similarity** is the average of strategic similarity/dissimilarity categorizations between firm  $i$  with every competitor  $j$  in the focus market (i.e., sub-market)  $m$ . Strategic similarity at the firm level is zero or one, a dichotomous variable. Following the methodology applied by Gimeno and Woo (1996), if the airlines are of the same classifications, their strategy is expected to be similar and the two competing airlines (within a specific city-pair route) are given a value of one. The one applies to either network-to-network airlines or low-fare-to-low-fare airlines. When the two airlines are of different classifications (i.e., different strategies), the value is zero. Strategic similarity is calculated by taking the average of airline pairings of similar and dissimilar strategies. The larger the strategic similarity value, the more airlines of similar strategy are competing on a route. The methodology applied in this study is also similar to Shepard's (1991) study in that she separated gasoline retailers into two groups; full-service and low-service retailers.

The operationalization of strategic similarity follows the discrete classification scheme used by the U.S. Bureau of Transportation Statistics (BTS), which classifies airlines as; (1) network (i.e., national, full in-flight service), such as American Airline, (2) low-cost (i.e., low fare with limited routes and limited in-flight service), such as Southwest Airline, and (3) regional. In this study, two major groups of airlines are evaluated; network (also referred

to as legacy airlines) and low-fare airlines (also referred to as low-cost or discount airlines).

Airlines with the same BTS classification are likely to be strategically similar in their intra-market positioning, which should influence the intensity of their rivalry. Hence,

$$\text{Strategic similarity}_{ij} = \begin{cases} 1 & \text{if firms (e.g., airlines) } i \text{ and } j \text{ have the} \\ & \text{same BTS classifications,} \\ 0 & \text{if firms } i \text{ and } j \text{ have different BTS} \\ & \text{classifications.} \end{cases}$$

Because the intensity of rivalry experienced by a firm in a market is affected by the rivalry with all competitors in the market, the effect of strategic similarity to those competitors is aggregated by calculating the average strategic similarity between all firms  $j$  in market  $m$  (Gimeno and Woo 1996). If total competitive pairs <sub>$imt$</sub>  represents the number of competitive pairs of firms competing in market  $m$  at time  $t$ , the aggregate measures of strategic similarity in a market  $m$  are calculated as follows.

$$\text{STS}_{mt} = [\sum \text{strategic similarity}_{ijmt}] / \text{total competitive pairs}_{ijmt}$$

Strategic similarity can vary from *zero*, where there is no strategic similarity (e.g., two dissimilar firms competing in a market), to *one*, when all of the competing firms in a market are strategically similar (e.g., all network airlines or all low-fare airlines).

**Market concentration** is the degree of dominance by firms selling similar products within a specific market. Market concentration is typically measured by the Herfindahl index (HHI), which is calculated by squaring the market share for each firm (i.e., airline) competing within a market. In this study, the city-pair route is the sub-market of interest and therefore, concentration of airlines is evaluated on each city-pair route. The Herfindahl index is calculated using the number of passengers per airline on the city-pair route each quarter.

The Herfindahl index has been applied as an independent variable in many studies including Borenstein and Rose (1994) and Hayes and Ross (1998) to evaluate the causes of price dispersion in the airline industry. The Herfindahl index can vary from near zero, in a market where there is a very large number of firms competing, all with near zero market shares, to one, when there is only one firm with 100% market share.

**Market size** is the number of passengers on a city-pair route. Market size measures how many passengers travel on the route, regardless of the number of airlines on the route. Gimeno and Woo (1996) studied the U.S. airline industry with the focus on variables that might affect the yield (i.e., fare divided by route distance). One of those variables measured passenger volume at the hub. Borenstein and Rose (1994) applied a similar independent variable, based on the total number of flights. In this study, market size is calculated by dividing the number of passengers on the route by the maximum number of passengers on the route with the most passengers on a single city-pair route and can vary from



near zero, on a route where there are very few passengers, to one, the route with the most passengers.

**Route distance** is the linear distance between the cities at each end of the city-pair route. Route distances the United States vary from 11 to 2,770 miles. This variable has been applied in a several studies on pricing levels on airline routes (e.g., Borenstein 1989; Evans and Kessides 1994). Hayes and Ross (1998) applied this variable to evaluate causes of price dispersion and scaled route distance by dividing by 1,000. In this study, the route distance variable is calculated by dividing each city-pair route distance by the longest route distance resulting in values from nearly zero to one.

**Hub airport** is a zero or one, dichotomous variable, which indicates that an airline's hub is at one or both ends of the city-pair route. If neither endpoint is a hub, the value is zero and if either or both endpoints are hubs, the value is one. Hayes and Ross (1998) applied this variable to evaluate causes of price dispersion. Borenstein (1989) applied this variable and found it to be an indicator of market power.

## **CHAPTER V**

### **ANALYSIS & RESULTS**

Multiple regression and bivariate correlation are performed on the data from 5,974 city-pair routes in the United States. The data in this study are from the first quarter of 1999. The prices, number of passengers and routes of seventeen airlines; seven network airlines and ten low-fare airlines, are evaluated in this analysis. The six main effect variables and the three interaction variables described in Chapter 4 are evaluated.

#### *Multicollinearity between Multi-Market Contact and Strategic Similarity*

In Table II, the Pearson correlation matrix for the variables of interest is presented. The correlation analysis of the main effect variables shows a high correlation (0.81) between multi-market contact and strategic similarity. As explained previously (p. 76), high levels of multicollinearity between independent variables is an important concern because it reduces the clarity of interpretation of the effect of the independent variables involved on the dependent variable.

Table II also shows the correlation between multi-market contact and price dispersion to be greater than the correlation between strategic similarity and price dispersion. The correlation values indicate that multi-market contact has more influence on price dispersion than strategic similarity. Although correlations are not the same as regression coefficients, it does indicate the superiority of multi-market contact over strategic similarity, which is supported by the regression analysis, which is discussed in detail below.

**Table II – Correlation Matrix (n = 5,974)**

Variable	Correlation Coefficients				
	1	2	3	4	5
<b>(1) Price Dispersion</b>					
<b>(2) Multi-Market Contact</b>	0.08				
<b>(3) Strategic Similarity</b>	0.05	<b>0.81</b>			
<b>(4) Market Concentration</b>	-0.43	0.14	0.07		
<b>(5) Market Size</b>	-0.13	-0.29	-0.21	0.01	
<b>(6) Distance</b>	0.32	0.10	0.02	-0.37	-0.09

There are several suggested methods for resolving multicollinearity problems (Wang 1996). The choice of the remedial method depends on the circumstances of the analysis. It was determined through analysis that by eliminating either strategic similarity or multi-market contact would reduce the highest correlation from 0.81 to 0.37. Appendix 3 provides a detailed comparison of the hypothesized model and two versions of a revised model; one without the strategic similarity variable and the other without multi-market contact. The bottom row of Appendix 3 shows that adjusted  $R^2$  for each of the three models. The adjusted  $R^2$  (referred to as the adjusted coefficient of determination) indicates the proportion of variance explained by the independent

variables. The larger the adjusted  $R^2$  value, the greater the explanatory power of the regression equation, and the better the regression equation is at predicting the dependent variable. By eliminating strategic similarity and the related interactions from the model, the adjusted  $R^2$  only decreased by 0.006 (0.248 to 0.242). By contrast, eliminating multi-market contact and the related interactions from the model, the adjusted  $R^2$  decreased by 0.014 (0.248 to 0.234). This comparison shows that the model with multi-market contact explains more about the competitive causes of price dispersion than the model with strategic similarity.

An evaluation using a holdout sample was also conducted. The results are shown in Table III below. The holdout analysis was conducted by separating the data into two sets of an equal number of observations. One set, referred to as the estimation sample is used to evaluate each of the three models shown in Appendix 3. The second set, referred to as the validation set, is used to compare to the first set. The adjusted  $R^2$  is shown for each of the three models using three sets of data; the full data set previously discussed and the two half sets used in this holdout evaluation. Although each provides different results, an important overall observation is that the simplified model (with multi-market contact) performs better than the simplified model (with strategic similarity). This adds to the evidence that the simplified model (with multi-market contact) is preferable to the simplified model (with strategic similarity).

**Table III – Holdout Sample Evaluation**

Model	Adjusted R <sup>2</sup>					
	Full Data Set	Change from Full Model	Estimation Sample	Change from Full Model	Validation Sample	Change from Full Model
Full model - hypothesized	0.248	---	0.265	---	0.230	---
Simplified model (with MMC)	0.242	-2.4%	0.258	-2.6%	0.227	-1.3%
Simplified model (with STS)	0.234	-5.6%	0.248	-6.4%	0.220	-4.3%

Therefore, since similarity and the related interactions were not contributing much to the model, and after a thorough evaluation and thoughtful consideration, strategic similarity and the related interactions were dropped from the model in the interest of providing clarity of the influence of the remaining independent variables on price dispersion. It is also noteworthy that the beta values and coefficient estimates for multi-market contact and the interaction of multi-market contact and market concentration are much larger than the beta values and coefficient estimates for strategic similarity and the interaction of strategic similarity and market concentration. The rest of the discussion of results is based on a revised model that does not include strategic similarity or the related interaction terms.

#### *Multiple Regression Diagnostics*

As mentioned earlier in this study, there are four major assumptions underlying multiple regression; (1) linearity of the phenomenon being measured,

(2) constant variance of the error terms, (3) independence of the error terms, and (4) normality of the error distribution. The following briefly discusses the evaluation of multiple regression assumptions:

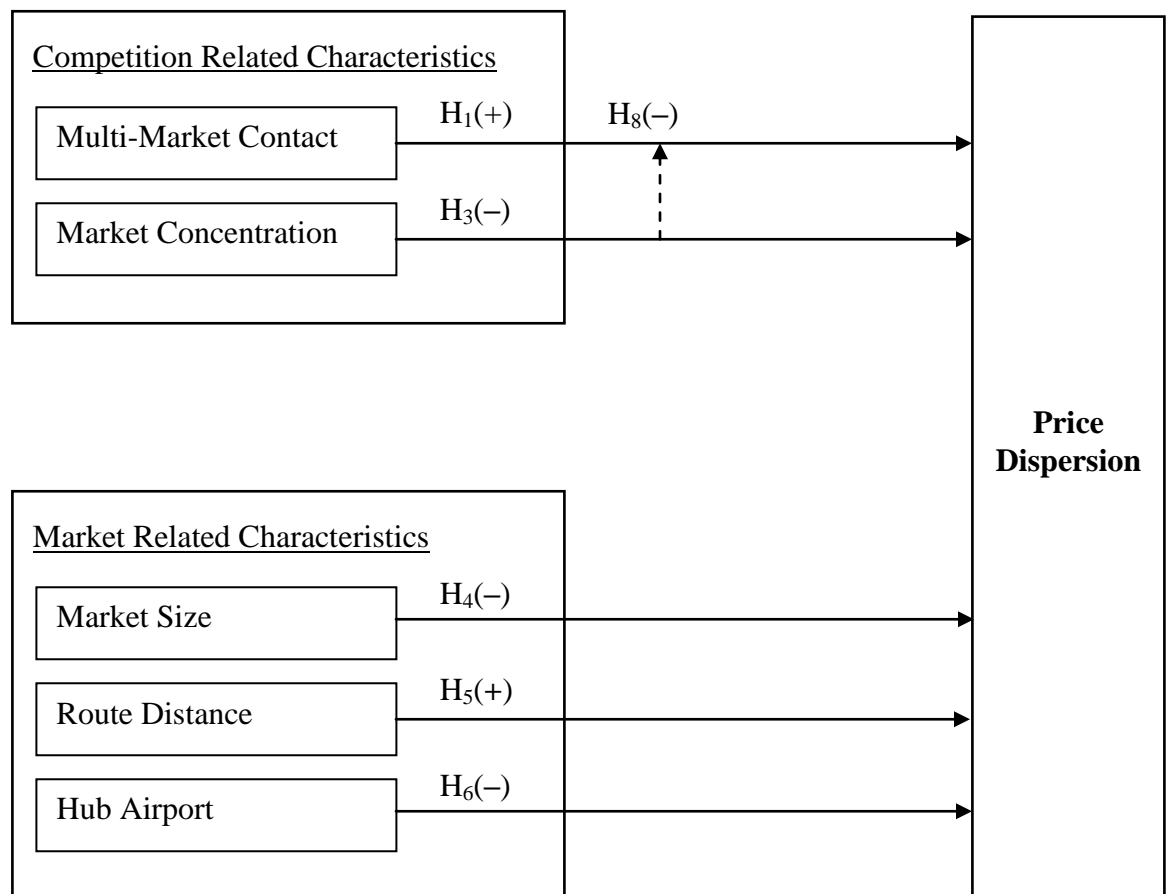
1. *Linearity of the phenomenon* was evaluated by reviewing partial regression plots. Partial regression plots are graphs that show the relationship between each of the independent variables and the dependent variable, and resulting residuals. A uniform distribution of residuals indicates a linear relationship. This review of partial regression plots indicated that a linear relationship exists between the dependent variable and each of the independent variables.
2. *Constant variance of the error terms* evaluated by examining residual plots. Residual plots are graphs that show the residuals relative to the values of the predicted dependent variable. A uniform distribution of residuals indicates homoscedasticity (i.e., uniform variance). The distribution of residuals is relatively uniform as the value of the dependent variable changes, indicating that there is little or no heteroscedasticity.
3. *Independence of the error terms* evaluated by examining residual plots. When the residuals are independent, the pattern of the plot appears random. There was no indication of individual predicted values being sequenced by any variable. Seasonality is an example of a sequencing variable.
4. *Normality of the error distribution* was evaluated by reviewing normal probability plots. Normal probability plots are graphs comparing the cumulative distribution of actual values with the cumulative distribution of

a normal distribution with normal distribution being represented by a straight, 45° line. The error distribution is reasonably close to a normal distribution.

### ***Revised Price Dispersion Framework***

The revised conceptual framework is illustrated in Figure 6 (below) along with the revised empirical model. Hypotheses 2, 7, and 9 are deleted due to strategic similarity being dropped from the model. The numerical sequence of the hypotheses is maintained consistent with the previous model and the hypotheses previously stated.

***Figure 6 – Revised Price Dispersion Framework***



Note: Dotted line indicates interaction between variables.

The following is the revised empirical model. The original model is on p. 77.

$$PRD_{ij} = \beta_0 + \beta_1 MMC_{ij} + \beta_3 HHI_{ij} + \beta_4 MSZ_{ij} + \beta_5 DST_{ij} \\ + \beta_6 HUB_{ij} + \beta_8 MMC_{ij} \times HHI_{ij} + \varepsilon_{ij}$$

where;  $i$  and  $j$  are the city pairs.

$PRD$  = price dispersion

$MMC$  = multi-market contact

$HHI$  = market concentration

$MSZ$  = market size

$DST$  = route distance

$HUB$  = hub airport

$\varepsilon_{ij}$  = error term



### ***Descriptive Statistics***

In Table IV, the means, standard deviations, and Pearson correlation matrix for the variables of interest are presented. The correlations between the independent variables are relatively small and therefore, multicollinearity is not a concern in this analysis. The largest correlation (0.37) is between market concentration and route distance, which is negatively correlated.

***Table IV - Descriptive Statistics (n = 5,974)***

Variable	Mean	Std Dev	Correlation Coefficients				
			1	2	3	4	5
(1) Price Dispersion	0.059	0.0006					
(2) Multi-Market Contact	0.248	0.0010	0.08				
(3) Concentration	0.458	0.0031	-0.43	0.14			
(4) Market Size	0.027	0.0008	-0.13	-0.29	0.01		
(5) Distance	0.416	0.0031	0.32	0.10	-0.37	-0.09	
(6) Hub	0.354	0.0062	-0.11	-0.19	0.02	0.34	-0.10

Table V shows the mean, standard deviation, high value, and low value for each variable. Rescaling was performed on the data because all but two of the variables have the potential range of 0 to 1; market size was rescaled by dividing all values by its maximum value of 41,826, and route distance was rescaled by dividing all values by its maximum value of 2,729.

***Table V - Data Statistics***

<b>Variable</b>	<b>Low</b>	<b>High</b>	<b>Mean</b>	<b>SD</b>
<b>Price Dispersion</b>	0	0.467	0.06	0.0006
<b>Multi-Market Contact (MMC)</b>	0.001	0.403	0.25	0.0010
<b>Market Concentration (HHI)</b>	0.127	0.999	0.46	0.0031
<b>Market Size</b>	1	41826	1128	35
<b>Market Size/41826</b>	0.000	1	0.03	0.0008
<b>Distance</b>	18	2729	1136	8
<b>Distance/2729</b>	0.007	1	0.42	0.0031
<b>Hub</b>	0	1	0.35	0.0062
<b>Interaction of MMC &amp; HHI</b>	0.001	0.400	0.13	0.0010

### ***Estimation Results***

The following estimation results are explained for the hypotheses previously discuss and shown in revised conceptual framework (Figure 6) above. Table VI provides a summary of the regression results.

***Table VI - Regression Results***

	<b>Variable</b>	<b>Hypothesis</b>	<b>Coefficient Estimate</b>	<b>Beta</b>	<b>Pr &gt;  t </b>
H <sub>1</sub>	<b>Multi-Market Contact</b>	Degree of MMC is positively related to price dispersion.	0.193	0.327	<0.0001
H <sub>3</sub>	<b>Market Concentration</b>	Degree of HHI is negatively related to price dispersion.	-0.029	-0.127	0.0006
H <sub>4</sub>	<b>Market Size</b>	Market size is negatively related to price dispersion.	-0.053	-0.073	<0.0001
H <sub>5</sub>	<b>Route Distance</b>	Length of the route is positively related to price dispersion.	0.033	0.164	<0.0001
H <sub>6</sub>	<b>Hub Airport</b>	When a route is connected to a hub, there is a negative effect on price dispersion.	-0.004	-0.044	0.0002
H <sub>8</sub>	<b>MMC x HHI</b>	As HHI increases, the effect of MMC on price dispersion decreases.	-0.236	-0.377	<0.0001

*Multi-market contact.* H<sub>1</sub> is supported ( $\beta_1 = 0.327$ ,  $p < 0.0001$ ), indicating that in city-pair routes where multi-market contact is greater, there is more price dispersion. In other words, when competitors in a local market have more contact in markets, the price dispersion tends to be greater in the local market.

This finding is consistent with the research of Baum and Korn (1996), which found that in local markets where multi-market contact was greater, the entry and exit rates were lower, indicating a reduction in competitiveness. This

study supports the premise that if firms feel less need to compete aggressively, they have more latitude in pricing, therefore in local markets where multi-market contact is greater, there is larger price dispersion.

The beta coefficient ( $\beta$ ) is calculated from the data, after each variable is standardized by subtracting the mean from each value and dividing by the standard deviation for each variable. By determining the beta coefficient, the variables can be compared to one another without regard to differences in units. This procedure allows the variables to be compared as to the relative effect each variable has on the dependent variable. The larger the beta coefficient value, the greater the influence on the dependent variable.

The beta coefficient of multi-market contact is relatively large (0.317) compared to all but one of the other beta values, which range from 0.044 to 0.377. This relatively large value indicates that multi-market contact is a relatively important variable in influencing the dependent variable, price dispersion.

Multi-market contact has the coefficient estimate of 0.193, which is the highest of the main effect variables and is only second to the interaction variable that has a coefficient estimate of -0.236. This result supports the multi-market contact theory, which postulates that as the degree of multi-market contact increases, price dispersion should increase. This finding demonstrates the considerable positive effect that multi-market contact has on price dispersion.

Due to the large sample size, practical significance needs to be considered, as well as statistical significance. In practical terms, for example, this means that if multi-market contact on a city-pair route increases from 0.25 to 0.30 (a 20% increase in multi-market contact) price dispersion (as measured by Gini) can be expected to increase from 0.095 to 0.105 (a 10% increase in price dispersion). The following statement by Borenstein and Rose may further expand the understanding of the effect on price dispersion. “A Gini of 0.10 ... implies an expected absolute price difference of 20 percent of the mean fare” (Borenstein and Rose 1994, p. 656). This increase in price dispersion benefits the airlines and some consumers. Airlines benefit from having greater flexibility in setting prices and gaining additional revenue and profit. Consumers benefit by having more price options when selecting flights.

Market concentration.  $H_3$  is supported ( $\beta_3 = -0.127$ ,  $p = 0.0006$ ), indicating that in local markets where concentration is greater, price dispersion in that market tends to be less. In other words, in markets where market shares are more concentrated, less price dispersion occurs. These results are consistent with Borenstein and Rose’s (1994) study on price dispersion in the U.S. airfare market. They analyzed pricing data to evaluate the effect of competition on price dispersion. Market concentration is one of the variables used by Borenstein and Rose to evaluate the construct ‘competition’. Borenstein and Rose found that in local markets where market concentration is higher, there is less price dispersion. Market concentration has also been applied by Hayes and Ross (1998), Walsh and Whelan (1999), and Zhao (2006) to evaluate the causes

of price dispersion. Their findings reinforce the finding that in more concentrated markets, price dispersion tends to be less.

Market concentration has the coefficient estimate of -0.029, which is relatively small compared to multi-market contact, but still has a significant negative influence on price dispersion. This result supports the oligopoly theory, which postulates that firms collude, either tacitly or purposively, within markets when they recognize their mutual dependence. The more concentrated the market, the greater recognition of the firms' mutual dependence, resulting in less price dispersion. This rationale is consistent with the finding of this study that as concentration in a local market increases, there tends to be less price dispersion.

In practical terms, for example, this means that if market concentration on a city-pair route increases from 0.25 to 0.30 (a 20% increase in market concentration) price dispersion can be expected to decrease from 0.040 to 0.038 (a 5% decrease in price dispersion). In comparison to multi-market contact, market concentration has less effect on price dispersion.

Market size.  $H_4$  is supported ( $\beta_4 = -0.073$ ,  $p < 0.0001$ ), indicating that in larger local markets, price dispersion in that market tends to be less. In other words, in larger markets (i.e., more customers), less price dispersion occurs. Market size has the coefficient estimate of -0.053, which is the second highest of the main effect variables.

This finding is consistent with Borenstein and Rose's (1994) study, which found that in larger markets, there is less price dispersion. Their findings

support the rationale that in larger markets (i.e., more customers) there is more competitive pressure on the airlines, resulting in less price dispersion. The finding of this study is also consistent with models of monopolistic competitive price discrimination (Borenstein 1985; Holmes 1989).

In practical terms, for example, this means that if market size on a city-pair route increases from 0.25 to 0.30 (a 20% increase in market size) price dispersion can be expected to decrease from 0.024 to 0.031 (a 8% decrease in price dispersion). In comparison to multi-market contact, market size has less effect on price dispersion, but more than market concentration.

Route distance.  $H_5$  is supported ( $\beta_5 = 0.164$ ,  $p < 0.0001$ ), indicating that as route distance increases, there is greater price dispersion. In other words, longer routes tend to have more price dispersion than shorter routes. Route distance has the coefficient estimate of 0.033, which is the third highest of the main effect variables.

The rationale behind this finding is that on longer routes, there tends to be less competition, which reduces the competitive pressure to compete on price. Furthermore, some passengers prefer more services on longer distance flights due to the longer times that they spend in the airplane, which leads to less price sensitivity and more price dispersion. The finding of this study is consistent with prior research of Hayes and Ross (1998) who found that dispersion increases on longer route distances.

In practical terms, for example, this means that if route distance on a city-pair route increases from 0.25 to 0.30 (a 20% increase in route distance) price

dispersion can be expected to decrease from 0.055 to 0.057 (a 3% increase in price dispersion). In comparison to multi-market contact, route distance has much less effect on price dispersion.

Hub airport.  $H_6$  is supported ( $\beta_6 = -0.044$ ,  $p = 0.0002$ ), indicating that when the city-pair route is connected to an airport that is a hub for at least one airline (other than a focal airline), price dispersion on that route tends to be less. In other words, in a local market where there is a dominant, local firm, (but not dominant nationally) less price dispersion occurs. This finding is consistent with prior research of Hayes and Ross (1998) who found that dispersion was less in routes connected to hub airports than in routes connected to non-hub airports. Hub airport has the coefficient estimate of -0.004, which is the third highest of the main effect variables, which is the smallest of all the coefficients, but still has a significant influence on price dispersion.

In practical terms, for example, this means that if at least one of the airports on a city-pair route becomes a hub (the 'hub airport' variable changes from 0 to 1), price dispersion can be expected to decrease from 0.047 to 0.043 (a 9% decrease in price dispersion). In comparison to a 10 % increase in multi-market contact, if at least one of the airports on a city-pair route becomes a hub, the magnitude of the effect of the hub airport is similar, but opposite in direction of a 10 % increase in multi-market contact's effect on price dispersion.

Interaction of multi-market contact and market concentration.

$H_8$  is supported ( $\beta_8 = -0.377$ ,  $p < 0.0001$ ), indicating that the effect of multi-market contact on price dispersion is less in local markets where there is greater



market concentration. In other words, in local markets where there is a higher degree of market concentration, the increase in price dispersion (that occurs as multi-market contact increases) is less than it would be in less concentrated markets. This finding is consistent with prediction of Fuentelsaz and Gomez (2006) who hypothesized that the effect of multi-market contact on mutual forbearance would decrease in more concentrated markets.

The interaction between multi-market contact and local market concentration has the coefficient estimate of -0.236, which is the highest of the independent variables. This finding is consistent with the multi-market contact theory, which predicts that the more multi-market contact among competing firms, the competitive pressure within a market is likely to be less. The reduced competitive pressure should result in greater price dispersion within a local market. Multi-market theory in combination with linked oligopoly theory suggests that linkage between firms in multiple markets will be affected by concentration within the local markets. Linked oligopoly theory implies that mutual forbearance will be more influential in concentrated markets. This finding supports Heggstad and Rhoades' (1978) conclusion that when evaluating a local market's competitive environment, only considering market concentration may be misleading due to multi-market contact's potential to reduce rivalry, even in concentrated markets.

This finding supports previous research by Bernheim and Whinston (1990), Scott (1982, 1991) and Phillips and Mason (1992), whose studies show that mutual forbearance should be greatest when market concentration is high. The

rationale for this outcome is that it in an oligopoly market structure, it is easier for firms who are multipoint rivals to collude and forbear in a concentrated market than it is for firms that are multi-point rivals in less concentrated markets. Firms in highly concentrated markets tend to know each other's strategic patterns better than they know the strategic patterns of competitors in less concentrated markets. The finding of this study that the effect of multi-market contact on price dispersion is less in local markets where there is greater market concentration supports this rationale and theory.

It is not as simple to compare the interaction between multi-market contact and market concentration, as it is to compare the main effect variables. The added complexity is due to the interaction terms' dependence on the values of multi-market contact and market concentration. The following section demonstrates and discusses the interaction effect of multi-market contact and market concentration on price dispersion. The section also provides practical insight into the relationship between multi-market contact, market concentration, and price dispersion.

*Demonstration of the interaction effect of multi-market contact and market concentration on price dispersion.*

Table VII and Figure 7 show the effect that market concentration has on the relationship between multi-market contact and price dispersion. In order to demonstrate the change that occurs when multi-market contact and market concentration interact, a median-split approach was applied to separate the data into four roughly equally sized groups of data. A median-split approach

separates the data in groups based on the median value of the variable. The average price dispersion for each data set was then calculated and then compared in Table VII to show that in markets where market concentration is greater, the effect that multi-market contact is not only reduced, but as multi-market contact increases, the regression line has a reduced rate (slope). This phenomenon is also shown graphically in Figure 7. Multi-market contact and market concentration are both continuous variables and this split-means approach has been applied to demonstrate the relationship proposed in  $H_8$  and the resulting outcome of this analysis, which supports  $H_8$ .

The calculations used in the creation of this table are based on an initial median split of market concentration (median 0.500), then a median split of multi-market contact (median 0.252). It shows that the average price dispersion decreases significantly (-0.031) in markets of greater concentration when multi-market contact is relatively low and average price dispersion decreases significantly (-0.035) in markets of greater concentration when multi-market contact is relatively high. In other words, in markets where market contact is high, the estimated regression line for multi-market contact and price dispersion (which has a positive relationship, as confirmed by the results of this study and shown in Table VII), is shifted downward and more important to  $H_8$ , the slope of the regression line is less.

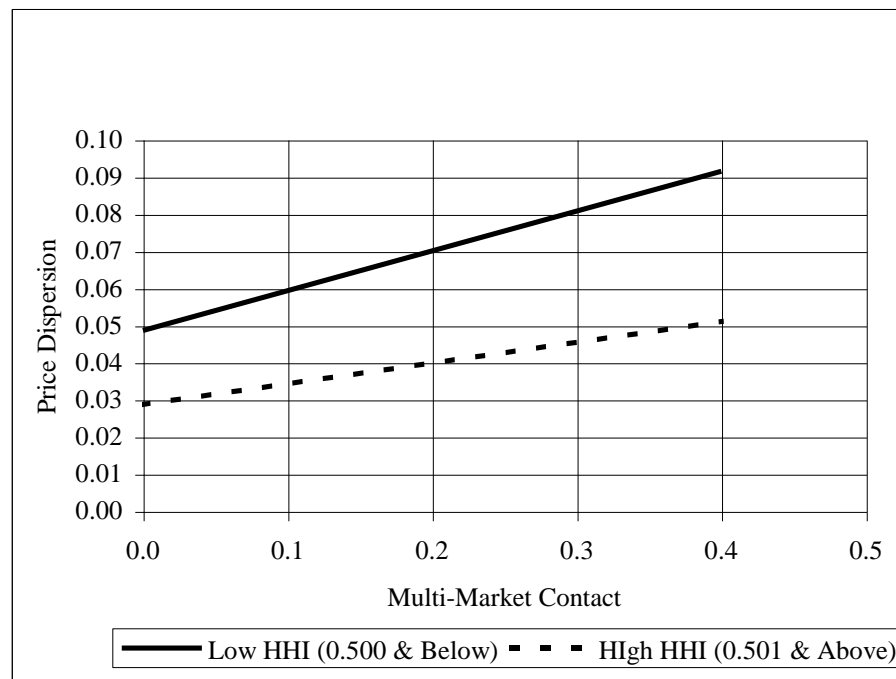
**Table VII - Multi-Market Contact & Concentration Interaction ( $H_8$ )**

		<b>Multi-Market Contact</b>	
		<b>Low (0.252 &amp; below)</b>	<b>High (0.253 &amp; above)</b>
		<b>Price Dispersion (Average)</b>	
<b>Market Concentration</b>	<b>High (0.501 &amp; above)</b>	0.037 (n = 1,315)	0.048 (n = 1,645)
	<b>Low (0.500 &amp; below)</b>	0.068 (n = 1,804)	0.083 (n = 1,210)
<b>Change (from low to high)</b>		<b>-0.031</b>	<b>-0.035</b>

Figure 7 shows the effect that market concentration has of the relationship between multi-market contact and price dispersion. The upper (solid) line is the regressed relationship between multi-market contact and price dispersion when the market concentration values are at the median or below. The lower (dash) line is the regressed relationship between multi-market contact and price dispersion when the market concentration values are above the median value.

The graph (Figure 7) shows that market concentration not only reduces the effect of multi-market contact on price dispersion, but also has a stronger reducing effect as multi-market contact increases. The increase in the reduction of price dispersion as multi-market contact increases, when market concentration is high, is the relationship predicted and hypothesized in  $H_8$ , and shown to be significant in this study. In other words, multi-market contact has less effect on price dispersion, when market concentration is greater.

**Figure 7 – Interaction of Multi-Market Contact  
and Market Concentration ( $H_8$ )**



### *Model Fit*

One of the key objectives of this research is to evaluate and demonstrate the benefit of including an evaluation of the macro competitive environment (i.e., multi-market contact) on price dispersion in local markets. The following chart shows the degree to which including multi-market contact improves the explanation of price dispersion beyond what market concentration (measured by HHI) explains.

As the following Table VIII (below) shows, when market concentration is applied exclusively to explain price dispersion, the adjusted  $R^2$  value is 0.182, meaning that market concentration explains 18.2% of the variation in price dispersion. By including multi-market contact and the interaction of concentration and multi-market contact, 20.9% of the variation is explained and with the full model, 24.2% is explained. The increase in adjusted  $R^2$  from 0.182 to 0.242 is a 33% increase in adjusted  $R^2$  and demonstrates the value of considering multi-market contact and local market conditions when evaluating price dispersion.

***Table VIII - Comparison of Results***

<b>Condition</b>	<b>Adjusted <math>R^2</math></b>	<b>Change in Adjusted <math>R^2</math></b>	<b>Percent Improvement</b>
Market concentration alone	0.182	-----	-----
Multi-market contact with market concentration and interaction	0.209	0.027	15%
Simplified model	0.242	0.060	<b>33%</b>

The purpose of this study is to expand the understanding of the effects of competition, especially multi-market contact, on price dispersion. As stated in the beginning of this study, there are other known influences on price dispersion. The three main sources of price dispersion, identified and described by prior academic studies (e.g., Borenstein and Rose 1994; Pan, Ratchford, and Shankar 2003; Zhao 2006) and discussed in the introduction (Chapter 1) of this study, are search cost, consumer heterogeneity, and competition. Some of the specific factors that may further explain why price dispersion occurs in airline ticket fares that are outside the scope of this research are:

1. Lead time in purchasing tickets. Airlines use revenue management systems that vary prices to maximize revenue.
2. Business versus tourist destinations and passenger mix.
3. Pricing promotions, such as weekend stays.
4. Group (e.g., family) travel versus individual.
5. Ticket agent type; online, airline, travel agency, travel discounter (e.g., Priceline).
6. Direct versus connecting flights.

## **CHAPTER VI**

### **IMPLICATIONS, LIMITATIONS, & CONCLUSION**

#### ***Academic Implications***

The findings of this empirical analysis have important theoretical implications. The most significant academic contribution of this study is the development of a conceptual framework of the competitive determinants (e.g., multi-market contact and market concentration) on price dispersion in a complex, service market context. Another contribution is that this study is a conceptual, empirically based, cross-sectional evaluation of price dispersion. This study evaluated the influence of two, important, recently developed variables; multi-market contact and strategic similarity on price dispersion, as well as the extensively researched, market concentration. Strategic similarity was not useful in this study due to its high collinearity with multi-market contact. Even though multi-market contact and strategic similarity are conceptually very different variables, the results produced by the model were much clearer without strategic similarity.

Market concentration is related to oligopoly theory, which deals with inter-firm coordination (Baum and Korn 1996). In oligopoly theory, collusion, either



tacit or purposive, among firms is predicted to occur because firms recognize their mutual dependence. However, in oligopoly theory, coordination derives from greater market concentration, not from multi-market contact (Scherer and Ross 1990). This study shows that market concentration has a small, but significant influence on price dispersion; coefficient estimate (-0.029) and beta (-0.127). The results support the theory by demonstrating that as market concentration increases, price dispersion tends to decrease.

An additional theoretical implication is the extension of multi-market competition theory to price dispersion. This theory suggests that when two rival firms compete in multiple markets, intensity of rivalry decreases due to mutual forbearance (Edwards 1955; Bernheim and Whinston 1990; Baum and Korn 1996; Jayachandran, Gimeno, and Varadarajan 1999). This decrease in rivalry results in greater price dispersion due to firms feeling less pressure to match or be close to competitors' prices. This study shows that multi-market contact has a significant influence on price dispersion. Multi-market contact has the highest coefficient estimate (0.193) and beta (0.327) of the main effect variables. This result supports the theory by demonstrating that as the degree of multi-market contact increases, price dispersion tends to increase.

The interaction between multi-market contact and local market concentration has useful implications for pricing research. Linked oligopoly theory (Solomon 1970) suggests that an important determinant of performance in oligopolistic market is the degree of linkage between markets or firms' presence in multiple markets. This theory assumes that multi-market firms

coordinate their operations across markets and that this coordination affects the intensity of rivalry. Heggestad and Rhoades (1978) concluded that considering only market concentration could be misleading because multi-market contact will likely reduce rivalry, even in concentrated markets. Linked oligopoly theory suggests that it seems likely that mutual forbearance will be more influential in concentrated markets.

The interaction of multi-market contact and market concentration has the highest coefficient estimate (-0.236) and beta (0.377) of any variable in the model. This result supports the theory by demonstrating that as the degree of multi-market contact increases, price dispersion tends to increase. Furthermore, this result supports the previous research (e.g., Bernheim and Whinston 1990; Scott 1982, 1991; Phillips and Mason 1992), which indicated that mutual forbearance will be greatest when market concentration is high. The rationale for this is that it is easier for oligopolists who are multipoint rivals to collude and forbear from intense rivalry, even easier than it is for multi-point rivals in less concentrated markets to do so. The finding of this study that the effect of multi-market contact on price dispersion is less in local markets where there is greater market concentration supports this rationale and theory.

This research also provides insight on strategic group theory. Gimeno and Woo (1996) suggest that multi-market contact and strategic similarity are two distinct dimensions of strategic heterogeneity and should be considered separately to evaluate their effects of intensity of rivalry. In this study, when multi-market contact and strategic similarity were both in the model, they were

highly correlated which made it difficult to evaluate the effect of each variable due to the strong interrelationship. The results of this study support the findings of Gimeno and Woo, which show that multi-market contact strongly decreases the intensity of rivalry, whereas strategic similarity moderately increases it, indicating that multi-market contact is the more useful variable in evaluating strategic heterogeneity.

### ***Managerial Implications***

Airlines, as well as other fixed capacity, service organizations, are seeking information to help them improve the financial performance of their organizations. This study has several useful and valuable implications for managers. The information presented can be useful to marketing managers in developing pricing strategies by helping them better understand likely competitive reactions to changes in market structure. This information on the effects of competition on price dispersion applies to managers working for firms that are considering entering new markets. The information is can also be useful to mangers of rival firms working in the local market when a rival firm enters the local market.

Managers can apply the conceptual framework on price dispersion to evaluating the effect of strategic moves (e.g., pricing strategies, market entry and exit) on market price dispersion. This framework can help managers to better understand how rival firms, who they compete against in other markets, may affect the price dispersion in the local markets, if their firm or a rival firm enters the local market. The framework developed in this study can be applied

to improve the accuracy of predicting price dispersion in local markets. When managers are evaluating market attractiveness, revenue potential and profit potential are important considerations. The framework presented in this study can improve the accuracy in the evaluation of target markets before firms enter new, local markets. Price dispersion has an important influence on revenue and profitability.

The finding that multi-market contact has a significant impact on price dispersion means that revenue and profitability opportunities can be better evaluated before entering a local market where there are competitors that are also in other local markets. Multi-market contact had the second highest beta coefficient (0.327), only slightly less than the interaction of market concentration and multi-market contact. The implication for managers is that competitors in a local market do not feel the need to compete aggressively in the local market when they have the means to retaliate in other markets. For example, if a firm is planning to enter a new market, the firms in that local market may not feel the need to compete aggressively in the local market due to the deterrence based on their means to retaliate in other markets.

The interaction of market concentration on multi-market contact reinforces the prior research, showing that the degree of concentration has a significant influence on the effect that multi-market contact has on price dispersion. This interaction has the highest beta coefficient (-0.377). The finding of this research is that multi-market contact has its greatest affect on price dispersion when market concentrations are relatively low.

The interaction of market concentration on multi-market contact is graphically represented in Figure 7. This interaction shows managers that by evaluating the degree of multi-market contact and market concentration of the firms in a local market (e.g., city-pair route) they can anticipate changes in price dispersion in the local market. Higher levels of price dispersion signify that managers have greater flexibility to vary price than when the lower levels of price dispersion are indicated. The understanding of changes in price dispersion can be used in developing pricing strategies and anticipating pricing changes that competitors may make.

The finding that route distance has a positive affect on price dispersion, and has the third highest beta coefficient (0.164), indicates the importance of considering route distance when planning pricing strategies. This finding indicates that there is less price competition on longer routes and as a result price dispersion tends to be greater. The finding that market concentration is a significant factor in understanding how competition affects price dispersion is not surprising given the extensive research supporting the concept that higher levels of concentration increases market power in those firms with large market shares. Market concentration has a negative effect on price dispersion and the fourth highest beta coefficient (-0.127), which supports the prior research in that few and more dominant firms tends to result in less price dispersion. This study shows that when multi-market contact is considered, market concentration has far less impact on explaining price dispersion.

The finding that market size (i.e., the number of passengers on the route) has a negative influence on price dispersion indicates that on routes where more passengers travel, there is less price dispersion. Market size has the fifth highest beta coefficient (-0.073). The finding that routes connecting to a hub airport have a negative influence on price dispersion indicates that on routes that connect to a hub airport, there is less price dispersion. 'Hub airport' has the sixth highest beta coefficient (-0.044).

Managers have the means to measure all of the independent variables in this study. By measuring and evaluating these variables, the model developed in this study predicts the effect of competition on price dispersion. The findings of this study suggest that managers can benefit from monitoring and assessing multi-market contact and market concentration in local markets when making pricing decisions. A better understanding of the factors (i.e., multi-market contact, strategic similarity, market concentration) that cause price dispersion to expand or contract provides important and useful information to managers developing pricing strategies and setting prices.

In summary, it is important for managers to understand that market concentration alone provides a limited insight into how firms competing in a local market react to each other when developing pricing strategies. The influence of multi-market contact in conjunction with local market concentration greatly improves the insight into how firms competing in a local market react to each other. This study showed that the adjusted  $R^2$  increased by 33% when all of the variables in the simplified model were evaluated, with multi-market

contact and the interaction of multi-marketing contact being major contributors to the increase in adjusted  $R^2$ . The adjusted  $R^2$  indicates the proportion of variance explained by the independent variables. The larger the adjusted  $R^2$  value, the greater the explanatory power of the regression equation, and the better the regression equation is at predicting the dependent variable. The improvement in predictive power of the model developed in this study can be applied by managers to increase the revenue and profitability of their firms.

### ***Limitations***

This research has limitations that suggest opportunities for future research. First, the data are from 1999. Since then, the U.S. airline industry has been affected by major changes in security regulations and dramatic increases in fuel prices. Also, the number of network airlines has decreased from seven to four and the number of low-fare airlines has increased. Future research using newer data may provide different results.

Second, this is a study of the U.S. airfare market and airfare pricing in markets in other countries may be affected differently by competition. Most other countries do not have the large number of domestic airlines competing for customers. Also, the different strategies of domestic airlines do not exist in most other countries. The circumstances that exist in the U.S. airfare market and airfare pricing reduces the generalizability of this study in those other markets.

Third, this study focuses on competitive factors and related market characteristics. There are other factors, such as customer related factors that influence price dispersion. If additional data related to these factors is

attainable, a more complete model could likely be developed. Some of these other factors are as follows:

1. Lead time in purchasing tickets. Airlines use revenue management systems that vary prices to maximize revenue.
2. Business versus tourist destinations and passenger mix.
3. Pricing promotions, such as weekend stays.
4. Group (e.g., family) travel versus individual.
5. Ticket agent type; online, airline, travel agency, travel discount (e.g., Priceline).
6. Direct versus connecting flights.

### ***Future Research Directions***

Several implications and direction for future research can be drawn from the results of this study, as well as from some of the limitations. First, since the findings of this study are based on firms in a single, geographically bounded industry during one quarter, it is possible that the results reflect some factors specific to the industry, geographic region, or period under study. Further replications of this study in other circumstances are needed to address this possibility.

Second, development of a comprehensive variable for strategic competitive heterogeneity that may include multi-market contact and strategic similarity is worth exploring. One of the fundamental issues is to determine what characteristics of firms set them apart from competitors in ways that affect their marketing strategies and how consumers perceive value of their product offerings. When firms can increase the perceived value of their product



offerings, they can increase sales revenue, profitability relative to other firms with less attractive products. Findings of this research show that multi-market contact in conjunction with market concentration improves the potential for firms to increase their financial performance in the marketplace.

Third, another option is to expand the model developed in this study to include some of the customer-based variables that influence price dispersion. If data on customer characteristics that are connected with prices paid for tickets can be acquired, it is likely that a broader based, more explanatory model could be developed to explain more of the reasons for price dispersion. The focus of this study is limited to increasing the understanding of the competitive factors that influence price dispersion.

### ***Conclusion***

The purpose of this empirical study has been to evaluate the affects of several key factors, especially multi-market contact and strategic similarity, on price dispersion in the airline industry. This study supports the concept that firms respond to competition by engaging in search for alternative ways to improve their performance. One of the research goals of this study is to increase the understanding of the effect of multi-market contact on price dispersion. Prior research has not included multi-market contact to evaluate price dispersion. The results show the importance of including multi-market contact and other key market characteristics in models that addresses competition within markets.

The conceptual framework developed in the study makes an important contribution to the understanding of the competitive determinants on price dispersion in a complex, service market. This study is the first known to

evaluate the influence of two important variables, multi-market contact and strategic similarity, on price dispersion. The results of this study have the potential for application in other fixed capacity, service applications, such as entertainment (including sporting event venues), other forms of public transportation (e.g., trains, buses, and ships), and distribution of energy (e.g., electricity). The results expand the understanding of competition theory that may be useful to academic researchers, as well as provide viable information that may be useful to marketing practitioners.

This study also provides information that may be useful in the development of future government policies related to competition's effect on market efficiency and social welfare. Social welfare considers the well-being of society at large and includes the welfare of both consumers and producers. Society is considered to be better off when resources are used efficiently to maximize the welfare of consumers and producers. Price dispersion has been shown to improve market efficiency and social welfare (Varian 1996; Brynjolfsson and Smith 2000; Borenstein and Rose 1994; Rob 1985).

Differential pricing (which results in price dispersion) improves economic efficiency and social welfare when the marginal willingness to pay equals marginal cost Varian (1996). Willingness to pay varies by customer, and therefore producers can apply different prices under different circumstances and improve customer satisfaction while improving the firm's profitability. An example is first class and coach class airline tickets. These tickets have different prices for consumers with different willingness to pay perspectives as well as slightly different marginal costs.

The type of economic efficiency applied in this argument is referred to as Pareto efficiency. An economic situation is considered Pareto efficient when there is no way to make one consumer better off without making some other consumer worse off. Pareto efficiency occurs when marginal willingness to pay equals marginal cost. Another factor influencing economic efficiency and social welfare is the degree of price discrimination. Third-degree price discrimination (when a firm sells its product to different consumers at different prices) is prevalent in the airline industry as well as other high fixed cost industries (Varian 1996). Varian's analysis shows that price dispersion often increases economic efficiency and social welfare. The rationale is that when price dispersion allows more customers to be served, social welfare is increased.

As shown by the classic economic model of social welfare, when a single price is set above the theoretical equilibrium price, some consumers miss out on socially efficient exchanges. Not only do some consumers lose the opportunity to make efficient purchases, firms lose the opportunity to receive the sales revenue from those purchases. Therefore, by developing policies that supports a level of competition, which encourages price dispersion, market efficiency and social welfare is increased. This study shows that higher levels of multi-market contact increase price dispersion, while market concentration decreases price dispersion. Based on prior research and this study, policies could be developed to encourage firms to expand into new markets while discouraging concentration in local markets.

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## **APPENDICES**

## SELECTED RESEARCH ON SOURCES OF PRICE DISPERSION

	Study	Subject of Analysis	Results/Conclusions
	<i>Consumer heterogeneity</i>		
1	Biswas, Dutta, and Pullig (2006)	Branded DVD player	Low price guarantee effects attenuated when consumers perceive market price dispersion to be high. <i>Consumer heterogeneity</i> was evaluated on the basis of differences in perceived price dispersion.
2	Zhao (2006)	Grocery items	Price dispersion and <i>consumer heterogeneity</i> shown to be highly correlated. Demographic variables included education and income of consumers.
3	Burman and Biswas (2004)	DVD player, camera	When price dispersion is narrow, reference price is more likely to be high, reducing the effectiveness of reference pricing. <i>Consumer heterogeneity</i> was evaluated on the basis of differences in value perception and shopping intention.
4	Clemons, Hann, Hitt (2002)	Airline tickets sold online	Significant price dispersion exists online. One of the causes identified was <i>consumer heterogeneity</i> related to differences between 'time-sensitive' travelers and 'price-sensitive' travelers.
5	Rhee (1998)	Generic, differentiated products	Price dispersion can be due to <i>consumer heterogeneity</i> related to differences in willingness to pay for quality and other attributes.
6	Borenstein and Rose (1994)	Airline tickets	Price dispersion exists in the airline ticket market in part due to <i>consumer heterogeneity</i> related to segmentation based on businesses and vacation passengers.
7	Shepard (1991)	Gasoline	Price dispersion can occur in multi-firm markets due to price discrimination when <i>consumer heterogeneity</i> exists related to differences in willingness to pay.
8	Diamond (1987)	Consumer product	Price dispersion can exist in consumer markets due to <i>consumer heterogeneity</i> related differences in consumers' willingness to pay.

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Study	Subject of Analysis	Results/Conclusions
<b><i>Consumer heterogeneity (continued)</i></b>		
9	Varian (1980)	Retail products sold in stores
		It is in the sellers' best interest to randomize prices to price discriminate between informed and uninformed consumers. Thus, <i>consumer heterogeneity</i> based the consumer's level of pricing information is a cause of price dispersion.
10	Salop and Stiglitz (1977)	Commodity
		Price dispersion can occur in multi-firm markets due to price discrimination when <i>consumer heterogeneity</i> exists related to differences in willingness to pay.

<b><i>Consumer search costs</i></b>			
11	Zhao (2006)	Grocery items	Price dispersion and <i>consumer search costs</i> were shown to be highly correlated across stores, across UPCs within a product category, and over time for a brand.
12	Walter, Gupta, Su (2006)	Commodities, quasi-commodities, and differentiated products.	Price dispersion existed across all product types and results suggest that the Internet did not compress <i>consumer search cost</i> heterogeneity, although it did reduce overall search costs for all users.
13	Sorensen (2000)	Prescription drugs	Price dispersion is lower for repeatedly purchased prescriptions, for which the expected benefits relative to <i>consumer search costs</i> are highest.
14	Stahl (1989)	Commodity	Price dispersion caused by increasing <i>consumer search costs</i> . Price distribution changes from 'perfectly competitive' pricing to the 'monopoly' pricing as search cost and population parameters change.
15	Dahlby and West (1986)	Automobile insurance	Price dispersion explained by costly <i>consumer search costs</i> . Consumers are often unwilling to change insurance companies due to the perceived cost of getting and comparing insurance quotations.
16	Rob (1985)	Commodity	Price dispersion arises in informationally imperfect markets due to the distribution of <i>consumer search costs</i> .

## APPENDIX A

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Study	Subject of Analysis	Results/Conclusions
<b><i>Consumer search costs (continued)</i></b>		
17 Salop and Stiglitz (1982)	Commodity	Price dispersion depends on the magnitude of <i>consumer search costs</i> and degree of scale economies.
18 Braverman (1980)	Commodity	Differences in <i>consumers' search costs</i> determine what type of equilibrium arises: perfectly competitive, monopolistically competitive, or price dispersion.
19 Pratt, Wise, Zeckhauser (1979)	Thirty-nine, standard products	Price dispersion explained by positive <i>consumer search costs</i> . Buyers employ searching and buying strategies in deciding whether to seek further price quotations; balancing the prospect of searching for a lower price against greater incurred search costs.
20 Stigler (1961)	Branded car and type of coal	Price dispersion caused by consumers' lack of information due to <i>consumer search costs</i> and variations in 'terms of sale'.

<b><i>Competition</i></b>		
21 Zhao (2006)	Grocery items	Price dispersion and <i>competition</i> were shown to be highly correlated. Price dispersion increases as new stores enter the market.
22 Dana (1999)	Airline tickets	Price dispersion shown to increase as <i>competition</i> increased due to increasing the number of firms in the market.
23 Walsh and Whelan (1999)	Grocery items	Price dispersion over the price of related brands increased with <i>competition</i> when conditioned on brand distribution structures.
24 Borenstein and Rose (1994)	Airline tickets	Price dispersion increases on routes with more <i>competition</i> . As the number of competitors on a route grows, price dispersion increases.
25 Borenstein (1989)	Airline tickets	Price dispersion is affect by <i>competition</i> . The greater the number of passengers on a route and the greater the dominance of an airline at a terminal positively influences price dispersion.
26 Moorthy (1988)	Differentiated, consumer products	Price dispersion increases with <i>competition</i> as differentiation between product attributes increases.

## SELECTED LITERATURE RELATED TO PRICE DISPERSION

Study	Objectives / Research Questions	Industry/Setting	Methods	Results/Conclusions
<b><i>Price Dispersion: Competition Focused Research</i></b>				
1 Ancarani and Shankar (2004)	Comparison of <i>price dispersion</i> and price levels.	Three types of retailers: Internet only, traditional, and multi-channel	Means, std dev, <i>t</i> -tests	Pure-play e-tailers shown to have the lowest <i>price dispersion</i> and the highest range of prices. Multi-channel retailers had the highest <i>price dispersion</i> .
2 Baye, Morgan, and Scholten (2004)	Tests the effect of “hit-and-run” pricing strategies (i.e., short term price promotion undertaken at unpredictable intervals) on <i>price dispersion</i> .	Online consumer electronics	Coefficient of variation - cross-sectional analysis - time series	<i>Price dispersion</i> in online markets is increased by hit-and-run pricing strategies by the firms. Hit-and-run-pricing shown to be an effective and widely used by e-tailer managers.
3 Brynjolfsson and Smith (2000)	Evaluation of <i>price dispersion</i> and price levels. Research question: Will competition on the Internet lead to lower and more homogeneous prices?	Books and CDs sold through Internet or traditional channels	Means, std dev, <i>t</i> -tests	<i>Price dispersion</i> arises from two forms of retailer heterogeneity; (1) customer awareness and (2) branding and trust. <i>Price dispersion</i> higher online and prices lower online.
4 Walsh and Whelan (1999)	Examine whether <i>price dispersion</i> between related brands is an outcome of brand pricing across different localized monopolies of oligopolistic segments of the market.	Grocery items in the Ireland.	Regression	<i>Price dispersion</i> over the retail price of related brands is estimated to increase with competition when conditioned on brand distribution structures.

Study	Objectives / Research Questions	Industry/Setting	Methods	Results/Conclusions
<b><i>Price Dispersion: Competition Focused Research (continued)</i></b>				
5 Dana (1999)	Evaluate intrafirm, equilibrium <i>price dispersion</i> in three fundamental market structures; perfect competition, monopoly, and oligopoly. Assess the effect of revenue management on price dispersion.	Airline tickets	Theoretical proofs	<i>Price dispersion</i> showed to increase as competition increased due to increasing the number of firms in the market. 1. Price rigidities and demand uncertainty lead not only to interfirm <i>price dispersion</i> but also to intrafirm <i>price dispersion</i> . 2. <i>Price dispersion</i> increases with the number of firms, in contrast to the relationship predicted by typical models of price discrimination.
6 Borenstein and Rose (1994)	Study the relationship between <i>price dispersion</i> and factors, especially competition, that might indicate either price discrimination or cost variations.	Airline tickets	Regression, summary statistics	1. Magnitude of <i>price dispersion</i> due to market structure, number of competitors, and airport dominance (all increase dispersion). 2. Frequency of flights decreases <i>price dispersion</i> .



Study	Objectives / Research Questions	Industry/Setting	Methods	Results/Conclusions
<b><i>Price Dispersion: Consumer Focused Research</i></b>				
7 Biswas, Dutta, and Pullig (2006)	Examine how the effects of a low price guarantee are moderated by consumer perception of market <i>price dispersion</i> .	Branded DVD player	ANOVA, ANCOVA	Results show that low price guarantee effects are likely to be attenuated when consumers perceive market <i>price dispersion</i> for a product to be high. Results show that higher levels of penalty can help restore a low price guarantee's effectiveness.
8 Zhao (2006)	Exploratory study of <i>price dispersion</i> . Checks consistency of the evidence on price dispersion with the existing theories of price dispersion due to costly consumer search, competition, and consumer heterogeneity.	Grocery products	Regression, cross-sectional analysis, time series, coefficient of variation	<i>Price dispersion</i> is positively correlated with consumer search costs, competition, and consumer heterogeneity.
9 Burman and Biswas (2004)	Examine the role of <i>price dispersion</i> and need for cognition in influencing consumer evaluation of reference prices. Key research question: Are there conditions when implausible reference prices may not have the potential for deception?	VCR, calculator, DVD player, student desk, bike	ANOVA (price dispersion is an independent variable)	Findings demonstrate the potential of <i>price dispersion</i> in strengthening the impact of implausible reference prices on consumer evaluations.

Study	Objectives / Research Questions	Industry/Setting	Methods	Results/Conclusions
<b><i>Price Dispersion: Consumer Focused Research (continued)</i></b>				
10 Sorensen (2000)	Establish the empirical importance of <i>price dispersion</i> due to costly consumer search by examining retail prices.	Prescription drugs	Regression, summary statistics	<i>Price dispersion</i> is lower for repeatedly purchased prescriptions, for which the expected benefits of search are highest.
11 Dahlby and West (1986)	Test whether <i>price dispersion</i> is based on costly consumer search.	Automobile insurance	Regression, cross-sectional analysis, time series	<i>Price dispersion</i> shown to be based on consumer search costs.
12 Salop and Stiglitz (1977)	Explore the problem of heterogeneity of consumer rationality with a model of monopolistically competitive <i>price dispersion</i> .	“Durable commodity”	Theoretical proofs	1. Shows that if prices do settle down, they will settle at the monopoly price or there may be permanent <i>price dispersion</i> in the range between the perfectly competitive and monopolistically competitive prices. 2. Final price dispersion depends on the magnitude of information costs and degree of scale economies.
13 Stigler (1961)	Analyze the effects of price advertising on consumer search costs and the resulting affect on <i>price dispersion</i> .	Cars and coal	Theoretical proofs	1. <i>Price dispersion</i> is affected by search cost for both buyers and sellers; a lower search cost reduces price dispersion. Therefore, price advertising reduces price dispersion. Market size and the number of sellers affects price dispersion.

	Study	Objectives / Research Questions	Industry/Setting	Methods	Results/Conclusions
	<b><i>Price Dispersion: Market Structure Focused</i></b>				
1 4	Lindsey-Mullikin, Grewal (2006)	Empirically test the concept that as the mean price of durables increases, the degree of <i>price dispersion</i> also increases.	Durables sold online	Regression	1. Demonstrates that as mean price of an item increases, <i>price dispersion</i> also increases. 2. Results provide evidence that, contrary to general economic expectations, the Internet has not commoditized products.
1 5	Xing, Yang, and Tang (2006)	Is <i>price dispersion</i> between two types of online retailers different and if so, will the difference increase or decrease in the long run?	DVDs sold online	Regression	<i>Price dispersions</i> of online branches of multichannel retailers and Dotcoms are significantly different and the differences decrease with time.
1 6	Pan, Ratchford, and Shankar (2004)	Meta-analysis - Review of literature on online price dispersion. Addresses whether price dispersion is greater or smaller online than off-line, examine whether price dispersion on the Internet has changed over time, and investigate the drivers of online price dispersion.	Many	N/A	<i>Price dispersion</i> is high and different across the different retailer types suggest that multi-channel retailers can price suitably to differentiate themselves not only among other multi-channel retailers, but also from other types of retails.

Study	Objectives / Research Questions	Industry/Setting	Methods	Results/Conclusions	
Price Dispersion: Market Structure Focused (continued)					
17	Klein and Loebbecke (2003)	Compares online and offline pricing strategies that affect <i>price dispersion</i> . Research question: What is the impact of the Internet in the design and implementation of pricing strategies? In particular, what will be the role of flexible pricing models that give customers an extended role in negotiations?	Scheduled airline flights	N/A	<i>Price dispersion</i> on the Internet is being influenced by two fundamental pricing strategies: smaller suppliers applying intermediated pricing models and the mainstream suppliers applying revenue management.
18	Pan, Ratchford, and Shankar (2002)	Examine the possibility that observed <i>price dispersion</i> in electronic markets is due to differences in service offerings among e-tailers. Main research question is whether this substantial price dispersion can be explained by differences in services offered by e-tailers.	Books, CDs, DVDs, computer software, and hardware	Factor analysis, hedonic regression analyses	<i>Price dispersion</i> explained by heterogeneity in e-tailer services is small and that substantial amounts of price dispersion remain, even after correcting for the influence of e-tailer services. This evidence is contrary to the hypothesis that search costs
19	Clemens, Hann, and Hitt (2002)	Examine the presence of <i>price dispersion</i> and product differentiation.	Airline tickets sold online	Log-linear regression	<i>Price dispersion</i> is still significant even after adjusting for product offering differentiation.

## APPENDIX C

### *Model Comparison*

	Variable	Hypothesized Model			Model without Strategic Similarity			Model without Multi-Market Contact		
		Coefficient Estimate	Beta ( $\beta$ )	Pr >  t	Coefficient Estimate	Beta ( $\beta$ )	Pr >  t	Coefficient Estimate	Beta ( $\beta$ )	Pr >  t
H <sub>1</sub>	<b>Multi-Market Contact</b>	0.149	0.252	0.0009	0.193	0.327	<0.0001	-----	-----	-----
H <sub>2</sub>	<b>Strategic Similarity</b>	-0.079	-0.438	<0.0001	-----	-----	-----	0.035	0.197	<0.0001
H <sub>3</sub>	<b>Market Concentration</b>	-0.052	-0.229	<0.0001	-0.029	-0.127	0.0006	-0.047	-0.209	<0.0001
H <sub>4</sub>	<b>Market Size</b>	-0.048	-0.066	<0.0001	-0.053	-0.073	<0.0001	-0.063	-0.087	<0.0001
H <sub>5</sub>	<b>Route Distance</b>	0.032	0.161	<0.0001	0.033	0.164	<0.0001	0.034	0.172	<0.0001
H <sub>6</sub>	<b>Hub Airport</b>	-0.003	-0.031	0.0101	-0.004	-0.044	0.0002	-0.005	-0.054	<0.0001
H <sub>7</sub>	<b>MMC x STS</b>	0.184	0.428	<0.0001	-----	-----	-----	-----	-----	-----
H <sub>8</sub>	<b>MMC x HHI</b>	-0.384	-0.615	<0.0001	-0.236	-0.377	<0.0001	-----	-----	-----
H <sub>9</sub>	<b>STS x HHI</b>	0.067	0.340	<0.0001	-----	-----	-----	-0.044	-0.226	<0.0001
<b>Adjusted R<sup>2</sup></b>		0.248			0.242			0.234		