COLLUSION AND PRICE DISPERSION

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Abstract

While there are suggestions in applied cartel studies that price dispersion changes when cartelization of a market occurs, there are few theoretical or empirical analyses of this effect. This paper surveys the thin economic literature on the link between overt collusion and price dispersion. Formal theories and observation of cartel behavior suggest that during successfully collusive periods prices become less variable and more negatively skewed compared to relatively competitive periods. Four empirical studies of cartels verify these predictions.

Key words: collusion, cartel, price dispersion

JEL categories: L11, L13, L41, D43

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Introduction

The effect of collusion on prices is a central concern of industrial economics. An enormous theoretical and empirical literature analyzes the partial-equilibrium relationship between collusive conduct of sellers and the resulting increase in average prices. There is also a very substantial body of work going back to the 1930s that examines the structural sources of price rigidity. Most of these analyses assume nondiscriminating monopoly pricing. What is rather surprising is the near absence of theoretical or empirical analyses of the effects of collusive behavior on market price dispersion.

The general objective of this paper is to ascertain whether changes in competitive regimes are associated with changes in the dispersion of market prices for homogeneous goods. First, I examine theoretical arguments, in the context of classic cartel behavior that raises transaction prices or restricts output of homogeneous commodities. Second, I present cite four empirical studies that verify that cartel behavior is associated with changes in transactions-price dispersion.

Theory

Stigler (1961) noted that significant price dispersion is typical of natural markets even for perfectly homogeneous goods in local geographic markets. Stigler's paper was seminal to a large body of research that linked search costs to market price dispersion (e.g., Salop 1977). Given that price information is distributed unevenly across demand segments, sellers will have an incentive to offer their products at different prices to well-informed buyers and to ignorant buyers. Rothschild (1973) criticized this Stiglerian branch of the literature as focusing too exclusively on only one side of the market – the demand side. He suggested that price dispersion may be the result of firm strategies capitalizing on their knowledge of buyers' search behavior. The theoretical literature that attempts to incorporate supply-side factors to explain price dispersion in homogeneous-goods markets is very thin.

Carlson and Judd (1983) developed simple market-equilibrium models that generate price dispersion for homogenous goods by assuming that supplying firms have different costs of production. Carlson and Judd's analysis may have been one of the first to consider price dispersion in the context of an oligopolistic industry structure.[i] The number of producers is finite and fixed; thus, the industry may have small numbers and entry to the industry is blockaded. Following Salop (1977), Carlson and Judd also assume that buyers differ according to the costliness of their individual costs of searching for prices. By making some additional structural assumptions, Carlson and Judd derive an equilibrium condition for the variance in prices. Dispersion is related to two factors: the slope of the marginal cost curves and the number of firms.[ii] Dispersion is greater when the cost curves become relatively *flat* or when *industry concentration* declines. Fershtman (1982) proved that when buyer concentration increases, price dispersion decreases; in monopsony, the equilibrium price approaches the competitive price. Dana (1999) verifies the concentration-dispersion results of Carlson and Judd in a somewhat different oligopolistic industry settling (one that mimics the airline industry).

A second strand of research considers market structure and price rigidity. Means (1935) examined U.S. price deflation in the Great Depression and noted an association between price rigidity and the degree of industrial concentration. Subsequent research has confirmed that oligopoly has tended to exhibited less flexibility in prices over time than more competitively structured markets (Carlton 1986). Price rigidity greater than cost fluctuations in oligopolistic settings is often attributed to a reluctance among the sellers to disturb an existing cooperative consensus. Except perhaps for quite large cost shocks, sellers prefer to avoid the possibility of a price war that might follow a unilateral price change.

Game theoretic models of cartels have considered the phenomenon of price rigidity. The standard model for studying explicit collusion is the infinitely repeated Bertrand game in which symmetric firms observe past market prices to form conjectures. Two celebrated models come to opposite conclusions. Green and Porter (1984) suggest that cartels exacerbate price variability relative to what would be observed under competition, whereas Rotemberg and Saloner (1986) predict price changes that are countercyclical. Athey, Bagwell, and Sanchirico (2002) provide a third extension to the standard infinitely repeated game. In their model, collusive firms with varying costs know each other's past and current prices, but they do not know their co-conspirators' costs. The collusive scheme is designed to make price wars unattractive and to have collusive informational costs. When firms are patient enough, Athey *e*t *al*. demonstrate that optimal collusion "… is characterized by a rigid-pricing scheme, in which firms select the same price…in each time period, whatever their cost levels" (p.4). Thus, their model demonstrates collusive price rigidity in a rigorous manor, verifying the informal insights of economists writing decades before. Although Athey *et al*. provide the most sophisticated theoretical basis for expecting a shift in price variance as a consequence of explicit collusion, it should be noted that neither this paper nor any other discuss skewness or kurtosis of prices in oligopolistic industry settings.

There has been a rebirth of interest among industrial economists in studying the organization and conduct of formal cartels. Many of these studies have been motivated by the discovery of hundreds of international cartels and the attendant record sanctions imposed by the world's antitrust authorities since the mid 1990s (e.g., Connor 2001and 2003). Generalizing from these cases can offer insights into the price-dispersion effects of collusion.

Cartelization brings about several changes in industry structure and conduct that are likely to affect price dispersion.[3] First, cartelization is formally equivalent to a horizontal merger, which effectively raises concentration to as high as the monopoly level if all sellers join the cartel. Second, cartels almost always attempt to prevent entry in order to extend the duration and profitability of the cartel. If not successful in preventing entry, cartels will attempt to coerce outsiders to join the cartel. Third, to reduce the number of collusive dimensions, cartels usually will adopt conventional industry exchange practices or will agree to create uniform terms of exchange, such as common delivery charges, standard price premiums for alternative grades, payment schedules, price protection clauses in supply contracts, and so forth.

All three aspects of cartelization suggest a reduction in price variance. Highly effective cartels, like nondiscriminating monopolies with no moral hazards, charge a single price. Moreover, monopoly pricing reduces buyer search costs because bargaining over terms of sale is eliminated. If the cartel also divides markets or customer lists among themselves, then buyer search costs can be totally

eliminated. By preventing entry or recruiting entrants into the cartel, price variation is almost certainly likely to be reduced. Moreover, even fringe firms that remain outside the cartel have an incentive to price up to the cartel's level (umbrella pricing).
Some cartels may rationalize production among their members, much as would be done by a multiplant monopolist. High cost facilities would be closed as output was reduced, thus reducing some variability in producer costs and the incentive to cheat. High prices would likely dampen expected future market growth and this in turn would reduce the incentive for plant expansions and upgrades in lower cost facilities. Thus, both changes in technology due to cartelization would reduce variability in prices.

Demand shocks have been suggested to be one source of price dispersion in oligopolistic markets. In order to manage an effective conspiracy, cartels often establish committees or secretariats to collect and share market sales intelligence. Alternatively, cartels may be operated in tandem with trade associations that perform the same functions. These activities may, by pooling information on industry trends, improve a cartel's ability to anticipate demand shocks, thereby reducing price dispersion.

Cartels fix prices either by announcing list prices to buyers and by agreeing to sell only at list or by agreeing to sell at some lower "floor" (minimum) price or at a "target" (average) price below list. Some cartels also agree to eliminate or restrict discounts, which will reduce the variance but cause negative skewness. Cheating is almost always a problem in cartels. Because the target price is high by historical or cost standards, few if any sales by cartel members would occur at supra-target prices. Cheating would cause prices to become negatively skewed compared to the same market without collusion.

Empirical Verification

There are few empirical studies of price dispersion in the context of homogenous oligopolistic market structures. Borenstein and Rose (1994) find that discriminatory price dispersion in airline fares in identical routes is explained by costs of whether cartel members cheated on the cartel's fixed list prices (pp. 48-56). Ellison develops an innovative method for detecting secret price cuts by cartel members. He finds that secret price cuts occurred during 25% of the cartel period and that the price discounts averaged about 20%. Ellison's work suggests that cartels induce negative skewness in pricing during periods of effective price increases; there was no evidence of price premiums above list (agreed) prices, only discounts. Abrantes-Metz *et al*. (2004) examine the effects of a bid-rigging cartel in frozen fish sold to the U.S. Department of Defense on price variance by comparing the variance during the cartel's effective period with the period after the existence of a formal grand-jury investigation became known to the conspirators. The average price dropped 23% after the cartel was uncovered (September 1988 to September 1989), but more to the point the variance increased by 145% compared with the variance during the conspiracy period (January 1986 to July 1988).

An alleged U.S. cartel fixed the prices of at least two products A and B in the late 1980s and early 1990s (Connor 2003). The delivered prices of all sellers in the cartel were available for thousands of deliveries during an eight-year period, one year before the cartel operated and seven years of effective cartel operation. Three measures of price dispersion were calculated for the two products (Table 1). The prices of these products are quite low (less than $0.25 per pound) and

they are difficult to transport, so after-delivery arbitrage is unlikely.[4] For both products price dispersion declines, leptokurtosis develops, and skewness is negative and much lower during the cartel period. Although not shown, these statistics follow the same pattern for all seven years and for each company in the vast majority of cases. These results are consistent with cartel conduct. (Perhaps the only unexpected result is that prices were positively skewed in the more competitive period, a pattern not suggested by economic theory.)

Table 1. Price Dispersion Analysis, Effects of Collusion on Two Products.

Product: Period	Coefficient of Variation	Kurtosis	Skewness
Product A:			
Pre-cartel	0.196	4.94	1.053
Cartel	0.134	3.58	0.401
Product B:			
Pre-cartel	0.159	10.57	1.947
Cartel	0.127	3.41	0.179

Note: Pre-cartel period is one full year before cartel began to fix prices. Cartel period is seven years (averaged). Based on thousands of delivered prices by five sellers to one city in the United States. Data are confidential.

Antitrust Policy Implications

Writers appraising the effectiveness of antitrust laws often identify the fight against price-fixing conspiracies as a signal achievement (Posner 2001). However, since 1995, antitrust agencies have been wrestling with a renewed outbreak of global cartels of massive proportions (Connor 2003; Evenett *et al.* 2001). The legal burden of proof of illegal cartel behavior rests with prosecutors or plaintiffs. In order to obtain restitution in civil cases or punitive sanctions in criminal cases, prosecutors must present persuasive economic evidence of monetary damages. The five methods of proof accepted by U.S. courts have deficiencies that can be exploited in forensic settings by defendants' economic experts (Connor 2004).

Quite simply, the availability of an additional, independent method of detecting collusion in natural markets would have two significant benefits for anticartel enforcement. First, the method of analysis proposed here offers a highly rigorous standard of proof based on broadly accepted statistical measures. Allowing evidence on price dispersion to prove the existence or nonexistence of collusive price behavior would narrow the scope of forensic debates. The concepts of price dispersion are relatively simple to explain and illustrate to jurors and jurists alike. (The same cannot be said for some methods of analysis focusing on price averages, some of which require an understanding of algebraic oligopoly models or advanced econometric techniques). Thus, evidence on price dispersion in conspiracy cases may well reduce the length, complexity, and costs of litigation.

Second, the availability of an additional tool of detection of collusive behavior will have

deterrence value. Transactions prices can be collected from the parties most likely to allege the existence of an illegal cartel – the customers. Thus, tests of price dispersion can be applied to samples of prices provided by suspicious buyers to prosecutors or plaintiffs attorneys *prior* to launching a formal investigation or filing a civil suit. Moreover, as the next section will explain, a sample of prices from a narrow geographic market will suffice for detection purposes, keeping analytical costs low. In other words, analysis of price dispersions can be part of a rigorous screening process that would winnow probably collusive episodes from unlikely ones and winnable suits from those likely to fail in the courts. Thus, evidence from changes in price dispersions over time can reduce both Type I and Type II errors in cartel detection.

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[i] Mund (1960) notes that identical bids on project tenders is viewed as strong evidence of collusion. Elzinga (1984) surveys cartel studies and mentions almost in passing "…the presumption that prices under cartels should be higher, less variable over time, and more uniform at a point in time, all other things equal (p. 22." There are no sources given for this notion.

[ii] A third factor, the density of demand, "plays a minor role" (p. 490) and disappears when the cost curves become flat.

[3] There are studies of cartel *stability* that examine the variation in prices as a measure of the degree of cartel discipline across multiple episodes (see, for example Suslow 2001). Classic examples of reversion to more competitive pricing conduct are price wars. However, these studies are motivated by an interest in why cartel consensus breaks down from time to time or whether price-stabilization schemes are successful. They do not examine intra-episode price variation.

[4] The product must be delivered in rail cars or truck trailers that cannot be used for any other product.