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STANFORD INSTITUTE FOR ECONOMIC POLICY RESEARCH

**Coordinated Interaction and
Clayton §7 Enforcement**

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March 2003

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Abstract

When proposed mergers are reviewed by antitrust authorities in the United States they are examined for possible adverse effects on competition and on consumers. Two varieties of adverse results are considered: coordinated interaction and unilateral effects. The first is a possible increase in cooperation among firms attributable to the elimination of a competitor. The second is the incentive to increase price unilaterally that arises when a close competitor is integrated. Recently, enforcement authorities have suggested greater attention to coordinated interaction. This paper reviews the recent history of anti-merger law enforcement and explores the economic basis, chiefly in game theory, for predicting the effects of mergers on coordinated interaction. Economic theory is found to provide weaker support for predicting the effects of mergers on coordinated interaction than for predicting unilateral effects. Recent advances in relevant experimental research are also discussed, and the possible usefulness of a competitive altruism/spite index (CASI) as a summary of a market's supply-side behavior is explored.

Coordinated Interaction and Clayton §7 Enforcement[#]

Stuart D. Gurrea[*]

Bruce M. Owen[†]

INTRODUCTION

Before the FTC-DOJ Merger Guidelines were revised in 1992, avoiding an "increased likelihood of collusion" was the principal target of merger enforcement. The revised Guidelines ushered in a period of emphasis on "unilateral" effects (defined below). Antitrust enforcement agencies have recently embarked in an effort to bring the analysis of mergers as facilitators of collusion, cooperation, or coordination among competitors back to the forefront of merger enforcement.[1] The term used to describe the adverse consequences of such mergers is "coordinated effects." Coordinated effects include increases in prices. This article surveys what economic theory predicts in this area of antitrust, and identifies the areas where conventional economic wisdom does not provide satisfactory answers to merger enforcement issues.

We start out by putting into perspective the alleged recent neglect of coordinated effects relative to the analysis of unilateral effects. In providing a historical perspective on this question, we consider how advances—or lack of same—in economic theory may have gradually contributed to a greater focus on unilateral effects. Next, we analyze coordinated effects as defined in the 1992 Merger Guidelines (hereinafter the Guidelines)

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[1] Coordinated effects have experienced a revival under the current Administration. See, e.g., Charles A. James, REDISCOVERING COORDINATED EFFECTS (U.S. Department of Justice, August 13, 2002).

by relating this antitrust term to a broader set of economic concepts.[2] We also assess the importance of coordinated effects in antitrust enforcement and in particular, we evaluate the role coordinated interaction plays in enforcing §7 of the Clayton Act.

A common theme in revisiting coordinated effects is to reconsider the relevant analytical tools. We interpret the Guidelines in the light of game theory and identify how this analytical framework contributes to our understanding of collusive behavior. In addition, we address the claim that while game theory has improved our understanding of collusive behavior, it has lacked generality and robustness in some of its predictions. More specifically, it has been argued that the complexity of the game theory paradigm adds little to the enforcement of coordinated effects beyond Stigler's "its easier to collude if there are fewer competitors" assertion.[3]

We also consider a more general issue that underlies the entire effort to reinstate coordinated effects: does greater emphasis on coordinated effects benefit society at large? Bearing in mind the difficulties to simply identify illicit coordinated effects it is necessary to consider how likely these are to have perverse effects on consumers.

Among alternative approaches that can shed light on policy issues in the area of coordinated effects, we consider two possible directions. One is to learn more from the contributions of other areas of economics and other social disciplines. In this article we review some of the lessons that can be drawn from the field of experimental economics. In particular, we consider its contributions in the area of industrial organization and its application to antitrust, especially in the areas in which empirical evidence is slim.[4] A second possible direction is to refine our conventional analysis within a structural framework. In the final section of this article we consider how an index to summarize market

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[2] U.S. DEP'T OF JUSTICE & FEDERAL TRADE COMM'N, HORIZONTAL MERGER GUIDELINES (rev. ed. 1997), *reprinted in* 4 Trade Reg. Rep. (CCH) ¶13, 104.

[3] George Stigler argued that collusion is easier if the number of firms is smaller; hence, mergers tend to facilitate collusion. George J. Stigler, *A Theory of Oligopoly,* 72 JOURNAL OF POLITICAL ECONOMY 44, 61 (1964).

[4] The use of cognitive psychology to enrich our understanding of economic behavior is another promising tool for understanding the likely effects of mergers. We do not explore this area in the present article. For a survey of the use of such tools in other areas of economic analysis of law, see Christine Jolls, Cass R. Sunstein & Richard Thaler, *A Behavioral Approach to Law and Economics*, 50 STANFORD LAW REV. 1471 (1998).

structure information when evaluating the potential for coordinated effects would work in this framework. In reviewing these alternative directions, we by no means envision these or other alternatives as mutually exclusive.

I. UNILATERAL EFFECTS AND COORDINATED EFFECTS

The 1980s—the Reagan era—were the heyday of the new Guidelines and the legitimization of economics as the touchstone of merger analysis. The 1990s saw some disappointments, including a series of failed attempts to stop mergers in rather narrowly defined markets.[5] Perhaps in frustration, the agencies did an odd thing—they largely abandoned the idea that merger law enforcement was about avoiding "collusion," and began to focus instead on "unilateral effects." There is a political angle to this. Apparently unilateral effects theories appeal to aggressive enforcers because they are more readily found in proposed transactions than are coordinated interaction effects. Virtually all relevant markets involve differentiated products and any merger among producers of competing differentiated products necessarily produces a price increase by the remaining competitors.[6] The only exceptions are when entry (or repositioning in product space) is free or efficiencies are achieved. Perhaps it was a desire for more aggressive enforcement that led to the ascendancy of unilateral effects, or perhaps it was the governments' relative lack of success in court.

A curious feature of the unilateral effects approach is that it quite explicitly ignores coordinated interaction. By this we mean that the unilateral effects predictions of economic theory rely expressly upon the assumption of Cournot-like behavior.[7] The theorems are not valid, as a formal matter, if the merger partners are enmeshed in any form of

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[5] U.S. v. The Gillette Company and Parker Pen Holdings, Ltd, FTC vs. R.R. Donnelley & Sons Co, U.S. v. Syufy Enterprises and Raymond J. Syu.

[6] This is proven under general assumptions by Raymond Deneckere & Carl Davidson, *Incentives to Form Coalitions with Bertrand Competition*, 16 THE RAND JOURNAL OF ECONOMICS 473, 486 (1985). Discussion of the unilateral effects model may be found in Carl Shapiro, *Mergers with Differentiated Products*, ANTITRUST 23, 30 (Spring, 1996); Gregory J. Werden & Luke M. Froeb, *The Effects of Mergers in Differentiated Products Industries: Logit Demand and Merger Policy*, 10 JOURNAL OF LAW, ECONOMICS AND ORGANIZATION 407, 426 (1994).

[7] This concept of competition among quantity-setting firms is defined below. *See infra* Part II.

cooperative coordinated interaction. One can imagine all sorts of stories about particular coordinated interaction environments in which a given merger produces price effects very different from those predicted by Cournot games. So far as we know, there is no systematic literature on this. But we suspect that many real-world differentiated products markets (except those with easy entry or easy repositioning) display some form of cooperative coordinated interaction amongst adjacent or near-by competitors.

The economic theory of unilateral effects predicts that a merger between competitors who are "adjacent" or even "near by" in differentiated product space (or geographic space) will necessarily produce a price increase, regardless of how the relevant market is defined and regardless of the level of concentration in that market, as long as there are significant entry and relocation costs and no offsetting efficiencies. Presumably the price increases that result from such mergers form a continuum. Bigger price increases take place when the merger partners are closer to each other before the merger. There is nothing in the Guidelines about how big a price increase is required in order for the merger to be objectionable. Perhaps the answer is that any increase is objectionable.

The unilateral effects and coordinated interaction analysis will be at odds if the unilateral effects analysis is performed in a static Cournot-like framework or more generally if it overlooks the dynamic interaction between competitors. Firms interact repeatedly with each other and this interaction will affect their optimal strategies. Consider for example an industry such as airlines or telecommunication networks requiring large initial investments. It is likely that a relatively stable set of firms will compete over time. In this scenario prices above those that characterize competition are sustainable because firms can retaliate and punish deviations from the collusive outcome in the future, as in the famous "tit for tat" strategic pattern. Therefore, with repeated interaction, cooperative outcomes may be sustainable, whether it is by firms making joint price and quantity decisions (a cartel) or independently sustaining non-competitive outcomes ("tacit" collusion). Therefore, overemphasis of static unilateral effects may lead to less vigorous enforcement than is appropriate.

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Advances in economic theory, or the absence of them in certain areas, may have also contributed to the focus on unilateral effects. For example, models demonstrating the profitability of a merger through greater market power provided further support for the analysis of unilateral effects. Some previous models had shown (albeit in very special and perhaps empirically trivial circumstances) that some mergers could lead to lower industry profits and prices, even absent efficiencies.[8] In contrast, the analysis of unilateral effects found support in new theoretical models showing how, even in the absence of cooperation, rival firms might profit from a merger in an oligopoly market. Unlike previous models in which pre-merger symmetry was preserved after a merger, in these models the merger yields a dominant firm.[9] From an empirical perspective, the unilateral effects approach advanced with the development of econometric methods that improved the ability to identify patterns of substitution across differentiated products and therefore predict the price effects of a merger.[10]

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[8] Dowell shows that mergers may not be profitable if assets are industry-specific and nonsalvageable. After the merger, industry-wide and merging firms' profits may remain unchanged. See, Richard Dowell, *Asset Salvageability and Potential For Trade Restraint Through Merger* 15 RAND JOURNAL OF ECONOMICS 537, 545 (1984). Salant et al., relying on the assumption of "symmetric" competitors facing a linear demand and constant marginal costs, showed that an exogenous merger would yield a more concentrated market of symmetric firms. In this model, the sum of the merging firms' profits may be greater than the profits of the merged entity. "Symmetry" here means that the pre-merger industry consists of *n* identical differentiated product firms and *n-1* such firms after the merger. See Stephen W. Salant, Sheldon Switzer & Robert J. Reynolds, *Losses from Horizontal Mergers: The Effects of A Horizontal Change in Industry Structure on Cournot-Nash Equilibrium*, 48 QUARTERLY JOURNAL OF ECONOMICS 185, 199 (1983).

[9] In Deneckere and Davidson's model, post merger profits can increase if the merged entity produces a greater variety of products. See Deneckere & Davidson, *supra* note 6. Perry and Porter show how the merged entity can produce the same output at lower costs. *See,* M. K. Perry & Robert. H. Porter, *Oligopoly and the Incentive for Horizontal Merger*, 75 AMERICAN ECONOMIC REVIEW 219, 227 (1985). Farrell and Shapiro show that without potential competition, synergies, and learning, asset based mergers yield a price increase under Cournot competition. *See*, Joseph Farrell & Carl Shapiro, *Horizontal Mergers: An Equilibrium Analysis*, 80 AMERICAN ECONOMIC REVIEW 107, 126 (1990).

[10] Steven Berry and others developed techniques for the analysis of demand and supply in markets with differentiated products. More specifically, they estimate elasticities and cost parameters from a structural model of supply and demand. This class of empirical models is helpful to answering policy questions related to merger analysis. For further discussion of these empirical methods see, *inter alia*: Steven Berry, *Estimating Discrete Choice Models of Product Differentiation*, 25 RAND JOURNAL OF ECONOMICS 242, 262 (1994); Gregory J. Werden & L. M. Froeb, *The Effects of Mergers in Differentiated Products Industries: Logit Demand and Merger Policy*, 10 JOURNAL OF LAW, ECONOMICS AND ORGANIZATION 407, 426 (1994); and Steven Berry, James Levisohn, & Ariel Pakes, *Automobile Prices in Market Equilibrium*, 63 ECONOMETRICA 841, 890 (1995).

The theoretical and empirical advances supporting the analysis of unilateral effects have not been mirrored in the area of coordinated effects. While progress has been made in the study of coordinated interaction, the analysis of coordinated interaction has lacked a general set of theoretical predictions comparable to those developed in the area of unilateral effects, in particular identifying what factors lead to coordination and addressing the relation between concentration and coordination. On the empirical front, the development of predictive tools in the area of unilateral effects has not been paralleled in the area of coordinated effects.[11]

Despite the prescriptions of economic theory being limited in the area of coordinated interaction, unilateral effects fans need to be careful that they are not paying attention only to those aspects of competition that lend themselves to static game-theoretic study but which may be of limited relevance to the empirically significant effects of merger activity on consumer welfare. In other words, the enthusiasm in recent years for unilateral effects analysis in merger enforcement may reflect not a new level of generality and sophistication but rather an acknowledgement that rigorous economic modeling has not yet advanced to the point of addressing the more interesting and relevant issues of merger policy. We are reminded of the story of the man who lost his wallet somewhere on a dark street, but confined his search to the vicinity of a lamppost because that area was well lighted. Mathematical rigor is not the same thing as wisdom, and there comes a point where the aesthetics of economic theory can become a hindrance rather than a help to making sensible merger enforcement decisions. In this vein, Charles James notes:

> Within the agencies, unilateral effects cases are perceived by many to be easier to analyze and more likely to gain economic support. Outside of the agencies, however, unilateral effects cases are no bargain. The case law of Section 7 largely has developed on a coordinated effects model, and courts appear to be more comfortable addressing merger issues based upon the traditional approach. Moreover, if placed under sodium pentothal, most economists would concede that market definition is not particularly important in unilateral effects analysis, an additional fact that can make it difficult to square the case theory with the way many courts tend to view merger issues. An additional complicating factor in unilateral effects litigation is the heavy dependence upon theoretic economic testimony -- particularly econometrics and merger models. Economic testi-

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[11] Merger simulation models based on unilateral effects are discussed Gregory J. Werden & Luke M. Froeb, "Calibrated Economic Models Add Focus, Accuracy, and Persuasiveness to Merger Analysis," (EAG working paper, Department of Justice, June 24, 2002). See also Daniel Hosken, Daniel O'Brien, David Scheffman, & Michael Vita, DEMAND SYSTEM ESTIMATION AND ITS APPLICATION TO HORIZONTAL MERGER ANALYSIS (FTC Working Paper 246, April, 2002).

mony, of course, is inherently easy to attack, especially because each side will have its experts advocating opposite conclusions. Finally, very often, the effects predicted by unilateral theory are small in percentage terms.[12]

II. THE CONCEPT OF COORDINATED INTERACTION

A first step in relating the theory and enforcement of coordinated interaction is to clarify the meaning and use of the term in the context of law and economics: is "coordinated interaction," as used in the Guidelines, the same as the economists' concept of "cooperative behavior"? If not, what is the distinction? For the sake of clarity in an area where lawyers and economists use similar terms to mean different things, we offer the following table of definitions, to which we will adhere. For the sake of clarity this table abstracts from a long list of real world complexities and refinements to these general concepts.

[INSERT TABLE ABOUT HERE]

 Section 2.1 of the Guidelines defines *coordinated interaction* as "comprised of actions by a group of firms that are profitable for each of them only as a result of the accommodating reactions of the others. This behavior includes tacit or express collusion, and may or may not be lawful in and of itself."[13]

The Guidelines' definition of coordinated interaction encompasses market outcomes that can result from firms individually or jointly deciding their optimal strategies. Economists generally embrace game theory as the best currently-available analytical framework to study firms' decisions, and in particular to understand the conditions in which competitors are likely to sustain non-competitive outcomes. Within this framework, competitor's decisions can be studied when they seek the group's best outcome (*cooperative game*) or when they seek their optimal course of action based on what are individually optimal prices (*Bertrand competition*) or individually optimal quantities

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[12] *See,* Charles James, *supra* note 1.

[13] *See* U.S. DEP'T OF JUSTICE & FEDERAL TRADE COMM'N, *supra* note 2.

(*Cournot competition*).[14] This game theoretical distinction does not imply that that non-competitive outcomes stem solely from cooperative behavior (e.g., collusion) among rivals. To the contrary, a departure from competitive outcomes may be observed when firms behave in a non-cooperative manner as long as "coordination" is provided by marketplace incentives and conditions.

Rival firms behaving strategically can sustain non-competitive outcomes by cooperating or colluding, i.e. by agreeing on prices above the competitive level. This agreement in turn may be explicit or tacit. An explicit agreement among independent firms results in the formation of a cartel with independent firms making joint price or output decisions. Once the cartel is formed and the agreement is binding firms play a cooperative game to maximize joint profits. The fact that firms are able to meet and jointly choose their optimal strategies does not guarantee that they can achieve monopoly profits. Tacit collusion on the other hand takes place when firms agree in a purely non-cooperative manner: rival firms recognize the possibility of outcomes above the competitive level and are able to implement them without any express agreement.[15]

Chamberlin long ago noticed that in an oligopoly market with homogeneous products, a supra-competitive price could be sustained without express collusion.[16] Chamberlin's model was quite simple. Imagine a firm considering whether to cut its price. The firm will expect an immediate gain because it will sell more output. It will also expect its rivals to cut price in response, leading eventually to lost sales for the original firm. The firm will see a tradeoff between the immediate gain and the eventual loss. If the eventual loss has a greater present value than the immediate gain, the firm will not cut its price in the first place. Thus, depending on the degree of product differentiation and the

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[14] The study of individually optimal behavior assumes the other firms will behave in the same way. These games are denominated *strategic* or *non-cooperative* games.

[15] For a discussion of the different forms of horizontal integration, see Alexis Jacquemin & Margaret E. Slade, *Cartels, Collusion, and Horizontal Integration, in* RICHARD SCHMALENSEE & ROBERT WILLIG, 1 HANDBOOK OF INDUSTRIAL ORGANIZATION (1989).

[16] Chamberlin's model neglects such important issues as entry. *See*, Edward H. Chamberlin, *Duopoly: Value Where Sellers Are Few,* 43 QUARTERLY JOURNAL OF ECONOMICS 63, 100 (1929).

firms' discount rates, rival firms can maintain supra-competitive prices without express collusion or even communication.

A first implication of the definition of coordinated interaction is that the Guidelines do not fully account for the likelihood of cooperation. This definition does not include scenarios in which the non-competitive outcome is not a result of accommodating reactions but instead of firms displaying some degree of altruistic behavior, as if assigning a positive weight to rivals' profits. While the outcome of express collusion results from cooperative joint decisions and tacit collusion relies on non-cooperative individually optimal decisions, a cartel's stability and a tacit agreement depend on the collusive strategy prevailing over the competitive strategy. In contrast, with altruistic behavior or purely cooperative behavior cooperation may always be an optimal strategy. To the extent that this sort of behavior takes place and to the extent that the Guideline's definition of coordinated interaction does not account for it, the concept of coordinated interaction is limited to a subset of all possible cooperative behavior.

Second, it is important to note that coordinated interaction as defined in the Guidelines includes both tacit and express collusion. By making this distinction the Guidelines acknowledge that communication about future actions is not a necessary condition for the existence of collusion, although the particular outcome may very well depend on the degree of information exchange. While communication may take place, it is possible that firms do not agree expressly on monopoly prices, do not meet to choose their prices and level of output, but the observed prices and quantities correspond to cooperative behavior, i.e. "tacit collusion" takes place.[17]

How does the term "coordinated interaction" differ from other commonly used terminology? Perhaps the authors of the Guidelines had "cooperative" or "collusive" behavior in mind, but wished to avoid its connotation, for a lay audience, of express collusion or agreement. Perhaps they had in mind the possibility of grudging cooperative behavior imperfectly implemented. While the term defined in the Guidelines explicitly refers to collusion, both tacit and express, the Guidelines emphasize with the use of the

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[17] We discuss in detail the role of information in Part III.

term "coordination" the conduct, regardless of how it come about. However, the fact that the 1992 Guidelines do not simply refer to collusion does not imply that they are concerned with a broader class of behavior.

Thus, in relating the Guidelines' definition of coordinated interaction with other generally used economic concepts, we find the Guidelines concept of coordination to be consistent with both cooperative and non-cooperative behavior, as well as gradations of each. More generally, interaction among competitors is always "coordinated" in some fashion, whether by the invisible hand of the market, by myopic non-cooperative reactions to changes in own-demand, or by some degree of cooperation. The Guidelines definition is a very special case of such interaction.

III. COORDINATED INTERACTION AND CLAYTON §7 ENFORCEMENT

Coordinated interaction plays a very different role in antitrust enforcement of Sherman §1 of the Sherman Act than it does in §7 of the Clayton Act.[18] One of the central legal issues in §1 enforcement for the last century has been where to draw the line between lawful and unlawful coordinated interaction. The law has also focused on distinctions between civil and criminal coordinated interaction and on the distinction between *per se* coordinated interaction and unreasonable coordinated interaction. In recent decades the law and economics movement has led courts increasingly to put an economic gloss on these debates, especially in such areas as so-called vertical restraints. Section 7, in contrast, is partly about preventing the establishment (or reinforcement) of coordinated interaction harmful to consumers.

Should enforcement policy with respect to Clayton §7 be indifferent to whether Sherman §1 might be implicated by the type of coordinated interaction in question? From the point of view of economic policy the answer is yes. Indeed, one could argue that §7 ought to be *particularly* concerned with coordinated interaction that, if it occurred,

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[18] Section 1 of the Sherman Act, 15 USC. §1 prohibits "contract[s], combination[s] … or conspirac[ies]," that restrain trade. Section 7 of the Clayton Act, 15 USC. §18 prohibits mergers or acquisitions "where in any line of commerce or in any activity affecting commerce in any section of the country, the effect of such acquisition may be to substantially lessen competition, or to tend to create a monopoly."

clearly would be *lawful*. Such behavior is undeterred by fear of §1 liability. Undoubtedly §1 has been effective from an historical perspective in preventing the most visible mechanisms of price fixing in part by making price fixing contracts subject to criminal and civil penalties.[19] Yet fear of section §1 liability does not deter all harmful coordinated interaction because monopoly or non-competitive prices can be enforced without contracts.

The fact that not all harmful interaction is undeterred does not mean that all interaction is harmful. In reality most markets display an oligopoly market structure, whereby the number of competing firms is such that competing managers would be remarkably dense not to recognize the interdependence of their decisions. In these markets, purely competitive profit-maximizing behavior is characterized by firms taking into account the actions and reactions of their rivals. The fact that firms acknowledge interdependence does not imply that firms take advantage of it to harm competition.[20]

Under oligopoly market conditions, antitrust enforcement of Sherman §1 is presented with the difficult task of prohibiting coordinated interaction without punishing legitimate competitive behavior that relies on the recognition of interdependence. When detection is difficult and the distinction between lawful and unlawful is blurred, the importance of enforcing Clayton §7 is even greater because it can prevent interaction from becoming coordinated (in the Guidelines sense) in the first place by scrutinizing the likelihood that the change in market structure entailed by a merger creates the necessary incentives to sustain cooperation. The complexity of this task is increased by the fact that enforcement requires evaluating probabilities and not identifying actual illicit conduct, unlike the *per se* approach of Sherman §1 under which it is sufficient to prove the existence of the actual conduct.

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[19] Price fixing contracts generally were not enforceable under the common law in U.S. courts even before the Sherman Act was enacted in 1890.

[20] The question of whether a small number of firms recognizing interdependence leads to collusive outcomes is referred to as the "oligopoly problem". For a detailed discussion see, e.g., Jonathan A. Baker, *Two Sherman Act Dilemmas: Parallel Pricing, the Oligopoly Problem, and Contemporary Economic Theory,* 38 ANTITRUST BULLETIN 143, 219 (1993).

Antitrust enforcement has become far more sophisticated as it has absorbed more and more of the economic learning relevant to promoting consumer welfare. Unfortunately, this learning at the theoretical level produces few useful generalities to guide antitrust enforcement. The strategic behavior of rivals in a non-zero-sum game tends to be *sui generis,* especially as models are made more realistic. Most games turn out to have multiple equilibria and in a dynamic world the policy significance of even one equilibrium is diminished. Tellingly, antitrust economists in the enforcement agencies these days like to "tell a story" about behavioral patterns that would harm consumers if encouraged by a particular merger. These stories generally are not game theory models and they are constrained only by one's imagination.

This makes economic analysis of mergers intuitive rather than analytical. The game-theoretic basis of modern industrial organization led to an initial vacuum rather than a general analytical framework useful to enforcement officials. As theoretical models of oligopoly advance, practitioners are increasingly better equipped to determine the likely consequences of a specific behavioral pattern in a given structural context. Nevertheless, accurate predictions require ample empirical evidence about the industry in question as well as a rich body of experience with comparable industries. Moreover, in some cases actual behavior may depart from the commonly assumed non-cooperative paradigm, limiting the applicability of most theoretical predictions.

To the question of how to close the gap between theory and antitrust enforcement application there are two possible answers. The first is to advocate rigorous application of the current game theory to merger analysis. The second is to propose alternative theoretical approaches that more readily bridge the gap between theory and policy. In section IV we consider this issue from the perspective of game theory, and in the remainder we present some alternative approaches.

Facilitating practices

In the Sherman §1 area the agencies in the 1970s embarked on a search for tools to attack coordinated interaction based on practices such as "facilitating devices" whose principal

effect was to encourage teamwork among competitors.[21] This effort responded to the acknowledgment that cooperation depends on the sustainability of the agreement, and that certain factors or "facilitating devices" will increase the likelihood of successful cooperation.

For example, the electric equipment conspiracy of the 1950's involved independent firms meeting to fix prices for standardized products and agreeing on pricing formulas for custom products.[22] These agreements were prosecuted successfully by the government. Later, the same manufacturers adopted standardized catalogs and public pricing formulae that made it easier for each to predict the price that its rivals would bid on complicated projects. The government alleged that these unilateral practices facilitated cooperative pricing.[23]

The electrical equipment case led to an enthusiastic search for facilitating devices in other industries. The Department of Justice undertook several screening programs, one of which was called the "shared monopoly" project, aimed at uncovering such devices. The screening programs met with little success and were eventually ended around 1980. The attack on facilitating practices came to grief in the FTC's Ethyl case.[24] In that case the Second Circuit Court of Appeals stiff-armed the FTC claim that Ethyl and others had

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[21] Facilitating practices can take a variety of forms: information exchange, trade associations, price leadership (one firm sets prices and other firms set the same price after a short period of time), collaborative research and cross licensing of patents, most-favored-nation and meeting-competition clauses in buyer seller contracts, resale price maintenance (manufacturers set a floor on the prices retailers can sell the product preventing in this way the possibility of collusive agreements been ineffective at the retail level), basing point pricing (information on transportation charges and prices is exchanged resulting in uniform prices for the delivered product), and common costing books which specify a cost formula for a given set of product specifications leading to price uniformity. *See*, Ray Rees, *Tacit Collusion*, 9 OXFORD REVIEW OF ECONOMIC POLICY 27, 40 (1993).

[22] *See*, F. M. Scherer & David Ross, *Conditions Facilitating Oligopolistic Coordination*, and *Conditions Limiting Oligopolistic Coordination*, *in* F. M. SCHERER & DAVID ROSS, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE (1990).

[23] In *United States v. General Electric Co. et al.,* (E.D.Pa), (Dec. 1976), Reported 1977 Trade Cases (CCH) 712, the Department of Justice moved the court to amend the decree that had ended the electrical equipment price fixing conspiracies to bar certain facilitating practices.

[24] *See: E.I. du Pont de Nemours & Co. v. Federal Trade Commission* 729 F.2d 128 (1984); George Hay, *Practices That Facilitate Cooperation: The Ethyl Case*, *in* JOHN E. KWOKA & LAWRENCE J. WHITE, THE ANTITRUST REVOLUTION (1989); Donald S. Clark, *Price-Fixing Without Collusion: An Antitrust Analysis of Facilitating Practices After Ethyl Corp.*, WISCONSIN LAW REVIEW 887, 896 (1983).

adopted most favored customer and other devices to facilitate cooperative behavior in the sale of gasoline additives. Ever since, facilitating practices have been part of the lore of merger enforcement, but have not been the subject of direct attack in the courts.

Facilitating practices take a very different role in the context of Clayton §7. While standard of Sherman §1 requires establishing whether facilitating practices are evidence of a cooperative agreement, in the context of §7, establishing the existence of facilitating practices is helpful in showing the relation between a merger and the likelihood of concerted action. As a result, as more attention is drawn to the analysis of coordinated interaction, greater emphasis will be put on the study of facilitating practices.

IV.   GAME THEORY, COORDINATED INTERACTION AND CLAYTON §7 ENFORCEMENT

The Guidelines spell out the determinants of collusion to guide antitrust practitioners in the area of coordinated interaction. These can be better understood from the application of game theory to the study of industrial organization. In this section we interpret the Guidelines in the light of game theory and considerer both the role of game theory as an analytical framework to study collusive behavior as well as the implications that game theory has for antitrust enforcement.[25] In particular, we explain the claim that while game theory has improved our understanding of collusive behavior some game theoretical predictions have lacked the generality and robustness that policy applications require.[26]

A. Conditions for Collusion

§2.1 of the Guidelines focuses on the three obstacles for collusion identified in Stigler's 1964 seminal work: first, a collusive agreement requires that the incentives to collude are sufficient and that firms are able to reach an agreement; second, since firms have incentives to undercut their rival's prices or expand production beyond the terms of

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[25] For another discussion of law, tacit collusion and game theory see, e.g., Dennis A. Yao & Susan S. DeSanti, *Game Theory and the Legal Analysis of Tacit Collusion*, 38 ANTITRUST BULLETIN 113, 141 (1993).

[26] *See, e.g.,* Jacquemin & Slade, *supra* note15.

the agreement, members of the agreement need to be able to detect cheating; and third, in order to deter deviations from the agreement, they need to be able to punish them.[27]

The very definition of coordinated interaction suggests that these conditions require to be studied in a dynamic model, i.e. in an analytical framework capable of formulating firms' strategic decisions over time. The dynamic aspects of competition have been often "built into" static models to avoid the complexity of dynamic models but, while static models may identify the Chamberlinian tradeoff between the gains from collusion and the risk of price undercutting, they fail to model firm's reactions to each rival's rational decisions over time. Game theory provides economists with an analytical framework capable of modeling rival's choices and reactions in a dynamic context overcoming the limitations present in traditional static models.[28]

A wide variety of oligopoly behavior can be modeled by means of a non-cooperative game in which coordination is precluded by firm's inability to prevent rivals from responding to the incentives to deviate from the agreement. This game is referred to in the game theory literature as the Prisoner's Dilemma and represents a standard problem firms face when deciding whether to cooperate or not: while it is profitable to cooperate, a firm is worse off if it sticks to the terms of the agreement while another firm chooses not to.[29] Under these conditions, and if firms' interaction is limited to one period, cooperation is not an equilibrium outcome since firms have incentives to deviate given that others are cooperating, i.e. coordination is not a Nash equilibrium.[30] In terms of Stigler's conditions for collusion, in a static framework firms are not able to punish cheating. An analogous outcome is observed when firms interact for a limited number of periods. In the last period rival firms play a static game and, as we have just seen, cannot sustain cooperation because deviation is profitable and no retaliation can take place in the future. In the period before the last, future punishment is not possible since firms will not coop-

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[27] *See,* Stigler, *supra* note 3.

[28] *See,* JEAN TIROLE, THE THEORY OF INDUSTRIAL ORGANIZATION (1988).

[29] *See,* Baker, *supra* note 20.

[30] For a formal definition of the concept of Nash equilibrium, see, e.g., ANDREW MAS-COLELL ET AL., MICROECONOMIC THEORY 246 (1995).

erate in the last period. The same logic applies going backwards up to the first period. As in the static one period game, the inability to punish deviations from the agreement will prevent cooperation from being a Nash equilibrium at every point in time.[31]

Unlike the static or finite horizon games, when the time frame is infinite or uncertain, game theory shows that any price between the competitive and monopoly prices can be an equilibrium.[32] In this setting a firm may consider deviating from a cooperative strategy, undercutting its competitors and increasing its share, but will take into account its rivals' possible "retaliatory" (spiteful) behavior in the future. If future payoffs are important enough, i.e. for a high enough discount factor, an equilibrium with prices above competitive levels can be sustained because the potential loss of future profits offsets the short run gains from cheating.[33]

An important contribution of this game theoretical analysis to the understanding of coordinated interaction is that it provides a formalization of tacit collusion. When competitors repeatedly interact, firms can sustain a collusive outcome while behaving in a purely non-cooperative manner. A straightforward policy implication of this general result is that when firms interact for a known limited number of periods antitrust enforcers need to pay less attention since game theory predicts that cooperation is not sustainable. For example, if an auction is repeated periodically and bidders are the same, it is

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[31] In a static game the most widely used concept of equilibrium in economics is the *Nash equilibrium*, which specifies a set of strategies such that each player's strategy is a best response to the strategies played by its rivals. In a dynamic context economists are generally interested in an equilibrium concept that specifies optimal actions at every decision point in time. The concept of *Subgame Perfect Nash Equilibrium* isolates this set of *reasonable* equilibria within the set of Nash equilibria. These equilibria are identified using the backwards induction procedure, which essentially considers the optimal action in the last period and works backwards by determining the optimal choice at each point in time within the payoffs that result from the optimal choices in the future. This refinement of the Nash Equilibrium guarantees that punishments are credible, i.e. that punishment will be applied if cheating takes place. In the absence of credible punishment cooperation is not sustainable. For further discussion on the concept of *Subgame Perfect Nash Equilibrium, see, e.g., id.*

[32] For a review of collusion as an application of repeated games see Kyle Bagwell & Asher Wolinsky, *Game Theory and Industrial Organization*, *in* ROBERT J. AUMANN ET AL. (editors), HANDBOOK OF GAME THEORY WITH ECONOMIC APPLICATIONS 3 (2002).

[33] For a formal treatment of this general result known as the *Folk Theorem, see,* e.g., Tirole, *supra* note 28.

more likely that collusion will take place than if bidders change over time and interaction among the same bidders is limited to one period.

The main shortcoming of this theoretical result is that almost any outcome can be an equilibrium, limiting the usefulness of the model's predictions. By virtue of its generality the policy implications of the theory are limited: for a fairly general set of market conditions multiple equilibria between the competitive and monopoly profits can be sustained. While economists have narrowed down the set of sustainable equilibria it has been done at the expense of generality, since the applicability of the theory and the validity of its results fall as the set of assumptions necessary for the result to hold become more restrictive. [34] Again, this approach is not satisfactory for antitrust practitioners since real world complexities are unlikely to fit the list of assumptions of a specific model.

B. Factors that Facilitate or Hinder Collusion

After defining coordinated interaction, the Guidelines go on to identify the "Conditions Conducive to Reaching Terms of Coordination" and " Conditions Conducive to Detecting and Punishing Deviations."[35] In particular the Guidelines focus on the role of information exchange and market structure on the likelihood of collusion. How does game theory inform antitrust practitioners about the role of information and market structure as facilitators of collusion?

In relation to coordinated interaction, we can distinguish two different aspects of information: first, the extent to which rival firms communicate their future strategies; and second, the degree to which rival's past actions are observable. In the context of non-cooperative game theory, for collusion to take place it is necessary that there are market incentives and conditions to make the agreement the firms' best strategy. So what is the effect of communicating future actions on these incentives and conditions? Sherman §1 makes express collusion unlawful, i.e. explicit agreements are subject to big risks—of

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[34] *See*, e.g.: W.Bentley MacLeod, *A Theory of Conscious Parallelism*, 27 EUROPEAN ECONOMIC REVIEW 25,44 (1985); and, James Brander & Barbara Spencer, *Tacit Collusion, Free Entry and Welfare*, 38 JOURNAL OF INDUSTRIAL ECONOMICS 277, 294 (1985).

[35] MERGER GUIDELINES §2.11 and §2.12, *supra* note 2.

criminal prosecution and private treble damage liability. Therefore communication or non-binding promises —referred to as 'cheap talk' in the economic literature—are irrelevant for the sustainability of the agreement since they are not enforceable in the courts and thus will not determine a firm's optimal strategy.[36] Therefore, whether the agreement is *express* or *tacit*, from an economic perspective the incentives to cooperate do not change, and preventing communication on what a firms decision is going to be is not a remedy for collusion.

This does not mean that communication of future decisions is irrelevant for the analysis of coordinated interaction. While this kind of information exchange does not determine firms' optimal strategies—whether to coordinate or not—it does help them choose a particular equilibrium. As discussed above, in a dynamic game with infinite horizon game theory shows us that any equilibrium between the competitive outcome and the monopoly outcome can be a Nash equilibrium; information exchange may help rivals choose the particular equilibrium.[37] In addition, from an enforcement perspective, information exchange can be an indication of collusion.

The second dimension of information is whether rivals' past actions are observable or not. Unlike a mere declaration of future intentions, observing past actions is a necessary condition for detecting deviations from the agreement, and hence it is key in determining a firm's optimal strategy.

The analysis of information exchange is particularly important due to the lack of appropriate analytical tests to separate legitimate competitive behavior from coordinated interaction. In order to identify anticompetitive behavior antitrust enforcers must rely on identifying the existence of mechanisms that enable the exchange of information as an

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[36] The informational value of an announcement of future actions, which is costless for the firm making the announcement, is small since other firms cannot verify it. This premise changes when in a dynamic framework firms assign value to their reputation and hence making false announcements comes at a cost. *See, inter al.*, Paul Milgrom & John Roberts, *Predation, Reputation and Imperfect Information,* 27 JOURNAL OF ECONOMIC THEORY 280, 312 (1982), and David Kreps & Robert Wilson, *Reputation & Imperfect Information,* 27 JOURNAL OF ECONOMIC THEORY 253, 279 (1982).

[37] This discussion focuses on the role of information exchange in singling out a particular equilibrium. More generally game theorists refer to "focal" strategies as those that are singled out because of information exchange, social convention, experience, etc. See, JEAN TIROLE, *supra* note 26, 247.

indication that interdependence is likely to result in concerted action. As highlighted in the discussion above, such mechanisms (facilitating practices) can take multiple forms and are characterized by the exchange of information.

The second set of factors specified by the Guidelines are market factors: "the availability of key information concerning market conditions, transactions and individual competitors; the extent of firm and product heterogeneity; pricing or marketing practices typically employed by firms in the market; the characteristics of buyers and sellers; and the characteristics of typical transactions."[38] This is the area in which game theory has received greater criticism since it has not been able to provide insights beyond those proposed by general economic theory. In particular game theory models have not provided a comprehensive answer to how the combination of these factors affects the likelihood of collusion.

A particular shortcoming of some of these models is that they predict a specific equilibrium outcome that by definition will persist over time. Such predictions contradict our observation that firms' behaviors change. Firms in an oligopoly market often set nominal or list prices that correspond to (possibly imperfect) collusive behavior and then engage in "price wars" (aggressive pricing) or non-price forms of competition. Green and Porter present a model that explains how such behavior can be an equilibrium outcome in the presence of imperfect information.[39] In their model, quantity-setting firms observing for example a low market price can not determine with certainty whether it is a result of rival firms undercutting or of random demand shocks. Therefore, the equilibrium path will combine both spells in which collusive behavior is observed as well as periods in which negative demand shocks drive firms to set non-cooperative Cournot quantities.[40]

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[38] MERGER GUIDELINES §2.11 and §2.12, *supra* note 2.

[39] Edward J. Green & Robert H. Porter, *Noncooperative Collusion under Imperfect Information,* 52 ECONOMETRICA 87, 100 (1984).

[40] Unlike Green and Porter's model in which price wars take place during periods of low demand, Rotemberg and Saloner present a model with no information asymmetry where greater gains from undercutting during periods of high demand result in price wars during periods of expansion. This model also presents price wars as part of the equilibrium strategies to support collusion. *See,* Julio J. Rottemberg & Garth Saloner, *A Supergame-Theoretic Model of Business Cycles and Price Wars During Booms*, 76 AMERICAN ECONOMIC REVIEW 390, 407 (1986).

In this model punishment phases are necessary to enforce the agreement, and hence are part of the equilibrium strategies and not a failure of the collusive agreement. This approach, based on demand shocks, may not capture fully the compelling idea that cheating can be an optimal strategy in many other circumstances (bounded rationality springs to mind). Stigler himself points out that cartels break down, but the contributions shedding light on this issue are limited. Furthermore, the empirical literature does not provide much guidance on the behavioral aspects of cheating.[41] Despite their shortcomings, these models do offer insights into how collusion may be implemented and thus inform antitrust enforcers about what are the appropriate remedies.

From a behavioral perspective most models of collusion have focused on the study of independent firms that make decisions in their best interest, i.e. they study the behavior of profit maximizing firms that do not display any sort of altruistic behavior.[42] This corresponds to the classical model of strategic behavior in oligopoly, which is considered a general framework that best describes the behavior of most firms. In this setting, collusion or cooperative outcomes will be observed if they are sustainable in a non-cooperative manner, i.e. firms will collude if it is in their best interest and if the agreements can be sustained. The substance [or do you mean sustainability?] of the agreement only depends on the incentives to cheat, the probability of detection and the possibility of punishing deviations from the agreement.

But the non-cooperative paradigm does not provide the full picture. While non-cooperative game theory provides a broad framework for the analysis of collusion, we can think of many situations in which the behavioral assumptions should be closer to those of purely cooperative behavior. For example, for regulated firms cooperative behavior may be imposed by the state. In the same way that individuals display altruistic

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[41] Levenstein and Suslow review different studies of the determinants of cartel success finding that cheating is common. Their study concludes that general lessons on the determinants of cartel stability are hard to extract, and attribute this to the multiplicity of factors that affect the success of a cartel. *See*, Margaret C. Levenstein & Valerie Y. Suslow, *What Determines Cartel Success*, *in* PETER GROSSMAN, HOW CARTELS ENDURE AND HOW THEY FAIL: STUDIES OF INDUSTRIAL COLLUSION (2002).

[42] As noted above at note ___, behavioral economics would approach these issues by examining the psychology of managerial behavior under the realistic assumption that in the real world managers, though certainly constrained by market forces, have some freedom not to maximize short-run profits.

behavior by taking into account the well being of others, the state can impose on regulated firms agreements that result in a cooperative behavior with some degree of joint profit maximization. When cooperative behavior is displayed, and agreements are enforceable, communication is valuable and no longer just 'cheap-talk.' As we will discuss further below, similar outcomes will be observed when private firms are constrained in their behavior by non-profit considerations and display a behavior akin to cooperative behavior. Finally, in some cases market structure determines that cooperation is always sustainable, i.e. if market structure is such that cooperation is always profitable, and cooperation can always be sustained. In these cases firms display non-cooperative behavior but do not face the Prisoner's Dilemma, i.e. do not have the trade-off between cooperating and cheating.

Therefore we must keep in mind that the general predictions derived under the assumptions of non-cooperative behavior are only valid when this behavioral assumption holds. Moreover, conventional models rely on basic assumptions about the stability of the agreements and the necessary incentives to sustain collusion. If these assumptions do not hold then the predictions of the model will be misleading and much of the observed behavior will remain unexplained.

V. EFFECTS OF MERGER ACTIVITY ON CONSUMER WELFARE

In the context of readdressing the focus of merger enforcement, and to guide this analysis, it is important to consider a more general question: what *are* the empirically significant effects of merger activity on consumer welfare, and are these effects best understood by focusing on coordinated interaction rather than (merely) unilateral effects?

The sad truth is that despite endless calls for empirical study of the effects of mergers and of antitrust enforcement of §7, there is very little empirical evidence demonstrating the effects of mergers (or enjoined mergers) on consumer welfare. A comprehensive survey of this literature by Pautler finds little basis for generalization beyond the observation that some mergers appear to improve welfare and others appear to reduce it.[43]

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[43] Paul Pautler, EVIDENCE ON MERGERS AND ACQUISITIONS (FTC Working Paper No. 243, 2001).

Scheffman and others have recently emphasized the importance of empirical tools aimed at quantifying the factors underlying coordinated interaction theories.[44]

There is also a lack of theoretical work explaining *how* tacit collusion takes place. A particular behavior may facilitate collusion or may be harmless. Empirical efforts to identify tacit collusion can identify the presence of higher prices but typically will not explain the mechanism that led to that outcome. As noted above, in a dynamic context there are a multiplicity of equilibria that can be sustained over time, ranging from the competitive to monopoly outcomes. Therefore it is difficult to distinguish collusive behavior from other possible market conduct, particularly when firms compete in oligopoly.[45] The task becomes even more difficult when these price changes are observed in the context of a merger.

Attributing negative effects to coordinated interaction in the context of a given merger requires a two-step analysis. First, it is necessary to show that the merger will facilitate collusive behavior. Second, it is necessary to prove that this behavior will have perverse effects on consumer welfare.

Do mergers facilitate collusion? In order to answer this question, we first need to examine whether a merger increases the likelihood of reaching an agreement. Typically it will be easier to collude when products are homogeneous and competitors are co-located (it requires agreeing on just one price and quantity) and there is no uncertainty (firms have the same predictions about the future). Second, we need to determine the effect of a merger on the stability of collusive agreements, i.e., the effect on the incentives to cheat,

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[44] *See,* David T. Scheffman & Mary T. Coleman, CURRENT ECONOMIC ISSUES AT THE FTC (2001); David Scheffman, Mary Coleman, & Andrew Baziliauskas, EMPIRICAL TOOLS FOR THE ANALYSIS OF CO-ORDINATED INTERACTION EFFECTS FROM MERGERS AND ACQUISITIONS, forthcoming as a FTC BE Working Paper. (July 2002)

[45] Carlton et al. note that mere cooperative pricing based on "mutual interdependence and collateral interest" cannot be a basis for condemning a behavior as bad for competition. Moreover, restrictions on posting prices "might not lead to any improvement in social welfare, because consumers would be poorly informed". *See,* Dennis W. Carlton, Robert H. Gertner & Andrew M. Rosenfield, *Communication Among Competitors: Game Theory and Antitrust,* 5 GEORGE MASON LAW REV. 423,440 (1997).

the probability of detection, and the possibility of punishing deviations.[46] We may be tempted to skip this step of the analysis and assume *a priori* (with Stigler) that mergers always increase the likelihood of collusion because of higher concentration. However, a merger may affect the determinants of coordinated interaction and reduce the likelihood of coordination.

For example Davidson and Deneckere show for one special case that a merger may improve the non-cooperative pay-offs and end up making collusion less likely.[47] This is because after a merger, competing firms become more profitable. In this scenario, the non-cooperative outcomes are more profitable than before the merger. Therefore the incentives to collude are smaller, the incentives to cheat are greater, and the punishment from retaliation is smaller.

Examining another special case, Frayse and Moreaux find that in the presence of fixed costs greater concentration reduces the likelihood of collusion.[48] With enough firms and fixed costs there may be an equilibrium in which not all firms produce. Therefore a cartel can threaten to exclude firms from the market if they deviate. Higher concentration resulting from a merger may render this threat non-credible because the new equilibria may require that all firms produce positive amounts.

It follows from these examples that it is necessary to analyze the particular circumstances of an industry to establish the relation between structure and conduct. Beyond this, recent game theoretical models fail to provide general predictions on how changes in the number of firms, product heterogeneity or other factors that are likely to be altered by a merger would affect the likelihood of collusion.

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[46] Those factors that are central to coordination were identified by Stigler (1964). For a recent discussion, *see*, Jonathan B. Baker, *Mavericks, Mergers, and Exclusion: Proving Coordinated Interaction under The Antitrust Laws,* 77 NEW YORK UNIVERSITY LAW REVIEW 135, 202 (2002).

[47] Carl Davidson & Raymond Deneckere, *Horizontal Mergers and Collusive Behavior*, 2 INTERNATIONAL JOURNAL OF INDUSTRIAL ORGANIZATION 117, 132 (1984).

[48] Jean Frayse & Michel Moreaux, *Collusive Equilibria and Oligopolies with Finite Lives*, 27 EUROPEAN ECONOMIC REVIEW 45, 55 (1985).

The second step of the analysis, once the relation between a merger and coordination has been established, requires determining if society will be worse off as a result of such conduct. In a dynamic context there are potential efficiency losses in the absence of certain forms of coordination. First, efficiency gains take place over time through economies of learning. Coordination and information sharing related to basic knowledge can facilitate newer entrants' benefiting from knowledge acquired by older incumbents, accelerating cost savings. Second, coordination may have an important role in innovation. Given the cumulative nature of innovation, information sharing and dissemination are central to this process. Furthermore, coordination that yields prices above marginal cost may provide incentives to make the necessary investments in innovation, increasing consumer welfare over time. This Schumpeterian view suggests that market concentration facilitates innovation and that a competitive market structure does not lead to dynamic efficiency.[49]

In addition to cost based efficiencies, Fershtman and Pakes highlight the importance of other possible beneficial effects of collusion in a dynamic setting.[50] They consider a dynamic model in which the possibility of collusion affects the firm's investment as well as their entry and exit decisions. Fershtman and Pakes conclude that overall consumers are better off since greater variety and quality of products offsets the negative effect of higher collusive prices. As opposed to the static world in with price fixing makes consumers worse off, this model suggests that this is not necessarily true in a dynamic setting because the possibility of collusion affects the structure of the industry and firm's investment decisions.

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[49] According to Scherer and Ross "[m]ost studies for the United States and other leading nations reveal a positive correlation between concentration and industry R&D/sales ratios, or cruder proxies of these ratios." *See,* Scherer & Ross, *supra* note 21 at 646. Levin et al. find this correlation to vary with the industry. See, Richard C. Levin, Wesley M. Cohen, & David C. Mowery, *R&D Appropriability, Opportunity, and Market Structure: New Evidence on Some Schumpeterian Hypotheses,* 75 AMERICAN ECONOMIC REVIEW 20, 24 (1985).

[50] Chaim Fershtman & Ariel Pakes, A DYNAMIC OLIGOPOLY WITH COLLUSION AND PRICE WARS (National Bureau of Economic Research Working Paper No. 6936, 1999).

Whatever the official policy documents may say, static and dynamic efficiency defenses are given short shrift in agency merger enforcement.[51] There are at least three reasons. First, the whole idea seems antithetical to the traditional focus of Clayton Act enforcement and threatens to drag the antitrust agencies further into the business of "industrial policy." Second, efficiency-enhancing consolidations that are erroneously blocked by the antitrust agencies can "often" (it is said) be achieved through internal growth and the bankruptcy process. Third, efficiency arguments almost always are constructed after a merger has been proposed and therefore lack credibility.

That is not the end of the story, however. In the last generation there have been advances on other fronts that may serve to offset the retreat from reality represented by the unilateral effects movement. These advances have been in experimental economics.

VI. EXPERIMENTAL ECONOMICS[52]

The preceding sections have identified some of the areas in which both theory and empirical methods have fallen short from a complete set of analytical tools to evaluate the potential for cooperation. To answer some of these questions, practitioners can also turn to experimental research applied to the field of industrial organization.[53]

From a methodological standpoint, Charles Holt has noted the usefulness of experimentation to evaluate behavioral assumptions on which concepts of equilibrium rely. While assumptions about market structure are difficult to evaluate, experiments can test assumptions such as cooperative or non-cooperative behavior, which are central to predicting coordinated interaction. For example, structural assumptions such as the contesta-

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[51] Short shrift is an abbreviation of the period once conventionally allowed for a criminal to make her confession prior to execution.

[52] For a comprehensive review of the importance of experiments to the study of industrial organization, and more specifically to the understanding the factors facilitating collusion, *see* Charles A. Holt, *Industrial Organization: A Survey of Laboratory Research*, *in* J. KAGEL & A. ROTH, THE HANDBOOK OF EXPERIMENTAL ECONOMICS (1993). This section follows Holt's discussion.

[53] In this section we will avoid a methodological debate. Supporters of experimental economics would argue that general theories should hold under laboratory settings. Opposing views such as those expressed by Werden criticize the lack of realism of these experiments. (See Gregory. J. Werden, A REVIEW OF THE EMPIRICAL AND EXPERIMENTAL EVIDENCE ON THE RELATIONSHIP BETWEEN MARKET STRUCTURE AND PERFORMANCE (Economic Analysis Discussion Paper EAG 91-3 U.S. Department of Justice, 1991).

bility of a market are part of the design of the experiment and therefore difficult to test.[54]
On the other hand there are behavioral assumptions such as altruism for which laboratory
tests are well suited. Given that these assumptions determine the predictions of the theory, failing to ascertain these assumptions may lead to entirely misguided policies.

As delineated in the Guidelines, antitrust analysis in the area of coordinated effects aims to make an *ex ante* assessment of how a merger will affect the likelihood of
competing firms engaging in concerted actions. This analysis relies on understanding
what factors hinder or facilitate coordination. More specifically, the Guidelines focus on
examining the effect of post-merger market conditions on the central elements of coordination: reaching an agreement; incentives to cheat and detection; and, the possibility of
punishing such deviations). Next we will consider some of the conclusions that can be
drawn from experimental research regarding the relation between market conditions and
the determinants of collusion.

One issue to which experimental research has devoted attention is the role of
communication on cooperative outcomes, and in particular how discussions previous to
the trading period affect the final outcomes. The Guidelines note the importance of information on the formation and sustenance of collusive agreements. According to Holt,
conclusions from research in this area are sensitive to the particular setting. Keeping in
mind this caveat, he notes that these studies do suggest that the effect is greater with
posted prices and differentiated products.[55] This result is consistent with the conventional
wisdom that with product heterogeneity, collusion requires a greater degree of communication since an agreement needs to be reached for multiple products. It follows that possibility of engaging in pre-trade discussions may be crucial to enable a collusive outcome.

Experimental economics has also addressed the detection and punishment of deviations from an agreement. In the context of evaluating the antitrust implications of a
merger, a central issue is the relation between market structure and cooperation. Gener-

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[54] Contestability refers to the ability of potential entrants to discipline a market and prevent non-competitive outcomes. *See,* WILLIAM BAUMOL, JOHN PANZAR, & ROBERT WILLIG, CONTESTABLE MARKETS AND THE THEORY OF INDUSTRY STRUCTURE (1982).

[55] Holt, *supra* note 51.

ally, experiments find that more sellers yield more competitive outcomes.[56] The difficulty these experiments face is telling apart the pure effect of the number of rivals from the change in incentives that takes place as the number of rivals increases. Overall these studies find that punishment is effective with two rivals; with more than three there is limited evidence that just the number of agents hinders or facilitates cooperation.

In previous sections we have seen that repeated interaction is central to the sustainability of collusive outcomes in non-cooperative games; only in sequential games can players earn reputations and impose penalties on each other. Experiments corroborate the idea that cooperation is less likely in single-period games. These studies suggest that cooperation increases with repeated interaction among the same agents. In addition to this effect of repeated interaction, which is acknowledged in the Guidelines for previous interaction in the same or comparable markets, these studies suggest that cooperation increases with experience developed from interaction with other agents.[57] It is important to note that this notion of experience suggests possible collusive outcomes beyond the equilibria for dynamic games discussed above. The Guidelines reflect the idea that if an agreement between two firms was sustainable in the past then it is likely to remain so in the future. The experimental results go further by suggesting that, if two firms have independently experienced successful agreements, perhaps with comparable firms, they are more likely to reach new agreements with other firms.

Finally, experimental research has addressed the relation between contractual provisions and cooperation. In addition to specific market or firm characteristics, firms can engage in "facilitating practices" that enhance the likelihood of collusion. Experi-

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[56] For a survey, see e.g., R. M. Isaac & J. Reynolds, *Two or Four Firms: Does it Matter? In,* CHARLES A. HOLT & R. MARK ISAAC, 9 RESEARCH IN EXPERIMENTAL ECONOMICS: MARKET POWER IN THE LABORATORY (1989).

[57] The effect of experience has been tested among others by: Douglas. D. Davis & Charles A. Holt, *Equilibrium Cooperation in Two-Stage Games: Experimental Evidence*, 28 JOURNAL OF GAME THEORY 89, 109 (1999); Rusell Cooper, Douglas V. DeJong, Robert Forsythe & Thomas W. Ross, *Cooperation Without Reputation: Experimental Evidence from Prisoner's Dilemma Games*, 12 GAMES AND ECONOMIC BEHAVIOR 187, 218 (1996). Some studies of the effect of repeated interaction among the same agents are: Charles A. Holt, 75 *An Experimental Test of the Consitent-Conjectures Hypothesis*, AMERICAN ECONOMIC REVIEW 314, 325 (1985); and Charles F. Mason, Owen R. Phillips & Douglas B. Redington, *The Role of Gender in a Non-Cooperative Game*, 15 JOURNAL OF ECONOMIC BEHAVIOR AND ORGANIZATION 215, 235 (1991).

ments have found that cooperative outcomes are, given certain conditions, more likely with posted list prices.[58] These findings are consistent with the literature on facilitating practices referred to above.

VII. AN INDEX OF MARKET OUTCOMES

In the absence of a robust and general theory supported by empirical results explaining the effect of market characteristics on the likelihood of coordination, antitrust practitioners are left with the basic structural presumption that with fewer firms it is more likely that firms will coordinate. An approach that relies chiefly on the number of firms in a market obviously comes at the expense of pro-competitive mergers being challenged if the number of competitors is small.[59] Therefore, while it might be the best rule at our disposition it also calls for cautious application. In particular one would be interested in making an assessment, absent other information, of when thereduction in the number of competitors is more likely to lead to an increase in the likelihood of cooperation.

Price fixing is about as coordinated as interaction gets. Competition is about as uncoordinated as interaction gets. Indeed, one could imagine a continuum of cooperative coordination described by a number (CASI, for "competitive altruism-spite index") that reflects the weight attached in the objective function of each seller to the profits of competing sellers.[60] If each seller seeks to maximize the sum of the profits of all firms in the industry with respect to its own decision variables, we get a system of equations that describes the first order conditions for maximization of cartel profits. If each seller puts zero weight on its competitors' profits, we are describing Cournot or Bertrand competition. Negative weights would correspond to some degree of economic warfare with the

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[58] See for example the study following the *Ethyl* case by David M. Grether & Charles R. Plott, *The Effect of Market Practices in Oligopolistic Markets: An Experimental Examination of the Ethyl Case*, 56 ECONOMIC INQUIRY 969, 983 (1984).

[59] The Guidelines suggest building on this approach by assessing the existence of Mavericks. This approach makes a qualitative distinction across firms based on their likelihood to set prices independently. When these cannot be identified we are left again with the structural premise as the best rule. *See*, Baker, *supra* note 45.

[60] The earliest use of this device to describe degrees of cooperation appears to be, J. W. Friedman, *Reaction Functions and the Theory of Duopoly*, 3 REVIEW OF ECONOMIC STUDIES 201, 208 (1968).

extent of spite increasing as the CASI goes from zero to larger negative numbers. (What could be more spiteful than predatory pricing?) CASI values greater than one presumably correspond to pathological altruism, although in some situations they might reflect second-best strategies based on constraints such as the existence of a competitive fringe. It would be intuitively pleasant if economic welfare peaked at CASI = 0 and increased monotonically in both directions from zero, but we have no reason to suppose this is true in general.

To suggest that the profits of competitors enter the objective function of a firm is contrary to the usual economic assumption of self-interested rationality, but only in a rather narrow and not very interesting sense. Global rationality requires the firm to recognize the possibility that the path to greater profit may lie in competitive altruism. This is a commonplace of human ethical memes. We are often instructed, in our personal lives, that altruism and self-sacrifice is the best strategy for attaining eternal bliss, while greed and narrow self-interest may produce the opposite outcome (if not eventually repented). Antitrust law imposes the opposite standard on each of us when acting as a market agent. Similarly, in practice we sometimes observe others willing to sacrifice their own short term well-being in order to teach others a lesson.

Cartels often involve relatively undifferentiated products such as feed additives, chemicals, and vitamins. But coordinated interaction is not limited to homogeneous products. Collusive outcomes without express agreement were alleged to have occurred in the 1960s, when GE and Westinghouse adopted common pricing formulas to bid for turbo-generators.[61] In other cases, such as airlines, tariff publishing allegedly allows immediate information about rival's prices to facilitate coordination without express agreements.[62] In the framework described above, non-cooperative behavior is equivalent to assigning a zero weight to other firms' profits, i.e. firms seek to maximize their own prof-

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[61] *United States v. General Electric Co. et al.,* CA. No. 28,228 (E.D.Pa), Dec. 1976.

[62] *United States v. Airline Tariff Publishing et al.,* CA No. 92-2584 (D.D.C.), August 1994. For a detailed discussion of this case see, Severin Borenstein, *Rapid Price Communication and Coordination: The Airline Tariff Publishing Case, in* JOHN E. KWOKA & LAWRENCE J. WHITE, *supra* note 24.

its with no regard to their competitors', and therefore the level of cooperative behavior measured by CASI is zero.

Nevertheless, we could still make use of CASI by mapping an observed market outcome under non-cooperative behavior to a comparable level of cooperation. The CASI idea is a bit like a measure of a volleyball coach's success in imbuing her players with team spirit. The most successful sports teams, like the most successful bridge pairs, are those whose players concern themselves only with the good of the team. Most sports teams, like most cartels, fail to achieve perfection in this respect, and pay a price accordingly. What a coach calls team spirit Judge Gary of U.S. Steel called gentlemanly behavior.[63] In both cases, the idea is to convince individual members that they should give positive weight to teammates' welfare, not only because to do so is morally sound under the Golden Rule principle, but also because such morally sound behavior would lead to greater individual gains. Teamwork feels good and pays off.

Somehow our economic models of cooperative behavior have neglected this "behavioral" idea. In contrast, our dramatic media often focus on conflicts between greed and altruism, and frequently, like Jimmy Stewart in the film *It's A Wonderful Life,* find resolution in the discovery that altruism is more self-rewarding than greed. We antitrust lawyers and economists are used to the idea of cooperative behavior being unlawful in a competitive context. Although we understand that there are excellent reasons for this, we perhaps tend to turn away from a full understanding of the forces that drive business people to engage in what, from a certain perspective, may seem ethical behavior. The phrase "honor among thieves" captures this tension nicely.

CASI has limited usefulness in a price fixing investigation. For one thing, it would have to be an "as if" tool. We might say, for example, that the oligopolists in a certain market had achieved a level of coordination equivalent to a CASI of 0.5. This would tell us that they were acting "as if" they valued each dollar of their competitors' profits as equivalent to $2 of their own profits. However, we would have no idea whether they were

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[63] "Judge" Elbert Henry Gary was chief executive of U.S. Steel. See the biography by IDA M. TARBEL, LIFE OF ELBERT H. GARY: THE STORY OF STEEL (1925).

engaged in unlawful price fixing. One cannot infer unlawful price fixing solely from an examination of pricing behavior.

Worse, experience with actual price fixing conspiracies has demonstrated that even express agreements seldom lead to sustainable profit-maximizing prices. There is no reason, absent additional assumptions about costs and other matters, to assume a general or regular relationship between the CASI index (other than at zero) and either prices or consumer welfare. For example, if the firms were acting as if they were in a perfect cartel, consumer welfare might well be higher, and prices lower, than at some intermediate level of CASI where inefficiencies arose out of the interaction itself or excessive industry costs were preserved or even created by the imperfections of coordination. (Many years ago, for example, one of the authors (Owen) analyzed the hearing aid industry and concluded that the pattern of territorial and product line exclusivity in retail distribution, which may have been a "facilitating device," had trapped manufacturers in a very inefficient equilibrium harmful both to consumers and themselves.) Finally, the degree of CASI in a market would be, in general, endogenous, just as cooperation may or not be a satisfactory strategy in any non-zero-sum game, depending on the characteristics of the game.

In spite of this, a CASI might find a role in summarizing information about coordinated interaction in markets, particularly if the assumptions required to find a regular correspondence between CASI and welfare are not overly restrictive. Like any index number, CASI sacrifices information in pursuit of convenience. Where might such an index find use in antitrust enforcement? It seems most likely that it would be useful in evaluating the possible effects of proposed mergers. In the merger context a high CASI connotes no blame, merely a stronger suspicion that industry consolidation is likely to be costly to consumers. If a market's CASI is "high" but not yet equal to one, then only frictions, imperfect information, or bounded rationally (presumably) keep the competitors from achieving a cartel outcome. Drawing on George Stigler's faith, that all these factors are a function of the number of competitors, we can conclude that reductions through merger in the number of competitors threatens consumer welfare. In markets where CASI

is closer to zero, it seems far less likely, on this reasoning, that welfare is similarly threatened by a small reduction in the number of competitors.

VIII. CONCLUSIONS

A merger to monopoly clearly will produce adverse effects for consumers of the monopolist. A merger between two wheat farmers is unlikely to harm any grain buyer. Our tools for understanding cases intermediate between these extremes are evolving. Because these tools have not yet been perfected, merger enforcement remains an inexact science.

Table 1

Term	Typical economic definition	Legal significance
Cooperative or coalitional behavior (game theory concept)	Every firm acts to maximize the profits of the group.	May violate Sherman §1 depending on how the behavior came about.
Non-cooperative or strategic behavior (game theory concept)	Each firm acts to maximize its own profits regardless of the behavior of its rivals. (See Cournot and Bertrand interaction.)	May violate Sherman §1. If facilitated by merger, merger may violate Clayton §7.
Interaction	Behavior motivated in part by rivals' actions or anticipated actions and reactions.	None.
Coordinated interaction (antitrust enforcement term)	Actions by firms that are individually profitable only as a result of the accommodating reactions of rivals. "… includes tacit or express collusion, and may or may not be lawful in and of itself." *Merger Guidelines* §2.1	May violate Sherman §1. If facilitated by merger, merger may violate Clayton §7.
Cartel (express collusion, price fixing)	A group of competitors with an express price fixing agreement. (Includes output, capacity, and allocation agreements.)	Violates Sherman Act §1. If facilitated by merger, may violate Clayton §7. See *Merger Guidelines* §2.1
Tacit collusion	Individual firm behavior in the absence of express collusion that yields the same *outcome* as express collusion.	May violate Sherman §1 depending on how the behavior came about. If facilitated by merger, merger may violate Clayton §7. See *Merger Guidelines* §2.1
Bertrand interaction	Each competitor chooses its profit maximizing price simultaneously and non-cooperatively taking rival's prices as given.	None
Cournot interaction	Each competitor chooses its profit maximizing output simultaneously and non-cooperatively taking rival's quantities as given.	None
Dynamic	Taking place over time, repeatedly (antonym *static*)	None
Facilitating device/practice	Any tactic that facilitates collusion, whether or not the tactic itself is expressly agreed upon.	Debatable (see FTC v. Dupont [Ti02])