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Market Structure and Market Performance

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Abstract I review studies of the determinants of market performance in the aircraft, passenger airline, supermarket, liner shipping, and hospital industries, and of mergers and market performance in markets for fast food, soft drinks, and retail gasoline. Common factors are that more competitive market structures accompany better market performance, and that firm conduct and industry-specific factors play independent roles.

Keywords Market structure · Competition · Performance

JEL Classification L11 · L13 · L41

1 Introduction

It is by now mother's milk to the industrial economist that market structure is as much an endogenous variable as market performance. If market structure is endogenous, how does one justify studying the impact of market structure on performance? Ought one not, rather, to be interested in the relation between the underlying factors that determine market structure and the aspects of market performance most often of interest to industrial economists—market power, X-inefficiency, productivity growth, and the like?

Several arguments may be put forward: The first, the old learning, is that market structure is endogenous but adapts slowly to long-run equilibrium levels. Over short- and medium-run time horizons, the structure of a market is predetermined with respect

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to firm conduct; market structure and industry-specific factors determine the range of feasible actions open to firms. The competitive interactions of firms as they choose from among these feasible actions in turn determine market performance.

The second argument, the new learning (Pakes and McGuire 1994; Ericson and Pakes 1995),[1] is that entry flows and exit flows are not the automatic equilibration mechanism they were once assumed to be. Entry is a response to perceived profit opportunities; exit is a response to realized losses. But entrants are imperfectly able to assess their post-entry profitability, which can usefully be modeled as having a large random component. The life of most entrants in most imperfectly competitive industries is spent on the fringes of the market, without substantially affecting the operations of an oligopolistic core of incumbents,[2] followed by exit when gross profit is insufficient to finance the investment required to maintain sunk assets.[3] There are persistent profitability differences at the plant level (Roberts and Supina 2000). Core market structure changes at irregular intervals, when a fringe firm is lucky or skillful enough to make the transition to the core. During those intervals, core market structure can legitimately be taken as given. Core market structure determines the range of feasible actions that are open to firms, and the argument continues as above.

Two other arguments refer to specific types of markets, in which market structure is endogenous but the nature of equilibrium market structure confounds conventional wisdom: (a) In markets with network externalities, equilibrium market structure may be asymmetric, with a dominant firm and fringe firms serving niche markets (Economides and Flyer 1998); and (b) In an endogenous sunk cost industry, the equilibrium number of firms is invariant to changes in market size; it is equilibrium product quality that rises with market size, not the equilibrium number of firms (Sutton 1991).

The mainstream industrial economics view is that more competitive market structure and more competitive firm conduct leads to better market performance. I examine this mainstream view in light of recent studies of market structure-static[4] market performance relationships in specific industries and of the impact of mergers on market performance.

In Sect. 2, I examine some conceptual issues related to the measurement of market structure and of market performance, and the factors that sit between the two and that determine firm conduct. In Sect. 3, I review the literatures on the determinants of market performance in specific industries In Sect. 4, I discuss some findings from

[1] See also David (1985); Agarwal and Gort (1996), and Geroski (1995).

[2] "Stylized fact 4. The survival rate of most entrants is low, and even successful entrants may take more than a decade to achieve a size comparable to the average incumbent" (Geroski 1995, p. 424).

[3] Also, exit by merger need not be an indicator of failure; instead, the acquired firm's assets may be deployed more efficiently when combined with the acquiring firm than on a stand-alone basis; the acquisition may enhance market power; or the acquired firm's owner(s) may simply want to retire and/or move on to other pursuits.

[4] Some aspects of market structure-innovation relationships are touched upon in the discussions of specific industries, but for the most part on this topic I refer the reader to the recent surveys of Schulz (2007) and Vives (2008). Syverson (2011) surveys the literature on productivity. Among dynamic aspects of market performance, one might count the impact of market power on the distribution of wealth; the evidence is against any such enduring impact (Siegfried et al. 1995; Hazledine and Siegfried 1997).

studies of mergers, with emphasis on the changes in market performance that follow changes in market structure.[5] Section 5 concludes.

2 Measurement

Much confusion attends economists' use of the term "competition",[6] which more often than not fails to distinguish between competitive market structure, competitive firm conduct, and competitive market performance. To paraphrase Lerner (1935, p. 162), the importance of competitive market structure lies in the belief that it implies competitive firm conduct; the importance of competitive firm conduct lies in the belief that it leads to competitive market performance; the importance of competitive market performance lies in the implication that it is an outcome that in some way or another is better than other outcomes.

"Market structure" refers primarily to the number and size distribution of firms.[7] Cross-industry comparisons commonly use a summary index like the Herfindahl index or an n-firm concentration ratio to measure market structure. Single-industry studies will typically identify at least firms making up the oligopolistic core, perhaps fringe firms as well, and compare their size in terms of assets, employment, sales, or other dimensions of particular relevance to the topic of interest.[8]

Lerner put forward the price-marginal cost margin as a measure of static market performance in constant marginal cost industries, because (1935, p. 169) "In such cases …the ratio of monopoly revenue to total receipts coincides exactly with the ratio of the divergence of price from marginal cost to price…".[9] He was skeptical about the

[5] There are discussions of some mergers in Sect. 3.

[6] McNulty (1967) cites Knight (1935, p. 49) remark that "The critical reader of general economic literature must be struck by the *absence of any attempt accurately to define* that competition which is the principle subject under discussion" (emphasis added by McNulty). In this regard, not much has changed since 1935 or 1967; see also Sjostrom (2009). For a discussion of the different meanings given to "competition" by noneconomists and economists, see Hayek (1948).

[7] As is discussed below, other structural conditions include conditions of entry, the structure of supplying and buying industries, the percentage of sales going to final consumer demand, the nature of the product, etc.

[8] Thus studies of productivity or innovation may measure firm sizes by patent stocks.

[9] That is, $(P - C)/P = (PQ - CQ)/(PQ)$ (where, following Lerner), "P = price and C = marginal cost". Economic profit is the numerator of the second fraction minus fixed cost. Profit per unit of assets has been used as a performance measure in empirical work; it is obtained from the Lerner index by simple multiplication. A similar transformation, in a model that includes product-market and financial-market decisions, yields the rate of return on stockholders' equity (Martin 1988). The Lerner index is a manipulation of the first-order condition for profit maximization; any index of market performance derived from a model of optimizing behavior very likely must reduce to the Lerner index for special cases (as does the Rosse–Panzar statistic; Rosse and Panzar 1977; Shaffer 1983). Other variables that have been used to analyze firm or industry performance are the internal rate of return (Fisher and McGowan (1983); Fisher (1987), and Martin (1984)), Tobin's q ratio (which can be shown to be related to the internal rate of return for special cases), and measures based on the Solow residual (Hall 1988; Klette 1999). In addition, following the criticisms of the use of accounting profit rates to measure the potential presence of market power, economists have increasingly turned to price data to measure the potential presence of market power. One might also consider direct measurement of deadweight welfare loss or consumer surplus to assess market performance

existence of any one-to-one relationship between market structure and performance, contrasting the case of single supply by a firm facing a horizontal demand curve[10] and "'partial' monopoly of a commodity for which the demand is inelastic…". This is no more than the point that firm conduct intermediates between market structure and market performance.

Lerner goes on to discuss product differentiation as a market characteristic that permits the exercise of monopoly power. One often encounters statements to the effect that markets in which products are better substitutes (Hausman et al. 1992, 1994), in which firms set prices rather than quantities, markets with lower sunk entry costs, markets in which the elasticity of firm profit with respect to marginal cost are greater (Boone 2008) are "more competitive". It is worth keeping in mind that while equilibrium firm conduct responds to differences in such market attributes, they are not themselves direct measures of firm conduct, and they are not measures of market performance at all.

For Knight (1946, p. 102), a market is competitive if "[actual and potential buyers and sellers] are numerous and act independently".[11] This is competition in the sense of conduct. It is tempting to identify "independent firm decision-making" with the game-theoretic concept of noncooperative behavior. Such an identification has its limitations: Once one enters the realm of repeated games, the Folk Theorem teaches that noncooperative conduct may lead to collusive outcomes.[12]

3 Single Industry Studies

In 1971, in concluding a comprehensive review of cross-section studies of structure-performance relationships, Weiss (1971, p. 398) wrote that "Perhaps the right next step is back to the industry study, but this time with regression in hand". Empirical research in industrial economics took that step; as Einav and Nevo (2006, p. 86) observe, "In the last 25 years, IO studies have increasingly focused on single industries, using a combination of economic theory and statistics to analyze strategic interaction between firms". Space constraints dictate a selective review of studies of industry structure-performance relationships. Here I consider recent studies of five industries—aircraft, airlines, supermarkets, liner shipping, and health care.

Footnote 9 continued
(Harberger 1954; Cowling and Mueller 1978, and more recently Hausman 1997; Hausman and Newey 1998; Petrin 2002; Dubé 2005).

[10] Lerner (1935, p. 166) "which will always be the case if there is some equally satisfactory substitute available at a constant price;" thus the importance attached to the cost of entry. For Andrews (1951, p. 141), this is very much Alfred Marshall's conception of a competitive industry, that it "would be possible for other businesses to produce a commodity with the same technical specifications as the product of any particular firm, and offer it for sale to that firm's customers".

[11] This is cited by McNulty (1968, p. 655).

[12] One may argue that antitrust and competition policy conceive of "competition" in terms of independent firms making independent decisions. This may reflect a judgment that, notwithstanding the Folk Theorem, collusive outcomes are not likely to be reached with some cooperation between implicated firms. It may reflect acceptance of Hayek's (1960, p. 102) dictum that "the law cannot effectively prohibit states of affairs, but only kinds of action", so that if firms' actions are genuinely independent, policymakers must accept the resulting market performance.

3.1 Aircraft

Benkard (2004) estimates a dynamic structural model of the commercial aircraft industry, incorporating learning-by-doing in the supply side of the model. He finds (2004, p. 598) that new aircraft price-cost margins are lower "(1) when there are more competitors in the market, (2) when incumbent products are higher quality, and (3) when incumbent firms are further down their learning curves". The first effect is evidence that more competitive market structure leads to better market performance. Benkard notes that the third effect is the strongest of the three.

He compares simulations of observed market structure that treat each aircraft as being produced by a single-product firm with multiproduct monopoly and with a net social welfare-maximizing social planner. Market equilibrium welfare is about 90% of the socially-optimal level. In view of the allowance for learning-by-doing in the model, it is (as Benkard remarks) interesting that the difference between market and optimal welfare stems from the familiar exercise of market power (pp. 605–606) "The [social planner] sets price approximately equal to marginal cost and produces about 40% more total output per period on average than the competitive firms. The competitive firms in turn produce about 2.5 times as much total output as the monopolist. The competitive firms achieve this higher output primarily through a greater number of products…".[13]

In an exercise with direct relevance for the market structure-performance relationship, Benkard examines the implications for market performance of an antitrust policy that limits the market share of the leading firm. If the policy binds, the static impact is to shift output from the leading (high quality, low cost) firm to rivals; the corresponding impact is that rivals move farther down their learning curves, and the leader less, than would otherwise be the case. Simulations suggest that the net welfare impact of a market share-restricting policy is negative.

3.2 Airlines

In the 1980s, empirical studies of the passenger airline industry established that it is not a remotely a contestable market.[14] Recent work has examined the impact of actual and potential competition on market performance, the impact of competition on market structure, and the welfare consequences of alliances between airlines with overlapping networks.

3.2.1 Fares

Some research establishes the impact of "maverick" firms on market performance, and in so doing raises questions about the adequacy of commonly employed solution concepts to capture the complex reality of conduct in oligopoly markets.

Morrison (2001) attributes fare reductions amounting to 20% of 1998 U.S. airline revenue to Southwest Airlines—$ 3.4 billion due directly to Southwest's low fares,

[13] Irwin and Pavcnik (2004) also find indications of brand proliferation in a study of Airbus and Boeing.

[14] Bailey et al. (1985); Call and Keeler (1985); see also Evans and Kessides (1994).

and $ 9.5 billion due to fare reductions of airlines flying the same routes as Southwest, to fare reductions of airlines flying substitute ("adjacent") routes, and to fare reductions of airlines proactively reducing fares to make entry less attractive. Goolsbee and Syverson (2008) similarly find evidence of fare reductions induced by potential competition from Southwest, in addition to fare reductions following actual entry.

Goolsbee and Syverson (2008, p. 1618) observe that these results are inconsistent with "the conventional, static-model view of threatened entry … that incumbents should not respond until they actually face competition. This notion … is based on the seemingly simple proposition that incumbents should not cut prices before they have to. Doing so entails losing profits in the short run and has no impact on future profits".

The results of Peters (2006) point in the same direction: He carries out a conventional merger simulation exercise[15] for five airline industry mergers that took place in the last half of the 1980s, compares the results with postmerger fares, and finds them wanting:

> [I]t appears that postmerger entry and exit and the demand-side effects of changes in flight frequency and airport presence played a relatively minor role in determining the impact of these mergers on prices. …the results suggest that in order to assess the likely effects of airline mergers on consumer welfare, an important focus should be on understanding the role of costs and firm conduct. While merger simulation can be useful in understanding the effect of a merger on unilateral pricing incentives, such methods are likely to yield unsatisfactory predictions of a merger's overall effect, at least in the context of the airline industry, unless richer models of firm conduct are incorporated into the methodology (Peters 2006, pp. 646–647).

Berry and Jia (2010) paint a picture of a U.S. passenger airline industry that became more price competitive between 1999 and 2006, as airlines "reduced differentiation among flights …cut down services and competed more intensively on prices" (Berry and Jia 2010, p. 24 They find the greatest impact of competition from low-cost carriers (LCCs) on direct flights:

> Around 40 percent of the markets experienced LCC entry during the sample period. Compared with changes in demand, competition from LCCs has a modest impact on connecting flights' profit. Removing LCCs explains 15 percent of a legacy carrier's profit drop in markets affected by entry, or 8 percent when averaged over all markets. There are a couple of explanations for this modest impact. First, many new products introduced by the low-cost carriers are direct flights. … LCC entry accounts for a much larger fraction of the direct flights' profit reduction. Second, the legacy carriers have gradually developed strategies (for example, lowering fares, adding departures) to compete with low-cost carriers (Berry and Jia 2010, p. 36).

[15] Peters (2006, p. 634) "The standard approach in the literature on merger simulation is to assume static Nash-Bertrand conduct: firms choose prices noncooperatively to maximize a short-run profit function. The widespread use of this assumption is partly due to its mathematical tractability and partly due to the belief that dynamic behaviors, such as tacit collusion, are more difficult to sustain when products are differentiated".

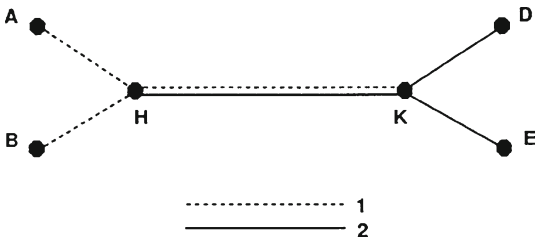

Fig. 1 Airline network structure. *Source*: Brueckner and Whalen (2000); Brueckner (2001)

The overwhelming impression given by Berry and Jia's work is of an industry in transition from one equilibrium market structure to another, with firms that cannot or will not adapt assets to a new demand structure losing money in an accounting sense, although economically (since the shadow price of sunk assets that are in excess supply is zero) they are optimally exploiting what are wasting assets. During this transition, the strategies that have been developed by legacy carriers can be counted a consequence of the change in market structure resulting from LCC entry.

3.2.2 Alliances[16]

Much research examines the impact of international alliances on airfares. This literature sees airline alliances as permitting some of the advantages that flow from mergers in the face of national regulations that restrict airline mergers that would result in national loss of control:

> [B]y coordinating flight schedules and ensuring gate proximity at connecting airports, the alliance partners can offer greater convenience to the passenger. *Alliance travel thus resembles on-line (single-airline) service, avoiding many of the inconveniences of a traditional interline trip.* This effect, which attracts passengers away from nonallied carriers, is reinforced by the unification of the partners' frequent-flier programs. In addition, the on-line nature of alliance travel is often formalized in a codesharing agreement, where the component flights are ticketed as if they occurred entirely on one partner airline (Brueckner and Whalen 2000, p. 504, emphasis added).

Despite these benefits, the implications of alliances for market performance are theoretically ambiguous, even viewed through the lens of static noncooperative pricing. The issues are depicted in Fig. 1, which shows[17] the overlapping routes of Airline 1, serving its domestic points A and B, as well as what is for it an overseas airport K, from its hub at H, and of Airline 2, with routes to its domestic points D and E, as well as H, from its hub K.

The ambiguous implications of an alliance for market performance arise from the facts that Airlines 1 and 2 compete on the gateway-to-gateway H-K market,[18] while

[16] For a survey, see Bilotkach and Hüschelrath (2011a,b).

[17] Following the discussion of Brueckner (2001, Section 2.1).

[18] For simplicity, I write to "the H-K route" to include travel in both directions between those endpoints.

service from one country to a behind-the-gateway destination in the other country (for example, D-K-H-A) involves complementary products provided by the two airlines (D-K-H provided by Airline 2, H-A provided by Airline 1). Noncooperative pricing to maximize the objective function of a one-shot game implies double marginalization in setting fares for complementary legs of international travel. A codesharing alliance with antitrust immunity (permitting allied firms to jointly set fares without exposing themselves to private or public antitrust complaints) allows allied airlines to internalize the negative externality (i.e., the double marginalization) that arises with independent pricing.

As one expects in price-setting oligopoly with product differentiation, the model predicts lower fares for behind-the-gateway traffic. This beneficial price effect may translate into cost advantages:

> Another key feature of the model is the operation of hub-and-spoke networks by the carriers, with the goal of exploiting economies of traffic density. …high traffic densities allow carriers to operate larger, more efficient aircraft and to disperse fixed costs over more passengers. In the presence of economies of density, international traffic gains from cooperative pricing of interline trips lead to a lower marginal cost of carrying an additional passenger within the networks of the alliance partners. This cost reduction allows the partners to charge lower fares for purely domestic travel (Brueckner and Whalen 2000, p. 506).

But an alliance with complete antitrust immunity allows Airlines 1 and 2 to jointly set fares—to collude—on the gateway-to-gateway H-K route. The net impact of an alliance is a tradeoff between improved market performance on behind-the-gateway routes and worsened market performance on the gateway-to-gateway market. At the level of theory, the net effect is ambiguous. Numerical evaluations of Brueckner (2001) find a net positive effect of alliances on market performance, unless demand is very low.

Figure 1 illustrates a network market that is served by two airlines. In practice, international markets are served by multiple airlines and potentially by multiple alliances. This raises the possibility, first, of an impact of alliances on the stability of tacit collusion, and second, that the formation of alliances, even with noncooperative fare-setting, leads to a worsening of market performance.

The nature of the impact of airline alliances on the stability of tacit collusion is not obvious. Much research in industrial economics suggests that a reduction in the number of independent decision-makers will facilitate tacit collusion. Along these lines, the U.S. General Accounting Office (1995, p. 5) reports that alliances may translate into higher fares if "strategic alliances lead to a marketplace dominated by a handful of 'mega-carriers' that are not effectively competing…". But it is possible that the "traditional" (that is, pre-alliance) approach to fare determination itself facilitated tacit collusion:

> This method, which was used exclusively prior to the emergence of alliances and codesharing, relies on fares generated by the International Air Transport Association (IATA). IATA convened periodic fare conferences, where carriers met to set fares for a multitude of international city-pair markets. The fare charged

> for a given interline trip would then be set automatically at the IATA level, and total revenue would be split between the collaborating carriers according to a distance-based prorate formula. Because the adoption of an IATA fare for a particular market required unanimous agreement among the airlines participating in the conference, IATA fares tended into be set high enough to cover the costs of the least efficient carriers… (Brueckner 2003, p. 107; see also his footnote 3).

The rise of international alliances may have destabilized a tacit collusion status quo.

Brueckner and Whalen (2000) examine the impact of international alliances on airfares by using U.S. Department of Transportation data for the third quarter of 1997. They find that alliance fares are nearly 25% lower than interline fares, controlling for other factors (Brueckner and Whalen 2000, p. 526). There is some indication that an alliance increases gateway-to-gateway fares (HK in Fig. 1), but this effect is not statistically significant.[19]

Among the other factors that are controlled for are the number of competitors serving a city-pair market. Results are that an additional competitor lowers fares between 1 and 2.6%, consistent with the traditional industrial economics viewpoint that more competitive market structure improves market performance.[20]

Bilotkach and Hüschelrath (2010) examine the impact of antitrust immunity granted to airline alliances on traffic patterns between U.S. and EU airports for the years 1992–2008. They find "increased specialization of individual alliance members on channeling the passenger traffic via the alliance partners' hubs, and reduction in traffic to the competing alliance's hub airports" (Bilotkach and Hüschelrath 2010, pp. 10–11). This raises the possibility of foreclosure (p. 2) "alliance members …reluctant to accept interline passengers from the outside airlines", and Bilotkach and Hüschelrath emphasize this possibility particularly for hub markets of alliances with antitrust immunity.

3.2.3 Firm Structure and Market Structure

Hendricks et al. (1997) model the consequences of hub-and-spoke networks for the profitability of regional airlines. They develop conditions under which a hub-and-spoke operator will remain in a spoke market, despite locally measured losses there, because exit would cause a loss of profit in its network as a whole. Carriers whose

[19] Whalen (2007) obtains broadly similar results by using panel data from 1990 through 2000. Gayle (2007) finds scant evidence of adverse alliance effects on fares for a U.S. alliance. Brueckner and Proost (2010) address the policy implications of the tradeoff between possible welfare losses due to an alliance on gateway-to-gateway markets and gains in markets where alliance members did not compete. Bilotkach (2011) finds that frequency of service, a nonprice aspect of market performance, declines after a merger that increases multimarket contact.

[20] They construct several measures of the number of competitors, but all yield similar results (Brueckener and Whalen, p. 529). For a sample of fares for gateway-to-gateway markets, they construct as well a Herfindahl index of concentration at the U.S. origin airport, and find that fares rise with the Herfindahl index. They interpret the number-of-competitors variables as controlling for the level of competition, and give the positive coefficient of the H-index a demand-side interpretation (p. 538): "since passengers value the extensive network of the dominant hub carrier, they are willing to pay higher fares for its service". An equally plausible reading of the results is that the H-index and the explanatory variables that are constructed from counts of the number of competitors are all measures of market structure and that the appropriate test of statistical significance is of the null hypothesis that the coefficients of all such variables are jointly zero.

operations are entirely in the spoke market may then sustain continuing losses and exit. Ciliberto and Tamer (2009), who find that the impact of one airline's presence at an airport on the probability of entry by other airlines depends on the number of markets served from the airport, offer some empirical support for the Hendricks et al. result. Aguirregabiria and Ho (2012) find that hub-and-spoke operation is explained by reductions in entry costs, with entry deterrence also a consideration for larger airlines.

3.3 Supermarkets (etc.)

The recent empirical literature on the supermarket and related retail sectors has been a lively one, focusing on the determinants of retail market structure and the relationship between retail market structure and market performance.

Smith (2004) estimates equilibrium prices and price-cost margins for the U.K. supermarket industry for January 1995. He uses the estimates to examine the consequences of mergers and breakups on market performance. He assumes that changes in firm structure carry no implications for cost functions. Price changes under different scenarios are therefore entirely due to changes in the extent to which a store internalizes the impact of its own price decisions on the profits of other stores.[21] Breakups (Smith 2004, p. 260) "[bring] price reductions of 2–3.8% for the largest firms and similar increases in consumer welfare as a percentage of industry revenue". Mergers would mean regional price increases as much as 7.4%. "Competition" here is conceived of in a structural sense (price-setting Nash behavior is assumed throughout), and the result suggests that an increase in the number of actual competitors improves market performance.

Bonanno and Lopez (2009) estimate the impact of service competition between 15 supermarket chains on the price of milk in 6 U.S. metropolitan areas for a period of almost four and one-half years beginning March 1996. They derive measures of two types of service, food and non-food, using principal component analysis. Higher levels of food service mean some economies of scope, attract less price-sensitive consumers, and allow price increases: an increase in market power. Service best-response functions are positively sloped (Bonanno and Lopez 2009, p. 563), which speaks to one type of nonprice competition.

Davis (2010) studies the impact of supermarket chain mergers on beverage and dairy product prices at U.S. supermarkets in the 1990s. He finds that larger national market shares translate into lower prices, which he attributes to lower costs (from either economies of firm scale or increased bargaining power vis-à-vis suppliers) that are passed on to consumers in the form of lower prices. Mergers are estimated to result in higher prices. Since antitrust scrutiny means mergers of chains has little impact on local market structure (Davis 2010, pp. 1–2), he attributes higher post-merger prices to changes in conduct (p. 15). Also evidence of changed conduct is the finding that temporary price reductions (sales) are less frequent and smaller in magnitude after mergers.

[21] Contrast this assumption, which may be entirely appropriate for the U.S. supermarket industry, with Peters' (2006, pp. 646–647) remarks about U.S. airline industry mergers, quoted above.

Ellickson (2006, 2007) views supermarket market structure through the lens of Sutton (1991) endogenous sunk cost framework. Consistent with Sutton's model, which he extends to include fringe firms, Ellickson finds that (2006, p. 524)[22]:

> supermarkets compete in a natural oligopoly, sustained by competitive investment in quality enhancing distribution systems. It is these fixed costs, rather than the number of firms, that increase with the scale of the market. Instead of having more firms, larger markets have stores with greater variety.

Jia (2008) examines a sector that is closely related to food retailing, discount retailing. Her topic is competition between Kmart and Wal-Mart in the 1990s. Many of the (county) markets studied will support at most one discount retailer (Jia 2008, p. 1302): "in 1988, Wal-Mart would only enter 400 markets if there were a Kmart store in every county. When Kmart ceases to exist as a competitor, the number of markets with Wal-Mart stores rises to 778.… In 1988, Kmart would enter 27.8% more markets when there were no Wal-Mart stores compared with the case of one Wal-Mart store in every county (474 Kmart stores vs. 371 Kmart stores)…". She also finds evidence of economies of chain operation, and that discount stores' entry decisions (Jia 2008, p. 1303) "have a substantial competition impact on small firms. In 1988, compared with the scenario with no chain stores, adding a Kmart store to each market reduces the number of small firms by 23.8% or 1.07 stores per county. Of the remaining stores, more than one-third could not recover their sunk cost of entry. …The story is similar for the entry of Wal-Mart stores".

Holmes (2011, p. 286) estimates that Wal-Mart's pattern of store locations around its network of distribution centers generates substantial economies of density. These are due to savings in trucking costs and the value generated by the ability to respond quickly to demand shocks. It is profitable to set up a dense network of retail outlets despite the resulting sales cannibalization across stores.

Hausman and Leibtag (2007) focus on the welfare consequences of Wal-Mart-like retail grocery operations. Using scanner data to compare prices for 20 food categories over the period 1998–2001, they find prices at supercenters, mass merchandisers, and club stores to be 27% lower, on average, than are prices at traditional supermarkets. There is a further indirect effect as the presence of such discount grocery operations induces traditional supermarkets to reduce their own prices. Hausman and Leibtag estimate compensating variation due to supercenter operation at 25% of consumer food spending.

3.4 Liner Shipping

Until relatively recently, liner shipping (ocean transport on regular routes according to fixed schedules) was exempt from the antitrust and competition policy prohibition of

[22] With quality-enhancing distribution systems (Ellickson 2007, p. 43) "advanced logistical software, optical scanners, and specialized sorting equipment allow products to flow from warehouse to store in a nearly continuous process. Store-level orders are filled automatically through paperless supply chains. The emphasis on variety and the requisite fixed investments yield tightly contested markets among a handful of rival chains". See also Bonanno and Lopez (2009, p. 557).

collusion.[23] The consequence was the operation of liner shipping conferences, legal cartels, on shipping routes around the world.[24]

Several studies examine the determinants of liner shipping market performance during the period when conferences enjoyed antitrust immunity. Clyde and Reitzes (1995) find that liner shipping conferences fell short of joint profit maximization, but also that "an increase in market concentration is associated with increased rate levels and increased rate dispersion on the basis of commodity value; this is consistent with the hypothesis that greater market concentration leads to greater market power" (Clyde and Reitzes 1995, p. 38). The magnitude of the rate increase that follows an increase in concentration, however, is relatively small. Emphasizing the importance of conference enforcement of collusive conduct, Clyde and Reitzes (1998, p. 302) find that "freight rates are significantly lower when individual conference carriers are allowed to enter into service contracts with individual shippers. These price reductions are large enough to suggest that there is market power in ocean shipping, and that it is reduced when conference carriers are allowed further pricing freedom in dealing with individual customers".

Deltas et al. (1999) study 47 shipping conferences that involved U.S. ports in the pre-World War I period.[25] They distinguish two types of conferences: those that limited their activity to rate fixing, and more comprehensive agreements (those that pooled revenue and involved themselves in routing decisions). More comprehensive agreements were more likely if there were few conference members and they had a high degree of multimarket contact.[26]

A sea change in U.S. policy came with the 1998 Ocean Shipping Reform Act (OSRA), which mandated that conference members have the right to conclude individual service contracts with shippers and eliminated cartel enforcement activities of the U.S. Federal Maritime Commission. Between 1997 and 2000, the number of conferences fell from 32 to 22 (Reitzes and Sheran 2002, p. 56). This is consistent with the hypothesis that the historical policy regime, cordial to cartels, was a necessary condition for cartel stability. The simultaneous post-OSRA increase in scale, decline

[23] For policy background, see Fox and White (1997); Townley (2004), and Sagers (2006). Liner shipping has attracted economists' attention for more than a hundred years (Smith 1906; and MacGregor 1909).

[24] Liner conferences often used deferred loyalty rebates to raise the cost of entry (McGee (1960, p. 243),Yong (1996); Marin and Sicotte (2003))", which is a practice discussed in the "empty core" literature. Telser (1978, p. 59) writes "We shall define a competitive equilibrium as synonymous with a nonempty core", and the literature that follows Telser's approach reasons that if the core is empty, there is no competitive equilibrium, in view of which restrictions such as loyalty rebates may have an efficiency justification (Pirrong 1992; Telser 1994). If a competitive equilibrium is defined as a point in the core, then it is correct but tautological that there is no competitive equilibrium if the core is empty. Telser acknowledges (1978, p. 257) that his definition of a competitive equilibrium is not "the one familiar in economic theory". One would not expect a competitive equilibrium in markets that are, structurally, imperfectly competitive, and nothing in the empty core literature rules out noncooperative equilibria, of the kind that is targeted by antitrust and competition policy, in industries like liner shipping.

[25] On British shipping conferences for an overlapping time period, see Scott Morton (1997) and Podolny and Scott Morton (1999).

[26] The role of multimarket contact is consistent with Podolny and Scott Morton (1999), who find that a predatory conference response to entry served to generate information about the entrants' characteristics. Firms meeting in many markets would be more likely to have such information.

in the number of conferences, and increase in mergers and alliances is consistent with the view that an antitrust policy that insists on noncooperative conduct and is hostile to strategic barriers to entry acts to promote efficient market and firm structure, and in this sense gives pride of place to competition in the sense of market performance, not competition in the sense of market structure. It is also an example of the endogeneity of market structure.

3.5 Hospitals

3.5.1 Profit/Not-for-profit

Gaynor and Vogt (2003) estimate a structural model using 1995 data for California hospitals. They assume that not-for-profit hospitals maximize an objective function that is increasing in output, subject to a minimum profit constraint. First-order conditions for for-profit and not-for-profit hospitals then have comparable forms, with what is equivalent to different marginal cost functions for not-for-profit hospitals.

Gaynor and Vogt use their estimates to simulate mergers using data for 7 hospitals operating in or near San Luis Obispo County, California. Four of the hospitals were owned by either Tenet Healthcare Corporation or Ornda Healthcorp, which merged in 1997. As a condition of allowing the merger to go forward, the U.S. Federal Trade Commission required the divestiture of one of the Ornda hospitals: French Hospital. Gaynor and Vogt (2003, p. 781) "analyze the Tenet/Ornda merger under three different scenarios. First, [they] simulate the merger assuming no divestiture of French Hospital. Second, [they] simulate the merger assuming divestiture of French Hospital. Third, [they] simulate the merger without divestiture under the counterfactual assumption that Tenet and Ornda were not-for-profit". Had the merger gone forward without a divestiture, estimates imply price increases of 52, 33, and 32 % at the three hospitals in the country owned by the postmerger entity. With the divestiture, estimates imply negligible price increases on the order of 2%. The implied price increases are essentially the same whether the merging firms are treated as for-profit or not-for-profit entities.[27]

3.5.2 Market Concentration

Kessler and McClellan (2000) estimate the impact of differences in hospital market structure on price and quality of treatment outcomes for U.S. nonrural elderly Medicare patients hospitalized for heart disease over the 10-year period 1985-1994. They compare an innovative Herfindahl index of supply-side concentration based on the estimated probability that a patient seeks treatment at a particular hospital (H^{pat}) with a Herfindahl measure calculated using a hospital's share of patents in a region

[27] See Lynk (1995) for a reduced-form approach to the comparison of for-profit and not-for profit hospitals. His results differ qualitatively from those of Gaynor and Vogt (1995, pp. 454–455): "The simulated merger of two non-profit hospitals results in postmerger net prices 12.8% lower than the merger of two otherwise identical for-profit hospitals, and 8.2% lower than for a government hospital merger: both of these estimated differences are highly statistically significant. And we cannot reject the hypothesis that the pricing effects are identical for government and for-profit hospitals".

Table 1 Inverse-Herfindahl index numbers-equivalent concentration measures

	$1/H^{pat}$	$1/H^{75}$
1985	3.08	2.32
1988	2.94	2.27
1991	2.82	2.19
1994	2.71	2.12

H^{pat} = H-index based on expected probability of hospital choice in patient's residence ZIP code; H^{75} = H-index based on hospital share of patient flows in a 75%-actual-patient-flow geographic market radius. Derived from Kessler and McClellan (2000, Table III)

accounting for 75% of the hospital's admissions (H75). The two measures are compared, in numbers-equivalent form (Adelman 1969), in Table 1. Both measures indicate that U.S. hospital market concentration increased over the 10 years of the Kessler-McClellan sample, with their preferred measure, H^{pat}, showing lower concentration (more numbers-equivalent hospitals per market). Using H^{pat}, they find that by the end of their sample, heart disease patients in less-concentrated markets faced lower prices and received better-quality care. Their results imply that the most concentration-increasing mergers worsen market performance: "For Medicare patients with AMI, those mergers that would lead to a change in [H^{pat}] out of the most-competitive quartile or into the least-competitive quartile (or both) would reduce welfare by increasing expenditures and rates of adverse outcomes" (Kessler and McClellan 2000, p. 610).

3.5.3 Efficiency

Bloom et al. (2010) relate hospital performance to a survey-based measure of management quality, and they use market concentration—the number of hospitals within a radius of about a one-hour drive—to explain variations in management quality. Their results suggest that better management goes with better performance (significantly fewer deaths from heart attack, for example; pp. 11–12). A more competitive market structure in turn translates into higher management scores (p. 13) "Adding an extra competitor increases the index of management quality by over one third of a standard deviation…". These results are consistent with a broader literature that suggests that competition promotes efficiency and productivity growth.[28]

4 Mergers

Spurred by antitrust policy needs, the merger literature, like the more general market structure-performance literature, increasingly consists of studies or simulations of the effects of mergers in specific markets.[29] Here (and complementing the previous discussion of hospital mergers) I review studies of the impact of mergers on performance

[28] Vickers (1995); Nickell (1996); Hay and Liu (1997).

[29] For surveys, see Pautler (2003); Weinberg (2008), and Budzinski and Ruhmer (2010). For cross-section studies, see Gugler et al. (2003) and Scherer (2006).

in the markets for fast food, soft drinks, and retail gasoline, and the impact of mergers that are on the edge of antitrust chastisement.

4.1 Fast Food

Thomadsen (2005) estimates a structural model of competition between Burger King and McDonald's fast food outlets in Santa Clara County during the summer of 1999, and uses the estimates to simulate the impact of mergers—changes in market structure—on prices. His results highlight the role of spatial differentiation in retail market performance.

He explains the intuition that mergers in a price-setting market for a differentiated retail good lead to price increases (Thomadsen 2005, p. 925): "A merger creates an incentive to increase prices as long as some of the outlet's consumers will instead choose to patronize the other store, allowing the owner to recapture some of the profits from these marginal consumers". His results—"mergers can have a large effect on price, …the effect of mergers is larger among outlets that are closer together, …a merger can lead to increases in prices even when outlets are located far enough apart that the presence of the other outlet would not decrease the outlet's price under separate ownership…"—confirm this intuition (Thomadsen 2005, p. 925). He further finds that hypothetical mergers between outlets of McDonald's, the market leader, have a greater impact on prices than do mergers between Burger King outlets.[30]

4.2 Soft Drinks

Dubé (2005) uses scanner data from the Denver area in the early- to mid-1990s to estimate a structural model of the market for carbonated soft drinks. He uses the model to estimate the effect of three hypothetical mergers[31] (between Coca-Cola and Dr. Pepper, between Pepsi and 7 Up, and between Coca-Cola and Pepsi) on prices, producer surplus, and consumer surplus. A Coke-Dr. Pepper merger is predicted to increase prices and profits modestly, but to result in large welfare losses for consumers. A Pepsi-7 Up merger is predicted generate large price increases for 7 Up, to increase Pepsi-7 Up profits by 1.5%, to increase Coke and Dr. Pepper profits 6 and 9%, respectively, and to reduce consumer surplus by nearly $2 million per quarter, versus $1.3 million per quarter for the Coke-Dr. Pepper merger. Both mergers would have reduced net social welfare. A Coke-Pepsi merger is predicted to result in large price increases, large profit increases for all firms (not just Coke and Pepsi), large welfare losses for consumers (nearly $30 million per quarter), and a large reduction in net social welfare. These results are consistent with the mainstream industrial economics expectations

[30] McDonald's product-differentiation advantage means that consumers who switch away from a McDonald's outlet after a post-merger price increase are more likely to patronize another McDonald's outlet than similarly situated Burger King customers would be to switch to another Burger King outlet. A post-merger McDonald's firm thus has a greater incentive to increase price than does a post-merger Burger King firm (Thomadsen 2005, p. 927).

[31] Some of the mergers he considers had been proposed and were the subject of antitrust opposition.

that market performance will be worse in more concentrated markets, and that for consumer good industries, the strength of the concentration-performance relationship depends on the degree of product differentiation between different varieties.

4.3 Retail Gasoline

The evidence of Sect. 3 is that market structure defines the extent to which firms enjoy discretion in their choice of conduct, and that firms' choices interact to determine market performance. One lesson of the merger case study literature is that firm structure interacts with market structure to determine the range of conduct that is open to firms, and perhaps nowhere is this lesson more clear than for mergers in the gasoline supply chain, where there is conflicting evidence on the impact of vertical integration—an element of firm structure—on market performance.

The supply side of the retail gasoline market sits atop a vertical chain that links extraction of crude oil, distribution of crude oil to refining, distribution from refining to wholesale distribution, and retail outlets. Activities at any level may be carried out by firms that operate only at that level or by vertically-integrated firms that operate at more than one stage of the vertical chain. Theory suggests that vertical integration, by eliminating double marginalization, should improve market performance.[32] But theory also raises the possibility that a vertically-integrated firm may find it profitable to raise the price of its upstream product to nonintegrated downstream competitors, raising their costs and worsening market performance.

4.3.1 Raising Rivals' Costs

This possibility is tested by Hastings and Gilbert (2005). In April 1997, the vertically-integrated refiner-distributor Unocal[33] sold its West Coast operations to Tosco Corporation,[34] which was also vertically integrated and a supplier of unbranded gasoline to independent retailers. The acquisition increased Tosco's downstream market share in different metropolitan markets; those markets in turn differed in the extent to which Tosco's retail outlets competed with independents. Hastings and Gilbert's (2005, pp. 474–475) statistical analysis of wholesale prices to these retail outlets shows "that, controlling for market structure at the refinery level, Tosco's wholesale price of gasoline to independent retailers increased in proportion to the increase in Tosco's retail market share resulting from the merger, adjusted to account for the proximity of its stations to independent retailers".[35]

This is consistent with the hypothesis that there is an "incentive [for] an integrated firm to raise downstream rivals' costs" because "a higher wholesale price for rivals

[32] For evidence consistent with this analysis, see Barron and Umbeck (1984).

[33] Union Oil Company of California, since 2005 a subsidiary of the Chevron Corporation.

[34] Now part of ConocoPhillips.

[35] They find a similar pattern in a separate analysis of wholesale prices in 26 U.S. metropolitan areas, using quarterly data for a four-and-one-half-year period beginning January, 1993.

leads to higher retail prices for the integrated firm when the downstream products sold by the integrated firm and its rivals are strategic complements".

4.3.2 Horizontal Market Structure

Simpson and Taylor (2008) test for an impact of modest changes in horizontal market structure on retail gasoline prices. They carry out an event study of the impact on retail gasoline prices of the 1999 acquisition by Marathon Ashland Petroleum (MAP) of the Michigan assets of Ultramar Diamond Shamrock (UDS), which increased MAP's share of terminal storage[36] in Michigan from about 16% to about 25% and which raised MAP's retail market share to the low teens in two Michigan cities, to near 20% in two cities, and to the 30% range in the two other cities. They reason that:

> MAP's acquisition of UDS's gasoline stations in Michigan could lead to higher prices in several ways: the acquisition could eliminate localized competition between gasoline stations supplied by MAP and gasoline stations supplied by UDS, the acquisition also could facilitate coordinated interaction through the reduction of the number of competitors, and the acquisition could lead to higher prices by prompting the combined firm to restrict access to its terminals, thereby raising costs for its independent rivals (Simpson and Taylor 2008, p. 141).

Their econometric results, however, which control for other shocks that might have affected retail gasoline prices, find no significant increase in retail prices. There is some indication that the merger may have lowered retail prices in one of the six retail markets, perhaps due to efficiency gains resulting from the integration of pipeline systems.

4.4 Mergers and Prices

Ashenfelter and Hosken (2010) report the results of scanner-data based event study analyses of five mergers of consumer goods-producing firms[37] that took place between 1997 and 1999. They selected mergers which, in their view, were close to but below the threshold level of concern that would have resulted in a challenge by merger policy enforcers. Four of the five mergers appear to have resulted in price increases for some but not all products of merging firms.[38] Analysis of aggregate prices revealed "modest price increases, ranging from roughly 3–7%, when using the change in private label products' prices as a control" (Ashenfelter and Hosken 2010, p. 28).

[36] Terminal storage stations operate at an intermediate stage in the distribution of gasoline and other products, receiving products (usually by pipeline) from refineries, storing it in aboveground tanks, and delivering it to retail outlets, including retail gasoline stations. Some 1300 terminal storage stations operate in the United States (American Petroleum Institute, "Marketing" (http://www.api.org/aboutoilgas/sectors/marketing/)) They supply gasoline service stations in a 50-75 mile radius (Simpson and Taylor 2008, p. 138, citing Federal Trade Commission 2004).

[37] The industries involved were motor oil, feminine hygiene products, ready-to-eat cereal, distilled spirits, and maple-flavored syrup.

[38] The exception was the 1997 purchase by Aurora Foods of Kraft Food's maple syrup lines.

Ashenfelter et al. (2011) examine the impact of the 2006 takeover of Maytag by Whirlpool on washers and dryers, refrigerators, and dishwashers. They characterize their results as showing "systematic price increases for products introduced after the merger occurred in two categories: dryers and dishwashers. Despite experiencing a large change in market structure similar to the dryer market, we do not observe evidence of a price increase for clothes washers. The results for refrigerators are more mixed. There is some evidence of a small price increase, 2–4%, for Whirlpool refrigerators, however, this price effect is imprecisely estimated and not as robust as the findings for clothes dryers or dishwashers" (Ashenfelter et al. 2011, p. 14). Possible explanations for the absence of price effects include technological change (a shift of consumers from top loading to front loading clothes washers) and foreign entry.

5 Final Remarks

The industry studies reviewed here all support the mainstream view that more competitive market structure and more competitive firm conduct leads to better market performance. They also suggest that industry-specific factors interact with structure and conduct to determine performance. This conclusion confirms the perspicacity of Leonard Weiss' 1971 advice, quoted above, that industrial economists look for relationships that are common to studies of specific industries.

In the aircraft industry, the learning curve is a factor. In passenger airlines, the efficiency and strategic possibilities of networks play an essential role. Understanding endogenous quality improvement is essential to understanding supermarket distribution. Tacit or overt public support for collusion has been central to a determination of the performance of liner shipping markets. Factors that determine management quality, as well as differences in market structure, contribute to understanding hospital market performance.

In the same vein, merger studies reveal that geographic proximity interacts with concentration/number of firm effects in determining fast-food market performance. Product differentiation, based on brand image rather than location, is important for soft drinks. Horizontal market structure interacts with vertical firm structure to determine market performance in retail gasoline. Vertical integration in this market has the potential for good and ill, and geographic proximity affects where the balance lies.

The evidence is that market structure matters for market performance, and also that market structure is not all that matters for market performance. Market structure sets the stage. Idiosyncratic industry-specific factors determine the broad outlines of a script. Market performance is realized only as firms improvise their parts.

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