Quantitative Analyses of Potential Competitive Effects from A Merger

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I.   Introduction

The *Horizontal Merger Guidelines* consider two potential theories of competitive harm arising from a merger: Unilateral Effects and Coordinated Interaction.[1] In this paper we distinguish between unilateral and "non-unilateral" theories. The latter encompasses coordinated interactions theories as well as other theories. We make this distinction as opposed to that found in the *Merger Guidelines* because there are merger cases that do not fit either unilateral or coordinated interaction theories.

A considerable body of literature exists that addresses the assessment of the potential for unilateral effects arising from a merger in the context of differentiated products.[2] There is also literature on assessing the competitive effects of mergers where transactions occur through some sort of auction mechanism. However, for many if not most merger investigations, a differentiated Bertrand model or an auction model are not appropriate models of competition or of potential competitive effects. There has been little literature regarding how to use quantitative analyses to assess the potential for competitive effects outside of these areas. In particular, very little literature exists relevant to the issue of how to analyze the potential for a horizontal merger to create, enhance, or preserve effective coordinated interaction in the market in which the

[1] *See* U.S. Department of Justice & Federal Trade Commission, Horizontal Merger Guidelines § 2 (rev. ed. 1997) *available at* http://www.ftc.gov/bc/docs/horizmer.htm [hereinafter Horizontal Merger Guidelines].

[2] These papers focus on modeling competition with "one-shot" Bertrand models. *See, e.g.,* Gregory J. Werden and Luke M. Froeb, "Simulation as an Alternative to Structural Merger Policy in Differentiated Products Industries" in Malcolm B. Coate and Andrew N. Kleit, eds. *The economics of the antitrust process*. Topics in Regulatory Economics; and Daniel Rubinfeld and Roy J. Epstein, "**Merger Simulation: A Simplified Approach with New Applications**", *Antitrust Law Journal*, Volume 69, No. 3 (Dec 2001). This literature has received considerable criticism. See, *e.g.*, David Scheffman, and Mary Coleman**,** "FTC Perspectives on the Use of Econometrics in Antitrust Cases," in *The Use of Econometrics in Antitrust,* J. Harkrider, ed. *available at* http://www.ftc.gov/be/ftcperspectivesoneconometrics.pdf .

merger is to take place. The core contribution of this paper is to discuss quantitative analyses suitable for assessing the potential competitive effects of a merger, with a specific focus on quantitative analyses relevant to an assessment of coordinated interaction.

The paper is organized as follows: In the next section we discuss what we mean by *Unilateral* and *Non-Unilateral.* In the following two sections we discuss theories of competitive harm arising under each category. We then go on to discuss how evidence regarding the current state of the market is important to assessing these theories, and we describe the types of empirical analyses that can be conducted to assess the current state of the market in relation to these theories, with particular attention to coordinated interaction. We then discuss the types of analyses that can be done to assess what effect the merger is likely to have on the market. Finally, we provide examples of the empirical analyses outlined in the previous section.

II.   Definition of Terms

Unilateral

Anticompetitive price increases arise from anticompetitive restrictions in output.[3] In a *Unilateral* theory the anticompetitive restriction in output arises *solely* because the merged entity has market power that, as a result of the merger, will allow it to profitably raise market prices relative to the pre-merger situation. In a unilateral theory other competitors respond by making unilateral decisions (according to their Nash reaction functions[4]) to maximize their own profits given the increase in demand they face as a result of the merged entity's anticompetitive restriction in its output.

Non-Unilateral

By *Non-Unilateral* theories we mean those cases for which the merger is anticompetitive but does not involve unilateral exercise of market power by the merged entity. "Non-unilateral" is broader than coordinated interaction. We begin by briefly identifying categories of "non-unilateral" theories.

Number of Competitors Matters

One potential non-unilateral theory is that the *Number of Competitors Matters*. In bidding markets with a sufficiently small number of bidders, in some situations the number of bidders may significantly impact outcomes. That is, although the merged entity does not appear to have unilateral market power (as would exist if the parties to the merger had significantly lower costs than other competitors), reducing the number of bidders by one increases, on average, on winning bids. In markets that do not involve bidding, a *Number of Competitors*

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[3] In this paper, we focus the potential competitive effects from a merger on price. Other types of competitive harm are also possible, including reduced quality or innovation.

[4]   In simple terms, by Nash we mean that competitors take everything other than their own actions as given and maximize profits – specifically, they do not anticipate and act on anticipations of competitors reactions to their actions.

Matters theory is a simple market structure/performance theory. Such a theory must be based on compelling evidence that the number of competitors matters significantly to pricing and output in the market.

Maverick

Another theory is the *Removal of a Maverick* (or "Maverick"). Under this theory, there is compelling evidence that a particular competitor (the "Maverick") has been a *particularly* aggressive competitor − *i.e.*, the impact of the maverick's loss is not just from the loss of a competitor but from the loss of this particularly aggressive competitor. In simple terms, the competitive significance of the Maverick is significantly greater than would be indicated by its market share.

Coordinated Effects

A third theory involves *Coordinated Effects*. A coordinated effects theory occurs when one or more other significant competitors *also restrict their output* when the merged entity restricts its output. A coordinated effects theory exists when a unilateral price increase of a particular amount by the merged entity is not profitable <u>unless</u> there <u>are</u> <u>accommodating</u> <u>responses</u> (*i.e.* output <u>restrictions</u>) <u>by</u> <u>other</u> <u>significant</u> <u>competitors,</u> <u>and</u> <u>the</u> <u>evidence</u> <u>indicates</u> <u>that</u> <u>there</u> <u>will</u> <u>be</u> <u>sufficient</u> <u>accommodating</u> <u>responses</u>.[5] Thus, with a coordinated effects theory, not only does the merging firm restrict output, but the other firms do as well because they are engaged in some sort of (presumably) tacit coordination. The key issue in analyzing the impact of a merger on the likelihood of coordinated effects is to assess why a merger might make accommodating responses (or "coordination") occur when they have not previously or why it would make such coordination more effective if it is already occurring. In most cases, the coordination at issue involves signaling or otherwise finding a mechanism to encourage collusion, short of explicit, overt collusion.

III.   Unilateral Effects Theories

A.   Description of Theories

Unilateral effects theories come in two basic categories: "dominant firm" type models and "oligopoly" models (although there can be significant similarities between the models). The simplest dominant firm theory involves a homogeneous product industry with a "large" firm (post-merger) with a competitive fringe (with an upward sloping supply curve). If the merged entity has unilateral market power that is created or enhanced as a result of the merger, it raises price by restricting its output *more than the amount the fringe expands output in response to price increases*.[6] If the fringe has a perfectly elastic supply curve and is not constrained in capacity, the dominant firm cannot raise price. If the combination of market demand elasticity and fringe supply elasticity – *i.e.*, residual demand – is too elastic given the dominant firm's

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[5]   A smaller price increase may be unilaterally profitable.

[6]   *See* JEFFREY CHURCH & ROGER WARE, INDUSTRIAL ORGANIZATION: A STRATEGIC APPROACH § 4.2 (2000).

costs (*i.e.*, the critical loss test fails), it also is not profitable for the dominant firm to raise price.[7]
A merger might result in higher prices either because the merger creates a dominant firm or
significantly enhances the ability of an existing dominant firm to raise price. The former might
occur if the merger combines the two significant competitors and the remaining fringe
competitors would not sufficiently expand their output (due, for example, to capacity
constraints). The latter might occur if the merger significantly reduces the supply available from
the fringe or makes it less elastic.

The Cournot and Bertrand oligopoly models are also models of *unilateral* effects, *i.e.*,
anticompetitive effects arise from the creation or enhancement of market power of the merged
entity.[8] In the Cournot model, which is a model of homogeneous product competition, the
merged entity restricts *its* output. In response, competitors *increase* their output in response to
the higher market price, but the merged entity has sufficient market power that it finds it
profitable to restrict output enough to reduce market output, despite the increased output of the
other competitors.[9] Thus, in a Cournot-like model, one would assess whether the restriction in
output necessary by the merged firm to cause prices to rise, given the likely responses of
competitors, would be profitable.

In the Bertrand simple model of competition among differentiated products, the merged
entity raises one or more of its prices. The result is that the demand faced by other competitors is
increased, and those competitors react unilaterally to the increase in demand, which will
generally involve an increase in their (unit) sales (generally at somewhat higher prices). The
higher prices of competitors here are not an "accommodating" response. Rather the higher
prices are a result of unilateral profit maximization given the greater demand they face. Thus, as
in the Cournot model, the merged entity (generally) reduces output by more than the total
industry reduction in output.

B.   Issues with Unilateral Models

Cournot and Bertrand models generally predict significant price increases from a merger
if the market is already concentrated unless the residual demand is "too elastic" or substantial
efficiencies vitiate incentives to increase prices. Why then are not all (or at least most) mergers
in concentrated markets anticompetitive? The evidence from the structure-performance literature

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[7] *See* William M. Landes & Richard A. Posner, *Market Power in Antitrust Cases*, 94 Harv. L. Rev. 937
(1981)**,** and David Scheffman and Pablo Spiller, *Geographic Market Definition Under the Department of
Justice Merger Guidelines*, 30 No. 1, Journal of Law and Economics 123-148 (April 1987).

[8] *See* DENNIS W. CARLTON & JEFFREY M. PERLOFF, MODERN INDUSTRIAL
ORGANIZATION § 6 (2000); JEFFREY CHURCH & ROGER WARE, INDUSTRIAL
ORGANIZATION: A STRATEGIC APPROACH § 8.3 (2000) for a discussion of these models.

[9] While individual firms maximize profits in the Cournot model taking the outputs of other firms as
given, in equilibrium, a change in the output of one firm will result in changes in the output of other firms
according to their response functions. One problem with applying the simply Cournot model to merger
analysis is that absent efficiencies, a merger reduces profits for the merging parties (although it increases
profits for the industry).

and from about twenty years of hundreds of intensive merger investigations under Hart-Scott-Rodino does not support a conclusion that most mergers in concentrated industries (other than very highly concentrated industries), are likely to be anticompetitive.[10] This immediately raises the issue of the appropriateness of Cournot and Bertrand models, since those models do not generally appear to yield results consistent with empirical research and observation.

It is certainly reasonable as one approximation to assume that competitors of the merged entity maximize profits unilaterally, *i.e.*, have *Nash* reaction strategies. It must be therefore, that in many industries, firms' Nash reaction functions are more competitive than would be suggested by Cournot and Bertrand.[11] Indeed, the Cournot and Bertrand models do not have rivalrous strategies and tactics in any fundamental sense. In each model, competitors simply maximize profits given the demand that they perceive they face. Furthermore, Cournot and Bertrand make some very important assumptions beyond Nash. First, they assume that a demand relationship is "revealed" in the convergence to equilibrium (and that existing prices are equilibrium prices). Second, and probably more important, in these models there is one price for each product (or for all products in the case of Cournot). For example, modifying a homogenous product Cournot model to permit competitors to give customer-specific discounts that are unknown to other customers or to competitors leads to the Cournot equilibrium reverting to the competitive equilibrium.[12] Real world markets often exhibit much "unsystematic" price variation (as shown in the examples below).

IV.   Non-Unilateral Effects Theories

A.   Number of Competitors Matters

As discussed above, "Number of Competitors Matters" is applicable when there is evidence that (1) the relevant market currently has a small number of major competitors; (2) reducing the number of significant competitors is likely to lead to higher prices; and (3) the evidence does not appear to support a unilateral theory. The auction literature provides one specific theory. In some auction models with imperfect information on competitor costs, reductions in the number of competitors can result in higher bids by the remaining competitors due to removal of some of the uncertainty on costs.[13] Whether or not the model is appropriate in a particular matter depends on whether a bidding model is appropriate for the industry, the nature of bidding in the market, and the amount of information available to competitors. Of course, the

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[10] *See* DENNIS W. CARLTON & JEFFREY M. PERLOFF, MODERN INDUSTRIAL ORGANIZATION § 12 (2000).

[11] Low entry barriers or efficiencies could also explain why a merger in concentrated industry is not anticompetitive.

[12] *See* Holt and Scheffman, *Facilitating Practices: The Effects of Advance Notice and Best-Price Policies*, 187-197 RAND JOURNAL (Summer 1987).

[13] *See*, McAfee and McMillan, *Auctions and Bidding,* 25 JOURNAL OF ECONOMICS LITERATURE (1987).

most relevant evidence would be evidence indicating that effect on the level of winning bids of variations in the number of significant competitors.

Outside bidding markets, there may be direct evidence that the number of competitors matters. For example, the number of competitors may have varied (either over time, across geographic markets or for different bidding events) and careful analysis indicates that the number of bidders significantly impacts transactions prices (or other important market outcomes).

Obviously, that a merger to monopoly in a well-defined market protected by barriers-to-entry is a merger where the number of competitors makes a difference is uncontroversial. It is probably in the mainstream of economics and antitrust that a merger in an industry with only three competitors in a well-defined market protected by barriers-to-entry is also likely to be problematic, absent convincing efficiencies or unusual facts. Because of the appellate court decision in the "Baby Food" matter, a merger of two of the three "significant" competitors in a well-defined market appears to have an almost non-rebuttable presumption of being anticompetitive.[14]

B.   Removal of A Maverick

In some markets, one competitor can be a particularly important factor in the nature of or intensity of competition in the market, *disproportionate to its size or market share*. For example, the "maverick" may have been very disruptive by attempting to expand share – lowering prices, trying to win customers from competitors and/or expanding capacity – and this behavior has caused other competitors to compete more aggressively and may have undermined their ability to coordinate.[15] A merger that removes this maverick may, as a result, significantly change the nature and intensity of competition, and higher prices may result as all firms compete less aggressively. For this theory to be applicable, one must show that one of the firms has behaved as a maverick and that its incentives will change post-merger.

Auction models provide a version of this theory. For there to be a maverick, one firm must consistently compete aggressively when it bids, causing other firms to bid more aggressively when it is present. The merger may remove this effect, not simply by removing any competitor as discussed above, but by removing this particularly aggressive competitor. As a result, all other firms can bid less aggressively post-merger.

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[14] *See Federal Trade Commission v. H.J. Heinz Company* 345 U.S. App. D.C. 364; 246 F.3d 708; (U.S. App. 2001).

[15] *See* Jonathan B. Baker, *Mavericks, Mergers and Exclusion: Proving Coordinated Competitive Effects Under the Antitrust Laws*, § III, 77 *NYUL. Rev.* 135 (2002).

C. Coordinated Interaction

1. Merger Guidelines Definition

The *Merger Guidelines* define coordinated interaction as follows: "A merger may diminish competition by enabling the firms selling in the relevant market more likely, more successfully, or more completely to engage in coordinated interaction that harms consumers. Coordinated interaction is 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."[16]

2. Traditional Approach to Coordinated Interaction Analysis

Traditionally, antitrust analysis of coordinated effects of mergers has focused first on whether the post-merger market is concentrated and whether the merger causes a significant change in concentration levels. Coordinated effects are then assumed feasible if the industry exhibits characteristics that are seen as conducive to coordinated outcomes. This "Check List" of industry characteristics that are likely to be conducive to coordinated interaction is based on analyses first pioneered by Stigler (and later adopted and expanded by Posner).[17] The *Merger Guidelines* also incorporate the Check List approach, identifying the following factors: (i) availability of key information concerning market conditions, transactions, and individual competitors; (ii) the extent of firm and product heterogeneity; (iii) pricing or marketing practices typically employed by firms in the market; (iv) characteristics of buyers and sellers; (v) characteristics of typical transactions; and (vi) previous express collusion.[18]

The existing literature and our experience across many industries indicates that such Check Lists are too crude to provide much assistance in determining whether a coordinated interaction theory is relevant. Specifically, many industries that fit the Check List do not appear to exhibit outcomes that are consistent with coordinated interaction. Moreover, this approach does not focus on why the merger should affect the likelihood of coordination. Thus, while the Check List can provide a starting point, it is necessary to analyze in more detail the nature of competition in the market at issue.[19] Below we will argue that detailed transaction-specific information where available is likely to be more informative as to the presence of or proclivity for coordinated interaction than is the typical Check List.

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[16] *See* Horizontal Merger Guidelines, § 2.1.

[17] *See* George Stigler, *A Theory of Oligopoly* JOURNAL OF POLITICAL ECONOMY 72:44-61 (1964), RICHARD A. POSNER, ANTITRUST LAW (AN ECONOMIC PERSPECTIVE (1976).

[18] *See* Horizontal Merger Guidelines, § 2.1.

[19] Judge Posner discussed this issue in his recent opinion in the High Fructose Corn Syrup case. (295 F.3d 651: 2002 U.S. App.). In that decision, although he discussed the features of the market that would make collusion on price feasible, he also relied on evidence of non-competitive behavior by the defendants.

3. Dynamic Oligopoly Theory

Dynamic Oligopoly theory provides a theoretical foundation for coordinated interaction. By Dynamic Oligopoly, we mean that through repeated interaction, companies reach an equilibrium where prices are higher (and output lower) than would be achieved through static short run Nash behavior. Some dynamic game theory models produce a result that there are equilibria in which it is unilaterally profitable for the significant competitors to restrict their outputs below Cournot (or Bertrand) levels.[20]

For such behavior to be feasible, the firms in the "coordination group" must be able to achieve three things. First, they must be able to reach *consensus* on the type of accommodation (i.e., raising prices directly, customer allocation or capacity reductions) and the coordination outcome (i.e., how high should prices rise, which customers are allocated to whom, or what amount of capacity should be reduced). For this to be feasible, firms must have reasonably common incentives (which are related, in part, to their costs and capacities) and a methodology of determining appropriate outcomes. As the type of coordination at issue is generally tacit coordination, this would require signaling or some other mechanism to achieve consensus. The more disparate are firm incentives (or the stronger the incentives for all to deviate) or the more complex are market outcomes, the more difficult reaching consensus will be.

Consensus alone is not a viable basis for effective coordinated interaction because coordinated outcomes create incentives to deviate ("cheat"). Thus the second requirement is that firms in the "coordination group" must be able to detect deviations from consensus outcomes. If cheating cannot be detected, the unilateral incentives to cheat cannot be thwarted. Finally, if there is consensus and deviations can be detected, there must be a viable and *credible* method of punishing cheating, since if cheating cannot be punished, the unilateral incentives to cheat will prevail. Punishment is only credible if it is in the unilateral interest of the firms to actually utilize punishment against cheating. With credible punishment, it becomes in the interest of each competitor to sustain the coordinated outcome.

As developed in the original Stigler article, the Check List approach can be viewed as an attempt to assess factors that might make consensus, detection, or punishment feasible. While useful, the literature does not focus on the types of analyses that can be used to assess the likelihood of coordination. In this paper, we propose that rather than focusing on Check Lists, the analysis should be focused on a detailed review of the nature of current competition in the marketplace and how this competition relates to the potential for coordinated effects.

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[20] *See* JEFFREY CHURCH & ROGER WARE, INDUSTRIAL ORGANIZATION: A STRATEGIC APPROACH § 10 (2000); *See also* JEAN TIROLE, THE THEORY OF INDUSTRIAL ORGANIZATION § 6 (1992). *See* EU *AirTours* decision *available at* http://europa.eu.int/smartapi/cgi/sga_doc?smartapi!celexplus!prod!CELEXnumdoc&lg= en&numdoc=61999A0342.

4. Why A Merger Might Make Coordination More Likely, More Effective, or More Durable

Key to the analysis of coordinated effects in a merger context is (1) determining whether coordination is likely to be feasible; and (2) explaining why the merger makes coordination more likely. Our first theory involves a situation where there is <u>Evidence of Existing Effective Coordinated Interaction</u>. In this case, there would be a presumption, absent evidence that the merger would undermine coordination (by, for example, creating a lower cost, more aggressive competitor), that a merger would make such coordination more effective or durable. With fewer players, a collusive arrangement is more likely to be stable and able to withstand demand or cost shocks. In this analysis, it is not necessary to focus on whether conditions exist that make consensus, detection, and punishment feasible but rather whether there is convincing evidence that coordination is already occurring. However, as noted below, assessing whether the conditions that would make consensus, detection, and punishment feasible are present may be important to assessing whether the outcomes that are observed are consistent with coordination. Evidence of past overt coordination may also be relevant. However, if the mechanisms used to enact the explicit coordination are complex and would be difficult to replicate tacitly, this evidence would be less relevant.

A second theory would be that the merger results in the <u>Removal of a Maverick</u>. This theory would be a subset of the removal of a maverick theory discussed above but focused on whether the "maverick" has been thwarting the ability to reach consensus. That is, other competitors would not be willing to make "accommodating" restrictions in output beyond short run Nash levels because the "maverick" would likely respond by expanding its own output and undermining attempts to raise prices.

A final theory would be that the merger <u>Removes Other Impediments to Coordination</u>. That is, there is not coordination today because there are impediments to such coordination such as (1) differences in incentives to reach consensus (but not due to maverick behavior); (2) complexity and/or lack of transparency in market outcomes to make consensus or detection feasible; or (3) lack of credible punishment strategies, *and* the merger would remove some of these impediments.[21] The key to the analysis of the merger, therefore, is to assess what factors make coordination difficult and how might the merger change things.

V. Evidence on the Current State of Competition in the Market

Each of the theories discussed above requires an analysis of the current state of competition in the market in order to assess which theory might be applicable, not only to distinguish whether unilateral or non-unilateral effects are likely but also which theory, if any, within each category would best apply. For example, analysis of current competition is necessary to assess whether the number of competitors makes a difference. Similarly, analysis of the current state of competition is also important to assess whether there is evidence of existing

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[21] *See* Andrew R. Dick, Coordinated Interaction: Pre-Merger Constraints and Post-Merger Effects, Prepared remarks for the Charles River Associates conference: Current Topics in Merger and Antitrust Enforcement, December 11, 2002.

coordination or whether one of the merging parties appears to be a maverick. Finally, the current nature of competition is also important to assessing whether the conditions are present for consensus, detection and punishment to be feasible and if not, what are the primary impediments to such an outcome.

Merger investigations typically rely on three types of evidence: (1) information from interviews with (or depositions of) industry participants (particularly customers); (2) information from business documents; and (3) quantitative analyses.[22] Each of these sources of information can be important in assessing the current nature of competition and of the potential effects of a merger. In this paper, we focus primarily on quantitative analyses; however, we briefly discuss the role of interviews and documents in this analysis.

Interviews of industry participants can provide information about the nature of transactions in the industry and competition among the various suppliers in the industry. Customers may be able to provide information on the factors that are important in their choosing suppliers that would also relate to the nature of transactions in the industry. Customers may also be able to provide information on whether the number of competitors matters. For example, some customers may purchase under what can be classified as a bidding arrangement and the customer may be able to describe from experience why reducing the number of competitors from current levels can result in higher prices. Competitors may be able to provide information on the various factors that go into pricing and other decisions in the industry. These may be relevant to assess the complexity and transparency of transactions. One must take care, however, in assessing the information from industry participants. Such discussions will frequently be at a general level and describe how the participant views the market on average, while missing some of the complexity of real world outcomes. In addition, both customers and competitors may have "agendas" that color the information they provide.[23]

Documents can also provide important information to assessing the current nature of competition. It is important to recognize however that these documents may simply show that suppliers currently compete vigorously with one another, which does not, in itself, prove that a merger is problematic. Such documents may provide one basis of a conclusion that there is not effective coordinated interaction currently in the market. An example of documents that might address a particular coordination theory would be documents that provide information about whether the number of competitors matters to pricing decisions. As another example, the documents may indicate existing coordination – perhaps suggesting some form of price leadership.

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[22] *See* David Scheffman*,* "Sources of Information and Evidence in Merger Investigations: An FTC Economist's View," Remarks to a session on "The Use of Economics in EC Competition Law," delivered in Brussels, Belgium, January 2003. (*available at* http://www.ftc.gov/speeches/other/sourcesofinfobrussels03.pdf)

[23] Customers may use a merger investigation to gain concessions even when the merger is not anticompetitive, and competitors may fear the merger will create a more formidable competitor, *i.e.*, strengthen competition.

The remainder of this section describes empirical analyses of the current state of competition in the marketplace related to each of the theories described in the previous section.[24]

A.   Unilateral Theories

Analysis of the current state of the market *should be* at the heart of assessing whether or not a merger is likely to result in unilateral effects. In recent years, economists have focused on quantitative economic analyses that estimate cross-elasticities of demand or the residual demand facing the merged entity, rather than analyses of the specifics of the competition between the parties to the merger.[25] Such estimates, when carefully done, can provide useful information to quantitative analyses bearing on whether the competition between the parties to the merger is, itself, an important determinant of prices are far more useful. In addition, in our opinion, demand estimates must be supplemented by evidence bearing directly on competition between the parties to the merger in order for estimates of market structure to be given much weight. For example, suppose the estimates of "diversion ratios" indicate that two companies are "close" competitors, but evidence from interview, documents, and empirical analyses do not support that conclusion. In such a situation, in our view, the estimates of "diversion ratios" should not be given weight.

There are two types of quantitative analyses that have been used extensively for assessing the viability of a unilateral effects theory that focus on the competitive interaction among the merging parties. In bidding models, analysis of bids focuses on whether the parties to the merger "often" have the two lowest bids. An analogous, more general analysis involves *Natural Experiments*. For example, if one of the merging parties entered recently (in general or into particular geographic areas), one can assess the reaction of the other merging party to that entry – did it lower prices and/or lose sales (significantly and on a sustained basis)? Alternatively, if the merging parties compete in some areas but not in others, one can assess whether their pricing differs in those areas where they compete. The Office Depot/Staples matter provides an example

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[24] See Jonathan B. Baker and Daniel Rubinfeld "**Empirical Methods in Antitrust: Review and Critique**,", AMERICAN LAW AND ECONOMICS REVIEW 386-435 (Fall 1999) for a discussion of various empirical methods used in antitrust litigation.

[25] *See* Daniel Hosken, Daniel O'Brien, David Scheffman, and Michael Vita, *Demand System Estimation and its Application To Horizontal Merger Analysis, Working Paper 246* (April 2002) *available at* http://www.ftc.gov/be/workpapers/wp246.pdf.

> It has also been common in recent years for demand estimates to be incorporated into simplistic "simulation models," which are assumed to reasonably reflect the "competitive dynamics" of the industry, in order to assess the likely competitive effects of the merger. While this approach can provide a method to summarize the implications of the information gathered from the demand estimation, it is only useful if the model provides a reasonable approximation of the competitive dynamics in the market. These models are generally not tested to determine whether they actually adequately "explain" competition or whether they adequately predict merger outcomes. Without such testing, in our opinion, little weight can be placed on the predictions from such models. Analyses geared towards assessing the current nature of competition in the market and between the merging parties can be used to assess the competitive implications of the merger more directly as well as to assess whether the simulation models are likely to provide a reasonable representation of the competitive dynamics in the industry.

of such analyses, where the analysis focused on whether prices were lower when the two companies competed head-to-head in a geographic area.[26]

Beyond the bidding or natural experiments analyses (which are not always applicable or possible) we advocate analyses of transactions level data focused on revealing whether the parties to the merger are particularly close competitors. For example, are their prices more related to one another than they are to other competitors? Below we will discuss transactions level analyses in detail.

B.   Non-Unilateral Theories Other Than Coordinated Effects

1.   Number of Competitors

Quantitative analyses bearing on whether the number of competitors matters seek to take advantage of "natural experiments" where the number of competitors has varied over space and/or time and determine if prices (or other facets of competition) are impacted by the number of competitors. Possible natural experiments may arise because (1) the number of competitors changes over time with entry and exit (the latter possibility being through past consolidations); (2) the number of competitors varies across geographic markets; or (3) in bidding models, the number of competitors bidding varies across customers or over time for the same customers.

The basic approach is to analyze data relevant to a determination as to whether prices are significantly elevated when there are fewer competitors. Critical to any such analysis is the identification of and control for other factors that might impact the level of prices. For example, if prices are lower when Staples and Office Depot compete head-to-head is this because the head-to-head locations have lower costs, on average, than other locations? If such factors cannot be adequately controlled for, one cannot have confidence in estimating the true relationship between the number of competitors and pricing. In some circumstances, after thorough review of the data and industry, the analyst can be confident that confounding other factors are not present. When potentially confounding factors are present, it is generally possible to control for them using various types of data analyses, including multiple regression analysis. As discussed in more detail in a recent paper that we wrote regarding best practices in the use of econometrics,[27] to be of value, such analyses should be firmly grounded in all of the evidence developed in the investigation and should be robust to reasonable alternative specifications of the model, and the findings should be considered in light of other available evidence.

Quantitative analyses focused on determining whether the number of competitors (or concentration) has a significant effect on the level of prices have been used often in merger analyses. A recent example was in the Cruises investigation, which tested for a relationship

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[26] *See* Jonathan B. Baker *Econometric Analysis in FTC v. Staples* JOURNAL OF PUBLIC POLICY & MARKETING 18(1) 11-21 (Spring 1999). Responding to Baker's comments see Jerry Hausman and Gregory Leonard, *Documents vs. Econometrics in Staples, available at* http://www.antitrust.org/cases/staples/hausleon.html.

[27] *See* FTC Perspectives on the Use of Econometric Analyses in Antitrust Cases *available at* http://www.ftc.gov/be/ftcperspectivesoneconometrics.pdf.

between concentration by trade or over time and the level of prices.[28] A "trade" refers to the general destination of the cruise – for example, the Caribbean, Alaska and Western Mexico represent different trades. Concentration varies across the trades and over time within a trade. Some analyses were conducted to see if higher concentration was correlated with higher prices. We found no credible evidence that the number of competitors or concentration significantly impacted pricing levels. Other examples of publicly available quantitative research on number of competitors makes a difference are studies that analyze the effects of the entry of generic pharmaceutical on the sales of "pioneer" brands and on prices of competing generics.[29]

2. Removal of a Maverick

The removal of a maverick theory requires that there is a competitor who has been particularly aggressive and caused the market to be more competitive than it otherwise would have been. One reason may be that the maverick has made coordination more difficult – we will discuss analyses associated with this theory in the next section. In this section, we discuss more general analyses aimed at identifying if a firm is a maverick. We suggest some potential analyses but note that more work should be done in this area.

One potential analysis again involves the use of natural experiments – for example, if the potential maverick does not compete for all customers or in all geographic areas. If pricing data is available for different "bids" or different geographic areas, it may be possible to determine if the presence of that firm in the market has impacted pricing or other competitive outcomes. Another potential analysis involves assessing whether the potential maverick has been more aggressive at attempting to gain new share. If information is available on customer turnover, one could analyze whether the "maverick" has a higher fraction of business from new customers, bids for more customers than other firms (and causes price decreases even if it does not win), or captures a significantly larger share of lost business than other firms.

Part of the analysis should also attempt to assess why the firm is behaving like a maverick. Does it have significant excess capacity (or low cost capacity) that it is trying to fill? Does it have an aggressive expansion strategy that it is acting upon? What do its growth plans look like and why is the company pursuing them?

C. Coordinated Effects Theories

1. Conditions Consistent with "Consensus, Detection, Punishment": Simplicity and Transparency

Either the simple Check List approach or the consensus-punishment-detection paradigm of modern game theory requires that the market and the nature of transactions and other market outcomes (*e.g.*, changes in capacity) be sufficiently simple and transparent. Sufficient simplicity

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[28] *See* "Cruise Investigation: Empirical Economic & Financial Analyses" (November 2002) *available at* http://www.ftc.gov/be/hilites/ftcbeababrownbag.pdf.

[29] *See* David Reiffen and Michael R. Ward *Generic Drug Industry Dynamics, FTC Working Paper* (February 2002) *available at* http://www.ftc.gov/be/workpapers/industrydynamicsreiffenwp.pdf.

is required in order to make consensus viable and to detect deviations from consensus. Sufficient simplicity is generally also going to be required in order for punishment strategies to be viable. For example, if transactions typically involve very complex terms that are not standardized and vary across customers, coordinated interaction on price is likely to be very difficult. However, in such circumstances, coordinated interaction via dividing customers or coordinating capacity may still be viable. Sufficient transparency is required in order for deviations from consensus to be detected.

The *Merger Guidelines* (implicitly) discuss Simplicity and Transparency as follows:[30]

❑ **Reaching Consensus**:
"At some point, however, *imperfections* [*i.e.*, complexities] cause the profitability of abiding by the terms of coordination to decrease and, depending on their extent, may make coordinated interaction unlikely in the first instance."

❑ **Detection and Punishment**:
"If orders for the relevant product are frequent, regular and small relative to the total output of a firm in a market [which other things equal reduces complexity], it may be difficult for the firm to deviate in a substantial way without the knowledge of rivals [*i.e.*, transparency] and without the opportunity for rivals to react. If demand or cost fluctuations are relatively infrequent and small, deviations may be relatively easy to deter."

❑ **Reaching Consensus**:
"Key information [*i.e.*, transparency] about rival firms and the market may also facilitate reaching terms of coordination. Conversely, reaching terms of coordination may be limited or impeded by product heterogeneity [*i.e.*, complexity] or by firms having substantially incomplete information about the conditions and prospects of their rival's businesses, perhaps because of important differences among their current business operations."

❑ **Detection and Punishment**:
"… if key information about specific transactions or individual price or output levels is available routinely to competitors, [*i.e.*, transparency] it may be difficult for a firm to deviate secretly."

Thus, analysis of the simplicity and complexity in the market is clearly relevant to an assessment as to whether coordinated interaction already exists or whether it is likely to be created as a result of a merger. In addition, analysis of these factors helps to determine which type of coordination is most plausible. Possible methods of coordination are: (1) coordinating on price; (2) allocating customers; or (3) coordinating on capacity. If prices are not transparent or are highly complex, price coordination would be much more difficult. Customer allocation would only be feasible if there is consistency in the customer base and good information about which competitors serve which customers and the reasons for changes can be readily ascertained.

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[30] *See* Horizontal Merger Guidelines, § 2.11.

Similarly, in some cases coordination on capacity might be feasible while in others, capacity is not an important competitive constraint. In conducting a merger analysis, determining the possible theories of harm early on is helpful both to the parties and the agency.[31] This can be done through initial empirical analyses or potentially through information gathered from other sources that might be more readily available. With a theory (or theories) in mind, the parties and staff can determine what types of tests would be most useful and what kind of data is needed to conduct these tests.

How does one then assess whether there is sufficient simplicity and transparency? We believe that the Check List is inadequate and largely unnecessary. Recall that the Check List arose in the Stigler theoretical paper on oligopoly. That paper, although seminal, did not foresee the rich body of evidence that is collected and analyzed in the context of a merger investigation. Assessment of simplicity and transparency can be best accomplished by drawing on this rich body of evidence, rather than relying on "30,000 foot" industry structural factors. In what follows we discuss various empirical analyses directly useful for assessing simplicity and transparency.

We begin with a hypothetical "benchmark" for what would be the "ultimate" simple and transparent market. It would have: (i) stable or predictable demand; (ii) (approximately) "one price" (*i.e.*, reasonably stable and predictable between list and transactions prices and standard terms such as quantity discounts) or predictable relationships between prices, (reasonably) known in real time to everyone; and (iii) no large customers/bargaining. Notice that these conditions would be consistent (but stronger than) the major Check List structural factors: (i) homogeneous product/no customization or bargaining; and (ii) frequent transactions/no significant buyer power. This type of market is an unusual (in reality) hypothetical. More realistic conditions might include: (i) prices largely determined by sellers' standard terms (quantity discounts, *etc.*); (ii) prices move together relatively closely; and (iii) if there are large customers, there is a reasonable amount of transparency about different sellers' positions across most major customers. Next we discuss various types of empirical analyses that can be used to assess these issues.

a. Systematic Patterns in Pricing

The first group of analyses we discuss is aimed at assessing the transparency and simplicity of pricing by examining whether there are systematic patterns in pricing across customers. In many industries suppliers negotiate individualized prices with customers, and other competitors and customers may have poor information about the prices to any particular significant customer. While negotiated pricing does not mean that coordination of pricing (or customer allocation) is impossible, if prices are not transparent, reaching an agreement is more difficult. In addition, if prices are opaque, detection of cheating (at least with respect to price) will not be possible.[32] When there is non-systematic variation in prices across customers, in

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[31] *See Best Practices for Data, and Economics and Financial Analyses in Antitrust Investigations, available at* http://www.ftc.gov/be/ftcbebp.pdf.

[32] A customer allocation collusive scheme would not have to monitor pricing.

order to coordinate prices, the price for each customer or class of customers must be coordinated and monitored. Since measurement error will increase when there are many prices, there will be substantial uncertainty about whether a deviation has actually occurred. This will be particularly so to the extent that different suppliers charge different prices for the same product to the same customer. Moreover, observing deviations from the coordination outcome is likely to be difficult if changes in price across customers are varied in direction and size at any given point in time.

Often in mergers, dollar and unit sales data are available from the merging parties at the transaction or customer level. These data, along with information on rebates and other discounts, can be used to calculate the net price per unit that each customer paid over a given time frame. This data can then be analyzed to assess:

❑ The variation in pricing across customers, controlling for observable differences in customers (such as volume, location, and/or customer "vertical" industry);

❑ Differences in the prices to the same customer for the same product across different suppliers; and

❑ The variation in changes in price across customers, controlling for observable differences in customers (such as volume or customer industry).

If significant variation is found, coordinated interaction is likely to be more difficult. Lack of variation does not imply that coordination is occurring – it does suggest however that it is more feasible.

b. List Pricing v. Transaction Pricing

Potential concern with coordinated interaction can be stimulated by use of list prices and what may appear to be "signaling" through changes in list prices. If such lists represent the prices paid by a large percentage of volume, such lists can provide a means of reaching consensus and observing prices. However, if many customers do not pay list price, using price lists to reach consensus and monitor pricing is more difficult. It is possible, however, if price lists are used as the starting point of most negotiations and thus transaction prices are highly correlated with list prices (the most extreme example would be that the contract price is a function of the list price), changes in list prices can provide information to competitors on a supplier's pricing strategy.   Even if list prices are not posted, suppliers frequently receive notice of a competitor's list prices changes from customers or the industry press. However, if the implementation of list price change varies widely across customers in size and particularly, direction, then the ability of suppliers to use list prices to coordinate behavior is significantly

diminished.[33] The fact that list price changes are followed does not imply coordinated behavior if transactions prices are not systematically related to list prices.

If list prices and changes in list prices are reasonably related to transactions prices and their changes, there may be a basis for concern with coordinated interaction. It is important to note, however, that observing such behavior does not necessarily mean that there is existing coordinated interaction (such movements may be explained by common changes in demand or costs) but rather that coordination is more likely. Thus, if list price change announcement dates and transaction prices are available, those data should be used to examine the extent to which list price increases have been successfully implemented, and the relationship between list and transactions prices.

c. Variability in Competitor Pricing

Another set of analyses focuses on the relationship of pricing across competitors. While finding that prices move in parallel does not mean that coordination is occurring (*e.g.*, this would be expected to result from common cost and demand shocks), finding that prices are not "very" correlated is clearly not consistent with existing coordination of pricing. Moreover, it suggests that there are significant complexities in the pricing decisions of individual firms that would make reaching consensus or detecting deviations more difficult.

In addition, analysis of pricing across competitors can examine whether the position of each competitor's pricing relative to each other remains relatively constant. For example, is one firm always the high price firm, while another is the second highest priced and so on. Again, finding constancy in relationships does not mean that coordination is occurring, but finding little stability in the relationship between competitors' prices is not consistent with coordination and also suggests reaching consensus would be difficult.

d. Availability of Information About Pricing, Quantity and Capacity

The information that is available about competitor pricing, the position of competitors at significant customers, and competitors' changes in capacity are clearly an important determinant of the viability of coordinated interaction. For detection of deviations from consensus to be feasible, suppliers must be able to observe accurately the prices charged, quantities sold, and capacities owned by competitors. Many firms typically try to collect and analyze information for the purpose of attempting to estimate the quantity competitors sell to individual customers and the prices charged and to detect changes in competitors' capacities. In addition, in some industries third party publications provide estimates of capacity. The accuracy of such

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[33] Judge Posner discussed the role of list prices versus transaction prices in his recent decision in the High Fructose Corn Syrup matter. (295 F.3d 651: 2002 U.S. App.). He noted that even if most customers do not pay list prices, list prices may have an impact on transaction prices and thus fixing list prices may have an effect. Our point here is not that list price coordination cannot have an effect even where transaction prices do not equal list prices but that the more non-systematic the relationship between list and transaction prices, the less likely that tacit coordination can occur. Further, we stress the importance of credible evidence that establishes a sufficiently close relationship between list and transactions prices.

information, if available, can be assessed in a merger setting by comparing these estimates with the actual prices and quantities for individual customers of, at minimum, the merging parties (and the FTC and DOJ may also have access to information for other competitors).[34]

For example, assume the acquiring company, "X," has maintained over a period of time estimates of the quantities sold by the acquired company, "Y" (as well as likely other competitors) to individual significant customers and the prices charged to those customers. If customer level pricing and quantity data is available from customer "Y" to the antitrust counsel and economists working with the merging parties on the transaction or to the antitrust agencies, Company X's estimates of Y's pricing and quantity can be compared to its actual prices. If the estimates are significantly different from the actual, this suggests suppliers do not have good information on the prices and quantities of their rivals.[35]

It is important to note that these analyses should be considered at the individual customer level, rather than just in aggregate, since deviations from the collusive agreement are likely to occur at individual customers, rather than to all customers, particularly if prices are negotiated. Also important is to consider what reflects a "meaningful" difference in the price and quantities to be estimated. For prices, one could start with a 5% test consistent with the *Guidelines*; however, in some industries, smaller differences may be important to determining who wins a customer's business. Finally, Company X's estimates of its competitors' capacities over time can be compared to information about "actual" capacities over time for the purpose of assessing the viability of coordinated interaction with respect to increments in capacity.

e. New Product Introductions

In some industries, new product introductions can have a significant impact on customer turnover and on the ability to coordinate. The greater the level of new product introductions, the more difficult it may be to "allocate" customers, since customers may switch due to the features available in the new products rather than due to "cheating" by the members of the collusive group. With available data, an analysis should be conducted of the number and importance of new product introductions over time. It may also be difficult to coordinate on price as new products would have to be continuously incorporated into the coordinated outcome. One possibility would be to calculate the percentage of sales in each year that are accounted for by products that were introduced in the last 2 or 3 years.

f. Other Factors Impacting Complexity

Other factors could also impact ability to reach consensus and detect deviations. For example, if demand or cost conditions are highly variable, it may limit achieving consensus or determining whether changes are deviations from the coordinated outcome or responses to changing conditions. Thus, analyses of the variability of demand would be relevant to these outcomes.

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[34] We do not provide examples below of capacity analyses but they could parallel those considered for price and quantity.

[35] If available, these analyses should be done for the estimates of other companies in the industry as well.

As another example, to the extent that there is substantial heterogeneity of the products offered by the firms, and this heterogeneity is an important factor in competition, reaching consensus may be difficult. Price is likely not to be the only consideration customers have in choosing vendors, and the incentives of the firms in the industry are likely to differ. The problems that this may cause will be reduced to the extent there is more similarity in the range of products offered by the various firms and there are systematic relationships between the pricing of these products (or distinct customer groups who use the products).

2. Empirical Analyses Regarding Evidence of Existing Tacit Coordination

The analyses discussed thus far are relevant to the assessment of whether there is existing coordination or whether conditions are conducive or non-conducive to coordinated interaction. Next we discuss analyses that can be conducted for specific theories of coordination. We note that it will usually be easier to be confident that the data supports rejecting the hypothesis that there is coordination (*i.e.*, that the results are not consistent with the coordination theory) than to be confident that the data supports accepting the hypothesis of existing coordination (because some of these outcomes may also be consistent with competitive behavior).

The analyses discussed below relate to particular theories of coordination. However, as a general matter, the goal of these analyses is to assess the current vigor of competition in the industry. If the industry currently appears very competitive, this would be inconsistent with existing coordination. For example, in the Cruises investigation, we concluded that the industry was currently very competitive – all the competitors were adding capacity, increasing amenities and competing on price. Even if the industry does not appear "highly" competitive, this does not mean that there is coordination – one would have to analyze whether firm behavior is consistent with coordination or unilateral behavior.

a. Price Leadership

One form of coordinated behavior is price leadership by a single firm.[36] To assess whether the industry competition can be accurately characterized by price leadership, it is important to analyze whether past behavior is consistent with price leadership occurring. If so, it is likely that a merger would make such behavior more effective. If not, then one must assess whether the merger removes an important competitive constraint from the market (*e.g.*, a maverick who has been reluctant to go along with the price leader), that is likely to make price leadership more effective. Evidence to consider includes:

❑ whether price increases (and decreases) are publicly announced;

❑ who initiated the price change and whether this varies over time;

❑ whether other competitors follow in announcing their own price changes; and

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[36] *See* JEFFREY CHURCH & ROGER WARE, INDUSTRIAL ORGANIZATION: A STRATEGIC APPROACH § 10.6 (2000).

❏ whether actual transaction prices react to these price announcements.

b. Capacity Coordination

In many industries where coordinated interaction concerns are raised, maintaining fairly high capacity utilization is important to profitability. This is likely to be more important for industrial than consumer products. Thus, ultimately, successful coordination may require capacity coordination. Coordination of capacity may be difficult because capacity is often difficult to observe. If capacity can be increased incrementally (*e.g.*, through "debottlenecking," as is often possible in chemical industries), observing capacity is made more difficult. Thus, one relevant quantitative test is to review past capacity changes in the industry to see the extent of such changes and whether they generally involved large increments of capacity or have involved, at least to some degree, smaller increments to capacity. In addition, frequent large changes in capacity can destabilize coordination, particularly if firms add different amounts of capacity at different times.

c. Customer Allocation

Rather than directly coordinate pricing, suppliers could allocate customers or territories.[37] If one firm knew that other firms would not seek its customers or business within its territory, it could raise prices to those customers or within that territory without fear of losing business. If little business shifts between suppliers (which is likely to be the case in a territorial or customer allocation cartel), then there is little need to monitor prices. In effect, each member becomes a monopoly in its area, and prices accordingly. However, typically some business does shift between members of the group who are allocating customers or territories (explicitly or tacitly). Thus, to effectively police such an agreement, members have to be in a position to determine first, whether their allocated customers shifted purchases to other members of the collusive group, and second, whether any such shifts in business resulted from efforts by other members to solicit this business rather than from customer decisions based on their changing needs.

The theory suggests that if coordinated behavior is occurring, one would expect to find little shifting of customers (entirely or shares of customer volume) across suppliers and fairly stable output shares. One test is to assess the amount of customer turnover or "churn" that has occurred in the industry. That is, what fraction of volume shifts across suppliers from year to year. The less stable is customer volume, the less likely that coordination for customers is occurring. In addition, the fact that there is little shifting of business between competitors may be the result of preferences of customers – so that such evidence cannot, alone, lead to a conclusion that there is existing customer allocation. Further, despite a factual pattern indicating that not much business shifts between suppliers, customers may nonetheless be able to protect themselves by threats to shift business.

Analogous analyses can be done for consumer products as well as for industrial products. To determine customer "churn," one can analyze how stable sales shares are over time across manufacturers – over all and to particular customers. In addition, consumer products

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[37] *See* DENNIS W. CARLTON & JEFFREY M. PERLOFF, MODERN INDUSTRIAL ORGANIZATION § 5 (2000).

manufacturers are frequently competing to gain more shelf space for existing or new products. One could analyze in detail these competitions to determine how much shifting of products occurs, how many new product introductions exist, and from whom shelf space or sales are taken.

VI. How the Merger Impacts Likelihood of Coordination

After assessing the transparency and complexity of the market and the current state of competition in the market, the next step is to analyze how the merger would impact the likelihood of coordination. For the "Number of Competitors Matters" theory, if careful empirical analyses support these theories, there is little additional work to be done. If direct evidence shows that the number of competitors matter, this suggests the merger will result in higher prices, so long as a significant competitor is removed. The results of the analysis may also be used to assess the size of the potential effect. An important consideration at this point, however, is the role of efficiencies. If there are significant efficiencies, this could change the outcome because, by lowering the costs of one of the competitors, the pricing incentives will be changed. It is possible that the efficiencies could offset the presumption of competitive harm.

If a maverick has been identified, it is also important to assess why the firm has been behaving like a maverick in order to determine whether the merger will change those incentives. For example, if the firm has a relatively small share but low cost ability to expand output and/or capacity, that may explain maverick behavior. A merger that combines the maverick with a substantially larger share firm may change those incentives.[38]

The question then exists, why the merger might change the outcome if there is not evidence of existing coordination or a maverick. The analysis of current competition will show what other impediments to coordination exist – e.g., lack of transparency or too much complexity or lack of credible punishment strategies. The question then arises whether the merger would change this outcome. We have not done much analysis in these areas and encourage more work to be done. As a first start, it seems unlikely, absent unusual circumstances, that a merger would substantially change the transparency or complexity of an industry.

If the relevant analysis supports a conclusion that the market currently has effective existing coordination, we propose a rebuttable presumption that it is likely that a merger would make such coordination more effective or durable. In some circumstances the facts may indicate that the particular merger is unlikely to have any impact on the state of competition. In other circumstances the facts may indicate that the merger is likely to create a more aggressive competitor (*e.g.*, because of efficiencies or other benefits arising from the merger) so that the merger might upset the coordination. For example if there are significant efficiencies, this could upset pre-merger consensus and result in incentives by the merged firm to deviate from the coordination outcome even in the presence of punishment strategies.

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[38] *See* Jonathan B. Baker, *Mavericks, Mergers and Exclusion: Proving Coordinated Competitive Effects Under the Antitrust Laws*, § IV, 77 N.Y.U. L. REV. 135 (2002).

VII. Examples of Quantitative Analyses for Coordinated Effects

A. Industrial Products Merger

1. Background

To demonstrate how these analyses can be implemented, we provide examples using data from an actual case where we were retained by the merging parties.[39] The matter involved an industry where pre-merger the market was concentrated with five competitors and the largest competitor was purchasing one of the smaller competitors. There were three primary end-use (vertical) segments. Although the product was relatively homogeneous, as in most industries like this one, customers sold their end-use products in part by trying to differentiate on quality and the level of quality was related to the product at issue. The product at issue was also a significant component of the cost of the customers' products − *e.g.*, customers considered a 2-3% difference in prices important. Finally, customers counted on suppliers to come up with new products.

Sellers had list prices and most volumes sold via "contracts." The contracts usually had terms related to volumes but were not enforceable. Assurance of supply and quality were important to customers. All of these factors might be considered consistent with likely coordinated behavior using the Check List approach. We found however using the empirical analyses outlined below, that industry behavior did not appear consistent with coordinated behavior, and that the proposed merger would not significantly impact the likelihood of post-merger coordinated interaction. There was not a viable unilateral effects theory because of excess capacity of other competitors and competition between the parties to the merger, itself, could not be concluded to be an important determinant of prices.

2. Analysis of Prices of Customers at a Point in Time

Figures 1A-B provide examples of the types of analyses that can be developed to address whether there is significant variation across customers at a point in time.   The first and second panels of Figure 1A show the range of prices paid by the top 25 and top 10 customers, respectively, of Company X over time.[40]   Figure 1B shows the percentage of customers that are common among the companies for whom price information is available where prices for the same product at the same time differed. The results show for Figure 1A, substantial variation in the prices across the top customers of Company X. The variation is frequently more than 10% of the transaction price, even among the top 10 customers. Moreover, the same customer can have

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[39] Because the data is confidential, we only provide high-level summaries of the data and do not identify the industry or companies involved.

[40] Focusing on the top 25 customers of the company eliminates, to some extent, the impact of volume on pricing. Additional analysis should be done to determine whether, within the group of top 25 customers, differences in price are be related to differences in volume. One could also formally control for volume using statistical analysis as discussed more below. The results were similar for other competitors. It is also important to consider the effects of outliers and to determine if the variation in pricing is due to a few "unusual" prices.

substantially different prices from different suppliers. These outcomes suggest a substantial amount of individual, idiosyncratic price negotiations with customers.   While there will be no hard and fast rules as to what represents substantial variation, one benchmark can be the 5-10% price test used in market definition analysis. Discussions with customers and suppliers can also indicate what size of a price difference is important to deciding which supplier to choose and thus how much variation might be "a lot." As noted above, in this industry, a 2-3% price difference was meaningful to customers.

We also calculate the coefficient of variation (ratio of the standard deviation to the mean) of prices across customers in each year for each segment. As opposed to looking at the range from highest to lowest prices, this measure provides an indication of the variation around the mean (which one would expect naturally to be lower than the range as a percentage of the mean) and potentially lessens the impact of any outliers (although we have accounted for this to some extent by focusing on the top customers within each category). The results show that the coefficient of variation varies between 3% and 6% and that the amount of variation appears to grow over time. The results are shown in Figure 1C.

To analyze this variation in prices, we calculated for each customer in each month the price paid and estimated a regression equation with this value as the dependent variable and the customer's volume and dummy variables for the year and segment as the independent variables. This analysis shows that only a small portion of the variation in price is explained by the regression (See Figure 1D). In addition, the model does not predict well the prices paid by a customer for a given volume (See Figure 1E).

The statistical tests thus show that there was a lot of price variability that was not related to vertical segment, volume, or general customer characteristics. This analysis indicates, among other things, that suppliers are able to charge different prices to different customers, and customers do not communicate accurately the prices they pay across suppliers and recognize that opacity and price variation are important to obtaining competitive prices. Thus, using prices as a signal to achieve a coordinated outcome is likely to be difficult.

3.   Changes in Prices Over Time

Figure 2 shows the range of differences in the month-to-month changes in price across customers for the two examples, starting in a month when a price increase was announced. In Figure 2, the size and direction of price changes across customers varies significantly. For example, in Month 2 to Month 3, while about 70% of the top 25 customers had no price change, 12% of customers had a price increase, and 16% had a price decrease (this after a price increase was announced).[41] In most monthly changes shown, a significant fraction of customers had a price change opposite in sign to what most customers experienced. This is not only important in assessing the transparency of pricing (as average price changes may not reveal much about what

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[41] Figure 2A-2 shows the same analysis weighted by volume. While the differences in movements are not as large as in the customer count analysis, the analysis still shows substantial variation in pricing movements.

is happening to individual customer prices) but also suggests prices are determined by individual situations, and it appears unlikely that there is much coordination in pricing.

4.   List v. Transaction Pricing

Figures 3A and 3B provide examples of the breakdown of pricing changes to customers after a list price change.[42] As seen in Figure 3A, when list prices increased, a substantial fraction of customers did not experience a price change (or had prices decrease). The results are similar when one analyzes the distribution of volume. (See Figure 3B.) For those who did experience a price increase, prices did not go up by the full amount of the price increase for most customers. This suggests that using list prices to coordinate price changes is not a very effective mechanism, as actual transaction prices may not reflect these changes, and there is substantial variation across customers as to whether this will occur. This type of analysis can be readily applied to consumer products as well, if adequate information is available on rebates and discounts to individual customers.

The previous example analyzed transaction price changes across customers after a given list price change. We also analyzed the extent to which average prices followed list price changes. Figure 4 shows price increase announcements initiated by Company X and the path of actual prices after those announcements. As seen in the figure, actual transaction prices do not follow closely list price changes – sometimes average prices fell after a list price increase and the amount by which actual prices were below list prices grew over time.

5.   Availability of Information on Price and Quantity

Figures 5 and 6 provide an analysis of how a firm's estimates of the prices and volumes of its competitors compare with actual prices and volumes.   Figure 5 provides information on quantities, showing the percentage of customers (and volume) where Company X's estimates are off by more than various percentages.[43] Figure 6 provides the same information for prices. The results in Figures 5 and 6 are striking in that they show that Company X has very poor information about the quantity and prices at individual customers. Company X's estimates of volume are off by more than 20% for 75% of customers and by more than 60% for almost 40% of customers. Moreover, in many cases, Company X does not correctly identify which other firms are supplying customers. This suggests that any attempt to coordinate based on a customer allocation scheme would be difficult, if not impossible, to monitor. In addition, Company X's information on price was also not very good, particularly with regard to Competitor Z.

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[42] We present the results based on the distribution of customers, one could also do an analysis based the distribution of volume.

[43] These analyses are done based on numbers of customers; similar analyses can also be done weighting customers by volume.

6. Price Leadership

Figure 7 provides an example of the types of analyses that can be performed to analyze price leadership.[44] Figure 7 provides information on the number of times various companies "led" price increases, followed, or did not issue an announcement for our two examples. In this example, several companies led the price increases, and in many cases not all competitors followed with a price increase. This suggests that no one firm is the price leader. Moreover, Companies B and D look somewhat like mavericks as they rarely followed price increases.

Above we showed an analysis of whether or not transaction prices followed list price announcements. Another potential analysis, not shown here, would be to look at the transaction prices of one of Company X's competitors after Company X led a price increase. This could provide information about whether the competitor "followed" even if it announced a list price increase as well.

7. Capacity Coordination

Figures 8 and 9 provide examples of analyses of capacity.   In Figure 8, we analyze each competitor's share of capacity growth year to year. The data shows substantial volatility in each competitor's share of capacity growth. Year-to-year, different competitors are adding different amounts of capacity. This is not consistent with coordination on capacity where one would expect smoother additions to capacity across suppliers and over time. Figure 9 shows the cumulative capacity share change for each supplier over the period analyzed. Some competitors gain substantially in capacity share while others decline. Again, this is not consistent with capacity coordination as one would expect suppliers to roughly maintain their shares over time under coordination.

8. Customer Allocation

Figure 10 provides an example of a "churn" (turnover of business among competitors) analysis. These analyses focus on the churn at one company in the industry; if data is available, such analyses should be done for as many companies as possible and, if possible, for the industry as a whole. The left panel of the figure shows the sum of gains and losses (in absolute value) as a percentage of total volume for Company X. Considering both gains and losses is important as it shows the amount of churn that is occurring in the industry. The right panel shows how the combined gains and losses broke down by competitor and thus provides information about how closely different competitors are competing. The analysis shows that a large fraction of the company's business is gained or lost from year to year and that these gains and losses are spread over many customers. This suggests substantial competition among suppliers and is not consistent with coordination. It should be pointed out that low customer turnover does not mean that coordination is occurring – there can be other reasons for low customer turnover that are consistent with competition (as customers and suppliers invest in their relationships and thus incumbents have an advantage).

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[44] Again, this analysis can readily be applied to consumer products mergers as well as industrial products mergers.

B.   Cruise Line Case

Similar types of analyses to those conducted above were also done for the Cruise Line matter. The following exhibits are taken from "Cruise Investigation: Empirical Economic & Financial Analyses"[45] and provide examples of the types of analyses we conducted in that matter.

1.   List v. Transaction Prices

In the Cruises investigation, we also considered whether "list" or "early" prices could be used as a coordination device. We considered whether there was a systematic relationship between early prices and average and/or late transaction prices. Figure 11 provides information for a particular ship sailing on the same itinerary for four consecutive weeks for a particular cabin category. For each sailing, we determined the early price that appeared to have been paid by a number of customers in the cabin category (and thus we considered the sailings' early "list" price) and then determined the distribution of discounts off that list price for the sailing. As seen in Figure 11, there is substantial variation in the level of discounts off the early price.

Figure 12 looks at this type of information more systematically across all sailings. For each sailing for which we had data, we calculated the average price paid by customers who booked more than 120 days in advance of the sailing ("early prices") and the average price for customers who booked within 120 days of the sailing ("late prices"). We then calculated the percentage difference between the late price and the early price. Figure 12 shows the distribution across all sailings of these percentage differences. One can see in this exhibit that while, on average, late prices are lower than early prices, the reverse is true for a significant number of sailings and the size of the differences varies substantially. This suggests there is no systematic relationship between early and late prices.

2.   Variability in Competitor Pricing

In the Cruises investigation, we analyzed the movements in pricing and booking rates of competitors on head-to-head sailings (that is, leaving from the same port on the same day with similar itineraries). Figure 13 provides an example of this type of analysis. For each 30 day period prior to sailing for a cabin category, we calculated the average price paid during that period and the number of cabins booked for each of the four sailings. The average prices are shown by the lines (with the values on the right-side axis) and the percentage booked during the period is shown by the bars (with the values on the left-side axis). This analysis shows substantial variability in the pricing movements across competitors and that these pricing movements appear to be driven by how much of the ship has been booked rather than changes in competitor pricing.

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[45] *See* "Cruise Investigation: Empirical Economic & Financial Analyses" (November 2002) *available at* http://www.ftc.gov/be/hilites/ftcbeababrownbag.pdf.

3. Capacity Coordination

In the Cruises investigation, we also considered the potential for capacity coordination. Here we saw that all the major firms and many of the smaller firms in the industry had been aggressively expanding their capacity and improving the quality of their ships. Thus, there did not appear to be any evidence of existing coordination on capacity.

VIII. Conclusion

In this paper we have argued for the importance of quantitative economic analyses as an input into assessment of the potential competitive effects of mergers. Quantitative analyses that can be used to assess the level of complexity and transparency in the industry and the current state of competition in the industry are clearly relevant to an assessment of potential competitive effects. We have described a number of analyses that we have found useful in merger investigations and also provided a number of examples. We hope that this contribution will stimulate more research focused on the development of empirical analyses useful for the assessment of the potential competitive effects of mergers.

Figure 1A
Variation in Prices Across Customers

Range in Prices Paid by Company X's Top 25 Customers as a Percentage of the Weighted Average Price by End Use Segment			
Year	**Segment A**	**Segment B**	**Segment C**
19xx	9%	15%	19%
19xx+1	10%	11%	21%
19xx+2	11%	14%	17%
19xx+3	12%	22%	26%

Range in Prices Paid by Company X's Top 10 Customers as a Percentage of the Weighted Average Price by End Use Segment			
Year	**Segment A**	**Segment B**	**Segment C**
19xx	7%	11%	5%
19xx+1	6%	11%	2%
19xx+2	11%	13%	5%
19xx+3	12%	15%	16%

Figure 1B
Variation of Prices Across Competitors
to Same Customers

Percent of Instances Where Prices to the Same Customer by Different Suppliers Differ by More than 5% by End Use Segment			
	Segment A	Segment B	Segment C
Company X and Company Y Prices	32%	49%	40%
Company X and Company Z Prices	25%	43%	22%

Figure 1C
Coefficient of Variation Analysis

Coefficient of Variation in Prices Paid by Company X's Top 25 Customers by End Use Segment			
Year	Segment A	Segment B	Segment C
19xx	2.7%	3.7%	4.9%
19xx+1	2.9%	3.6%	4.8%
19xx+2	3.3%	4.0%	4.3%
19xx+3	3.9%	5.6%	6.1%

Coefficient of Variation in Prices Paid by Company X's Top 10 Customers by End Use Segment			
Year	Segment A	Segment B	Segment C
19xx	2.3%	4.2%	1.6%
19xx+1	2.1%	4.7%	0.9%
19xx+2	4.3%	4.7%	1.9%
19xx+3	4.3%	5.0%	4.8%

Figure 1D
Regression Analysis of Prices Across Customers
Dependent Variable = Price

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	2.20241	0.36707	164.99	<.0001
Error	3522	7.83552	0.00222		
Corrected Total	3528	10.03793			

Root MSE		0.04717	R-Square	0.2194
Dependent Mean		0.91014	Adj R-Sq	0.2181
Coeff Var		5.18239		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	0.88914	0.00207	429.17	<.0001
Volume	1	-0.00002034	0.00000115	-17.73	<.0001
19xx+1 Dummy	1	0.05371	0.00224	24.02	<.0001
19xx+2 Dummy	1	0.03469	0.00224	15.46	<.0001
19xx+3 Dummy	1	0.02112	0.00225	9.39	<.0001
Segment B Dummy	1	0.00601	0.00201	3	0.0027
Segment C Dummy	1	0.00216	0.00195	1.11	0.2674

Figure 1E
Prices
19xx - Segment A
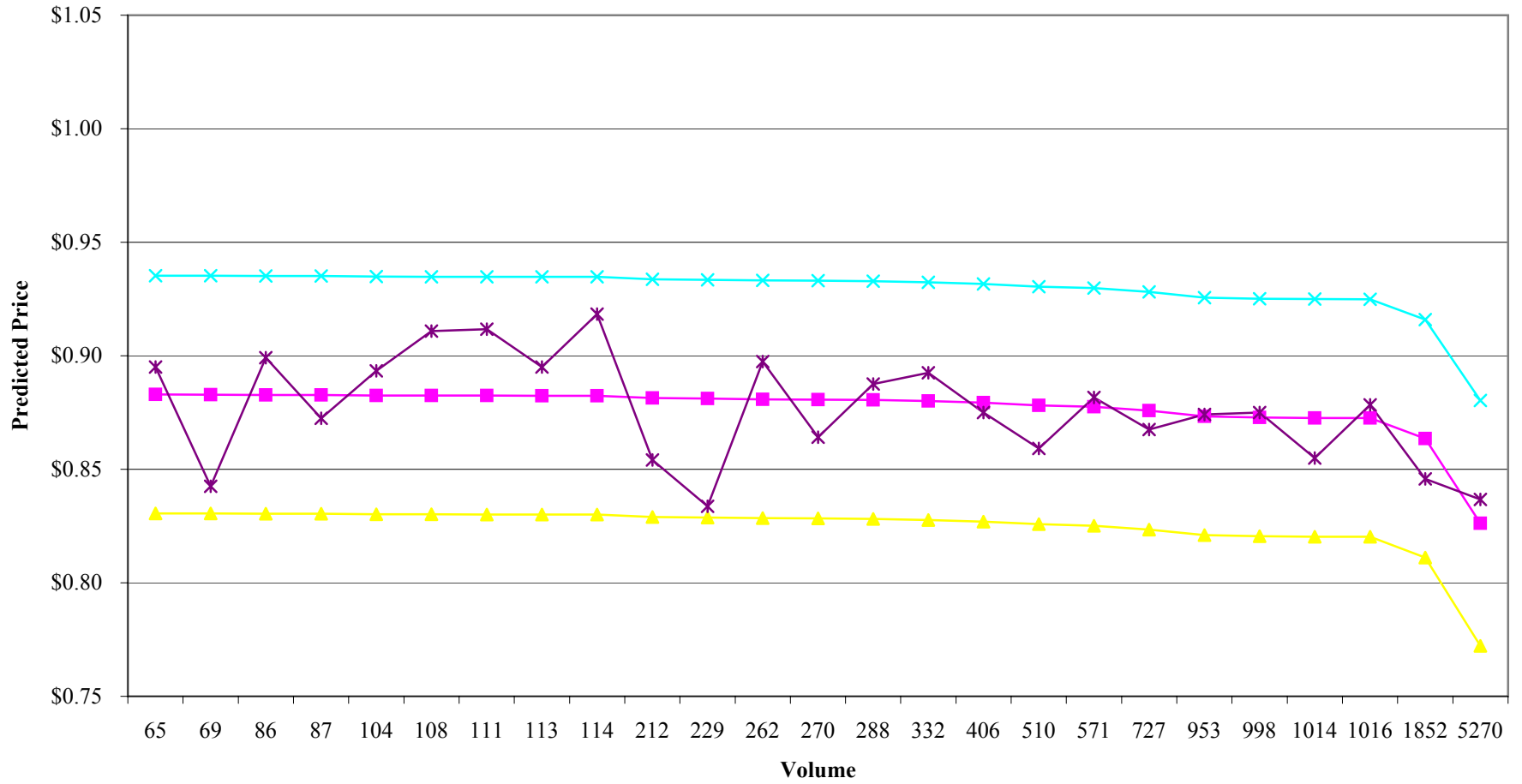
Figure 2
Variation in Price Changes

Percent of Company X's Top 25 Customers For Whom Prices Change by Varying Amounts Month 1 = Announced Price Increase				
Segment A				
Price Change Range	**Month 1 to Month 2**	**Month 2 to Month 3**	**Month 3 to Month 4**	**Month 4 to Month 5**
Increase	16%	12%	9%	79%
No Change	84%	72%	83%	16%
Decrease	0%	16%	9%	5%
Segment B				
Price Change Range	**Month 1 to Month 2**	**Month 2 to Month 3**	**Month 3 to Month 4**	**Month 4 to Month 5**
Increase	12%	13%	13%	67%
No Change	80%	78%	78%	10%
Decrease	8%	9%	9%	24%

Figure 3A
Vatiation in Actual Price Changes
Customer Distribution
7¢ List Price Increase

Equal to $.07
0%

Greater than $.07
0%

Negative or Zero
15%

$.06 to $.07
5%

$.05 to $.06
10%

$.04 to $.05
5%

$.00 to $.01
20%

$.03 to $.04
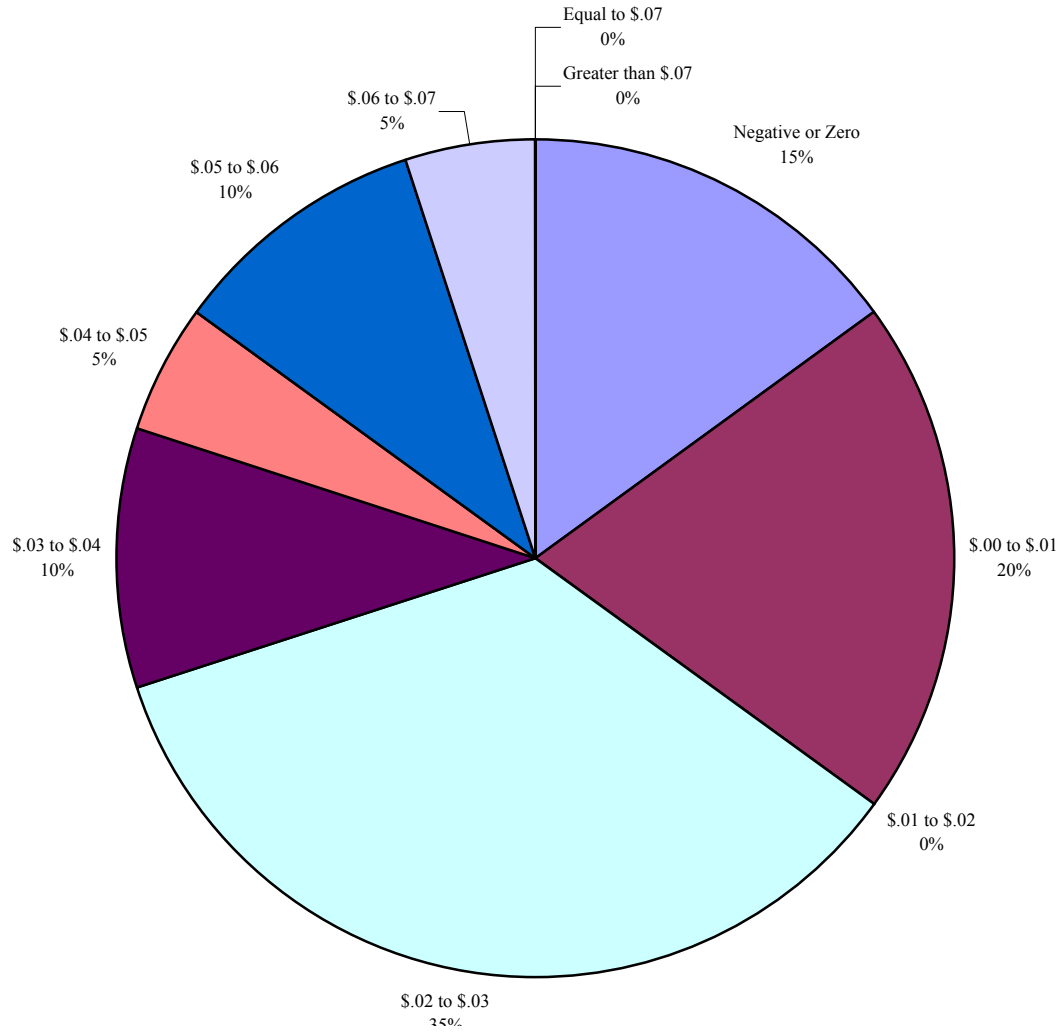10%

$.01 to $.02
0%

$.02 to $.03
25%

Figure 3B
Vatiation in Actual Price Changes
Volume Distribution
7¢ Per Unit Increase
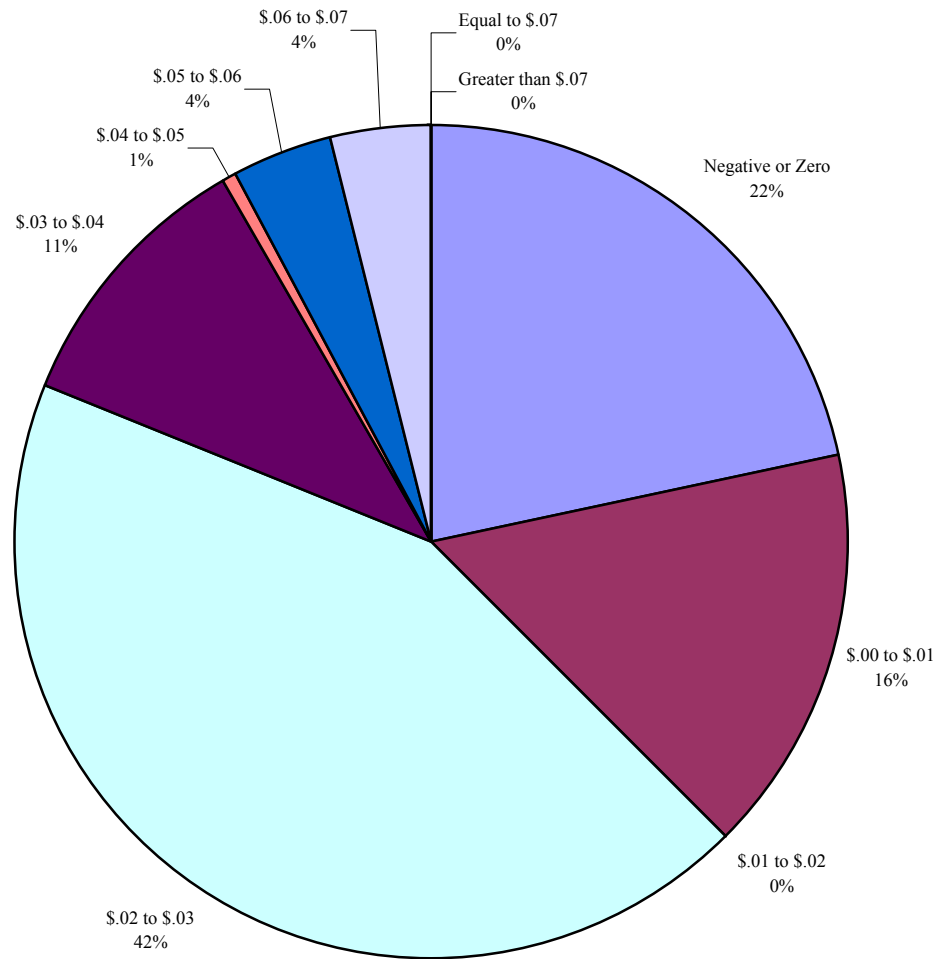
Figure 4
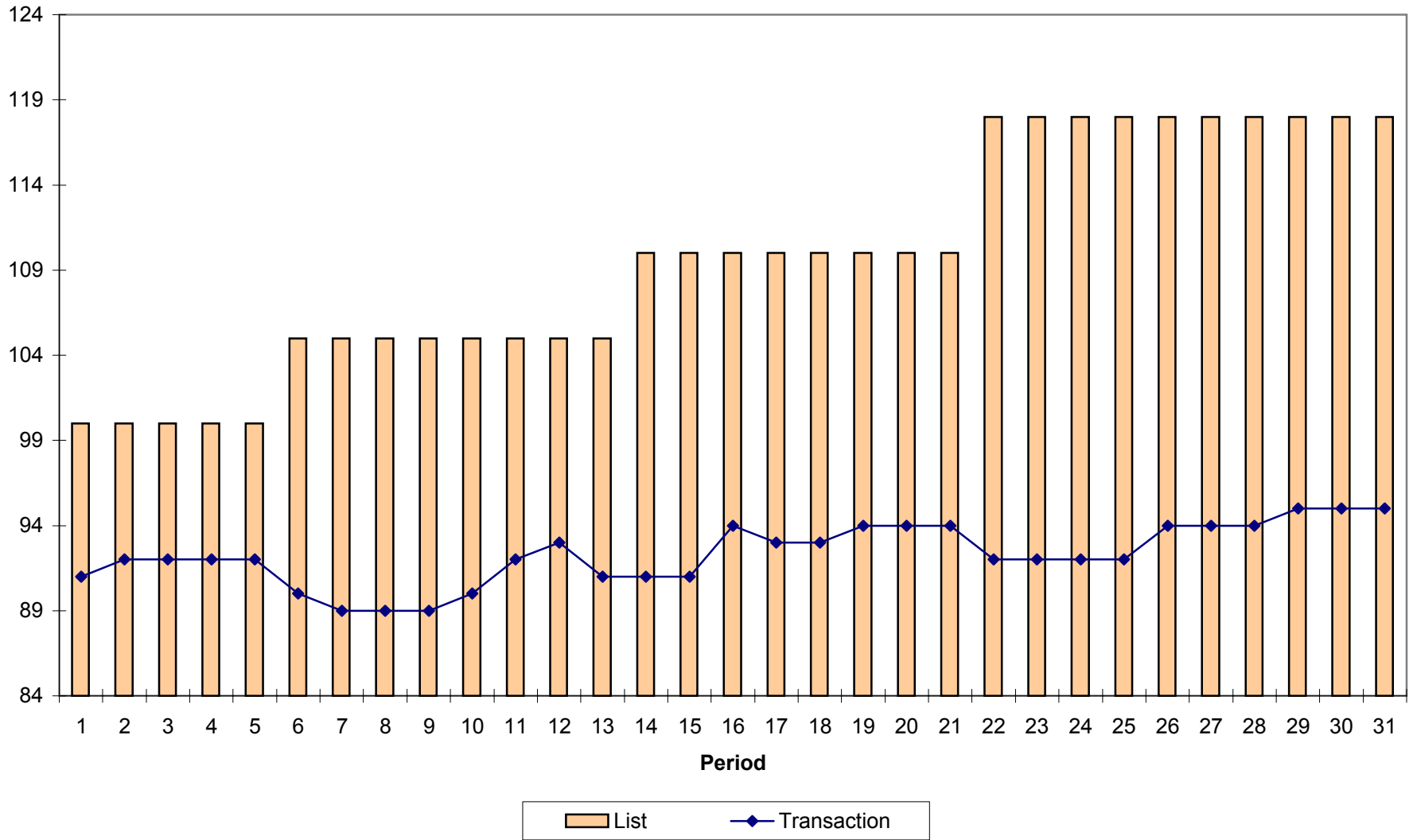**List Price vs. Actual Prices**
Company X's List v. Transaction Prices Over Time

Figure 5
Analysis of Competition Transparency

Comparison of Company X's Estimates of Competitors' Volume
Versus Actual Volumes for Two Major Competitors

	Competitor Y	Competitor Z
Number of customers that Company X Identifies as Supplying	55	46
Number of customers Company X identifies as supplying when did not	22	12
Number of customers Company X does not identify as supplying when did	12	8
Percent of customers for whom Company X's volume estimate was off by more than 20%	75%	82%
Percent of customers for whom Company X's volume estimate was off by more than 60%	39%	47%

Figure 6
Analysis of Price Transparency

Comparison of Company X's Estimates of Competitors' Prices

Versus Actual Prices for Two Major Competitors

(Recall that 2% is Viewed by Customers as Significant)

	Competitor Y	Competitor Z
Percent of customers for whom Company X's price estimate was greater than the actual price by more than 2%	15%	30%
Percent of customers for whom Company X's price estimate was greater than the actual price by more than 5%	5%	18%
Percent of customers for whom Company X's price estimate was less than the actual price by more than 2%	28%	40%
Percent of customers for whom Company X's price estimate was less than the actual price by more than 5%	8%	28%

Figure 7
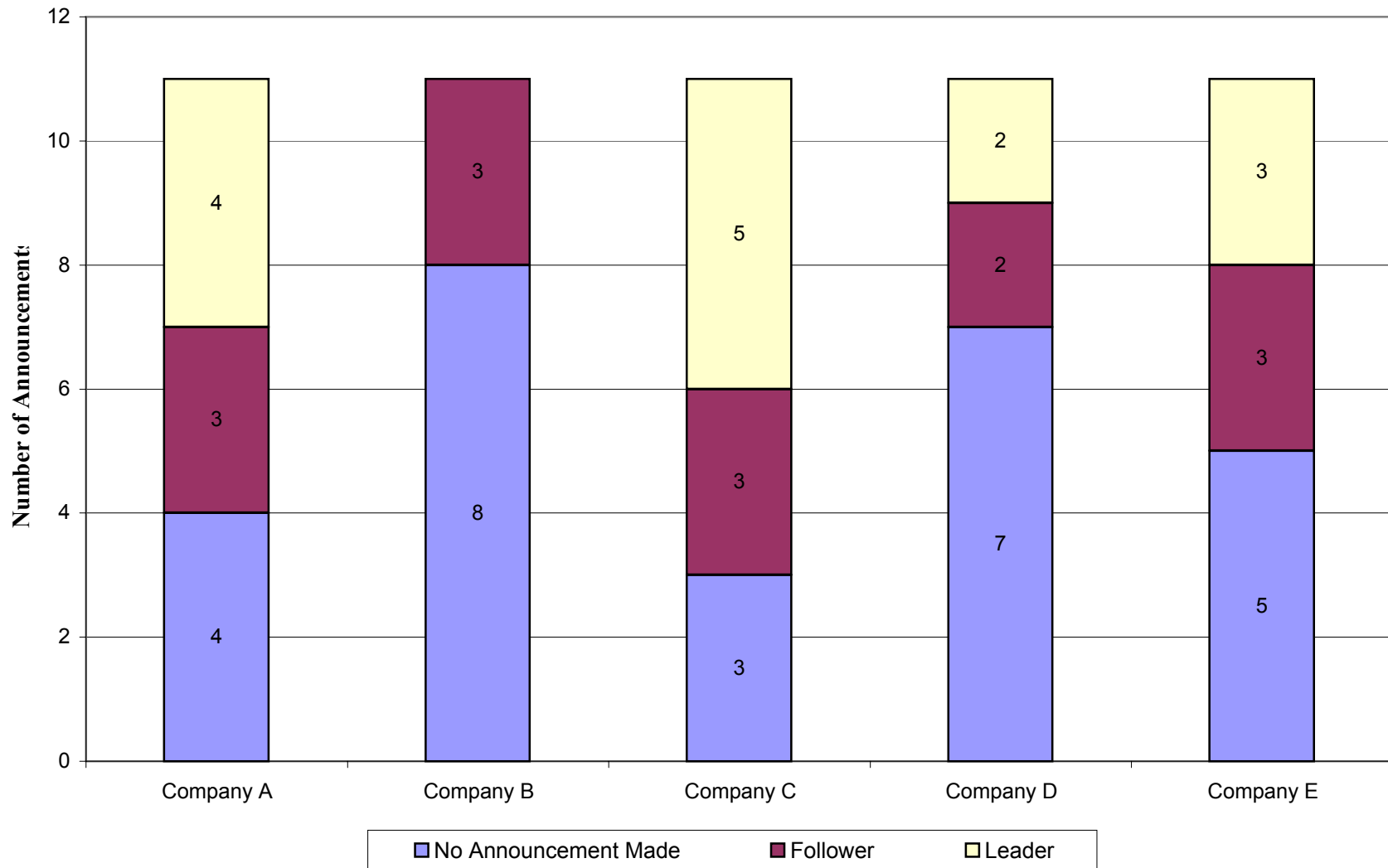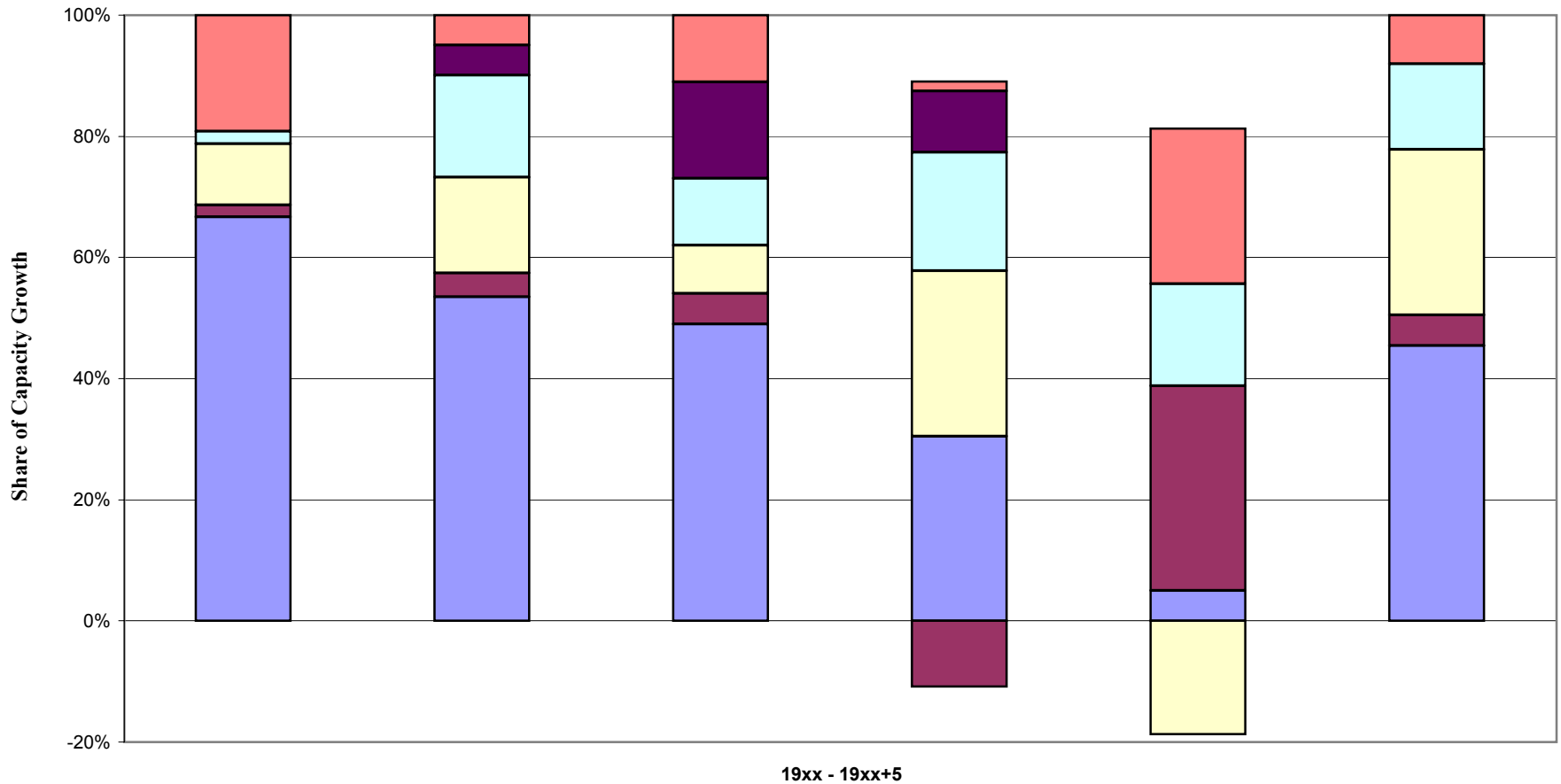## Is There a "Leader"?
List Price Change Announcements by Company

Figure 8
Analysis of Capacity Changes
Each Competitors' Capacity Change as a Percentage
of Total Industry Capacity Change by Year

Share of Capacity Growth

19xx - 19xx+5

Each segment of a bar represents that company's percentage the total capacity growth between the first and last year listed

Figure 9
Analysis of Capacity Changes
Cumulative Capacity Share Point Change by Competitor
19xx - 19yy
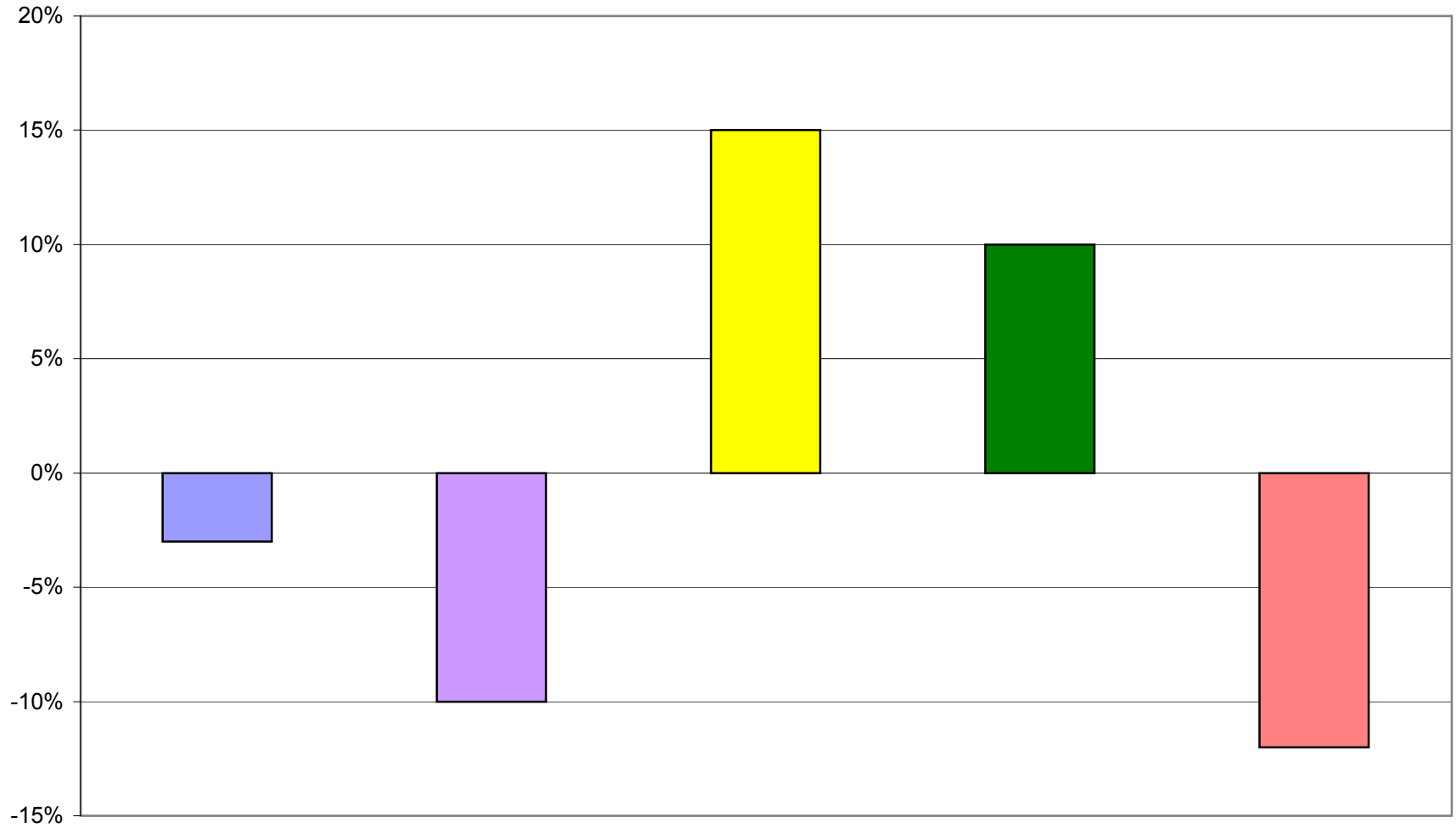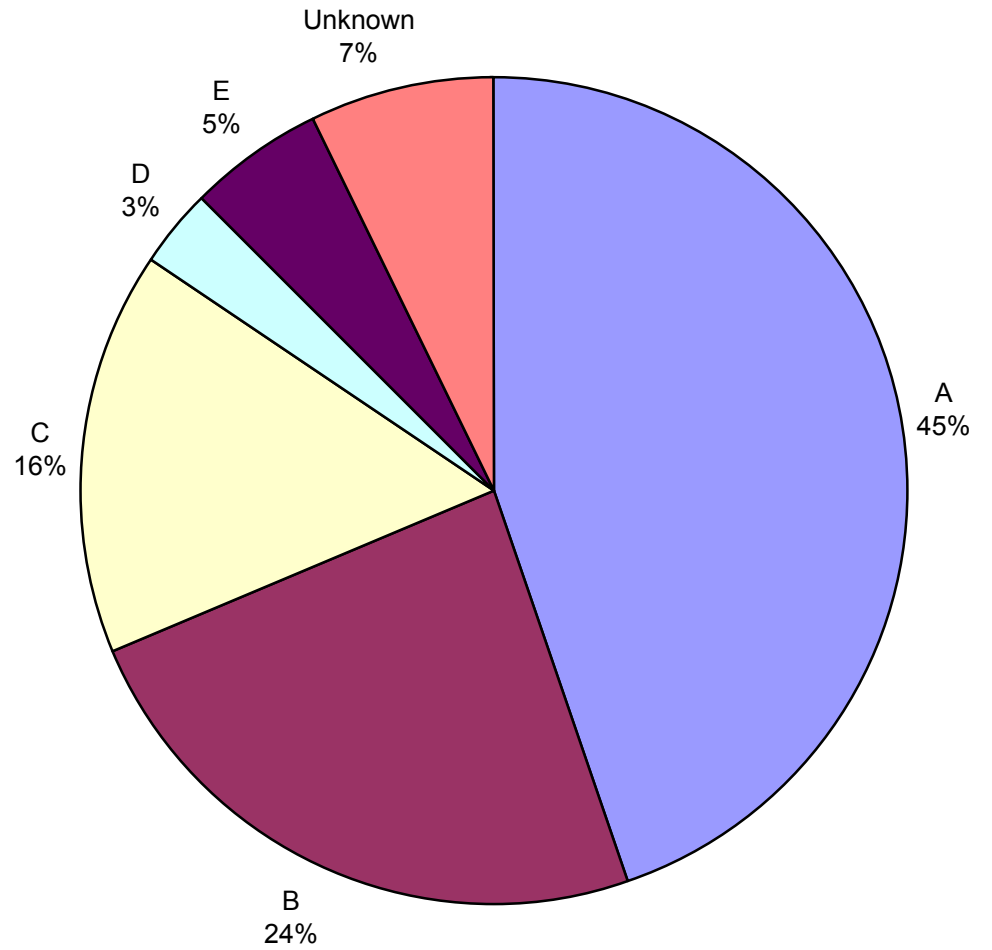
Figure 10
"Competitive Churn"
Gains and Losses in Volume

Company X's Estimate of Gains and Losses
as a Percentage of Its Total Sales

<u>19xx</u>   <u>19yy</u>

21%   19%

Unknown
7%

E
5%

D
3%

C
16%

A
45%

B
24%

Gains + Losses by Competitor

Figure 11
Distribution of Passengers Paying Rounded Percentage of "Early" Price for Four Consecutive Sailings of Ship A, for a 7 Day Cruise, Category 1 Cabins
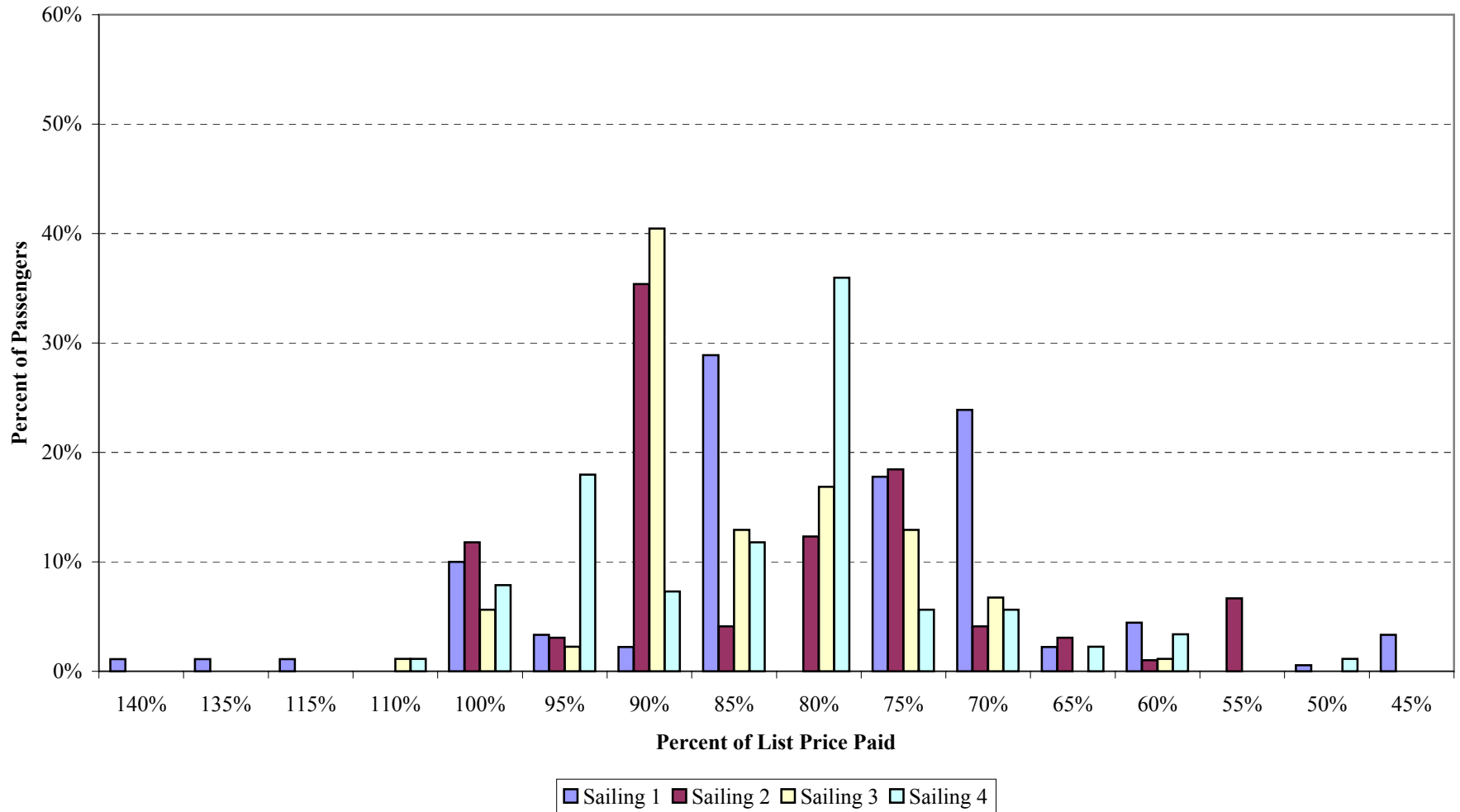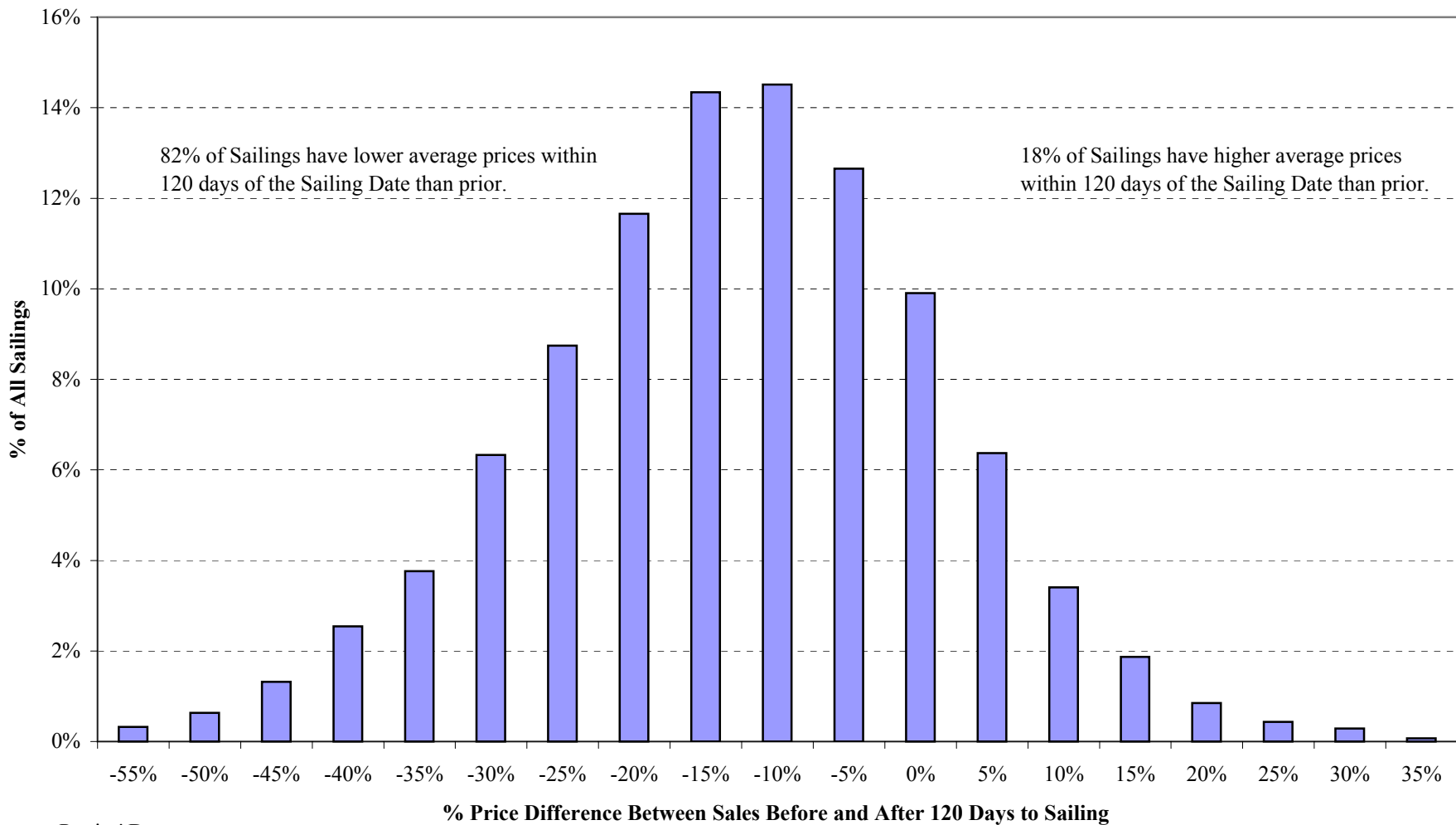
Figure 12
Relative Pricing Before and After 120 Days to Sailing
All Cruises - All Cabins

82% of Sailings have lower average prices within 120 days of the Sailing Date than prior.

18% of Sailings have higher average prices within 120 days of the Sailing Date than prior.

% of All Sailings

% Price Difference Between Sales Before and After 120 Days to Sailing

Source: Parties' Data

Figure 13
Average Gross Per Diem and by Months Prior to Sailing
Four *Competing* Ships Departing the Same Port the Same Day on Similar Itineraries
(Category X Cabin)