MARKET CONCENTRATION, MULTI-MARKET

PARTICIPATION AND ANTITRUST

By

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Abstract

We explore the trade-off between market concentration and multi-market participation in evaluating proposed mergers. When demands are complementary, the *price-decreasing effect* of multi-market participation provides a countervailing influence on the *price-increasing effect* of higher market concentration. The larger the "footprint" of the multi-market provider, the greater the likelihood the *price-decreasing effect* dominates, *ceteris paribus*. In the case of substitutes, precisely the opposite occurs, multi-market participation compounds the *price-increasing effect* of higher market concentration. A key finding in the case of complements is that higher market concentration may be consistent with non-increasing prices despite the absence of merger economies. It follows that merger guidelines that place undue emphasis on market concentration can lead policymakers to block mergers that enhance consumer welfare and vice versa.

1. Introduction

The horizontal merger guidelines (HMG) of the Department of Justice (DOJ) place considerable weight on market concentration in evaluating proposed mergers. An emphasis on market concentration may be appropriate for evaluating mergers that do not involve multi-market participation. In contrast, for mergers that transform single-market providers (SMPs) into multi-market providers (MMPs), such an emphasis can lead policymakers to block mergers that actually enhance consumer welfare and vice versa. The potential for error is likely greatest in network industries, including telecommunications and transportation.[1] The defining characteristic of these industries is that of demand complementarities. That is, increased traffic flows in one direction on the network generate increased traffic flows in the reverse direction and also between other nodes on the network as illustrated in Figure 1.

The fundamental question that we examine in this analysis concerns the reliability of market concentration (respectively, changes in market concentration) as an indicator of market power (respectively, changes in market power). We show that mergers that

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[1] There has been significant merger activity in the telecommunications and transportation industries in recent years. See, for example, Dreazen, *et al.* (2002), Dreazen (2002) and Weisman (1999).

increase the market share and the "footprint" of MMPs can combine with demand complementarities to exert greater pricing discipline despite higher levels of market concentration.[2]   It is well-known, of course, that higher concentration may benefit consumers if it results in merger economies, a supply-side effect. It is also well-known that a merger between two firms that produce complementary products can result in lower prices, a demand-side effect. The purpose of this paper is to recognize explicitly the trade-off between market concentration and multi-market participation.[3]   In other words, at what rate should antitrust authorities trade off increased market concentration for increased multi-market participation such that prices are non-increasing, post-merger?

In the simple Cournot model of oligopoly comprised exclusively of SMPs, an increase in market concentration leads to an unambiguous increase in market power, *ceteris paribus*. This *price-increasing effect* of higher market concentration is also present when the market includes MMPs, although in this case there is a countervailing influence that must be taken into account. This countervailing influence is a *price-decreasing effect* that derives from the MMP's participation in complementary markets. The MMP takes into account, whereas the SMP does not, that a price increase in market i reduces demand in market h and vice versa.[4] Under conditions to be described, the *price-decreasing effect* of multi-market participation can dominate the *price-increasing effect*

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[2] The term "footprint" in this context refers to the degree to which the MMP participates in other markets.

[3] The parallels with Farrell and Shapiro (1990) are noteworthy. Welfare can rise with market concentration in the Farrell and Shapiro framework if demand is redistributed from relatively inefficient to relatively efficient firms. In this analysis, welfare can rise with market concentration if demand is redistributed from SMPs to MMPs. This occurs because the effective "super elasticity" confronting the MMPs in the case of complementary demands is higher than the own price elasticity confronting the SMPs. In the case of substitutable demands, precisely the opposite is true.

[4] These are sometimes referred to as "network effects" or network externalities. See Liebowitz and Margolis (2002) for a comprehensive survey of the literature. For a discussion of network effects and their prominent role in recent high-profile court cases, see Shelanski and Sidak (2001).

of higher market concentration.[5]   These issues figure prominently in the recent trend

toward greater consolidation in the market for wireless telecommunications (as discussed

in Section 5 below).

A simple, stylized example should serve to illustrate the type of merger contemplated

by this analysis. Suppose that United Airlines and Northwest airlines serve the route

from City A to City B and that American Airlines and Southwest Airlines serve the route

from City B to City C. Pre-merger, United and Northwest do not take into account the

effect of their pricing on the demand for air travel from City B to City C. Similarly,

American and Southwest do not take into account the effect of their pricing on the

demand for air travel from City A to City B.   Suppose now that the four airlines merge

into one. There are two distinct and countervailing price effects associated with this

merger. The *price-increasing effect* derives from the increased concentration on both the

City A to City B route and the City B to City C route. The *price-decreasing effect*

derives from the increase in multi-market participation and the internalization of demand

externalities (*i.e.*, demand complementarities) that the individual airlines previously had

no incentive to take into account.[6] Figure 2 illustrates a merger of this type in which a

duopoly of SMPs in two distinct markets merge to form a monopoly MMP that serves

both markets.

The primary findings of this analysis are three. First, mergers that increase both

market concentration and multi-market participation may be consistent with non-

increasing, equilibrium prices, even in the absence of merger economies.   Second,

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[5] In contrast, when demands are substitutable, multi-market participation serves to compound the *price-increasing effect* of higher market concentration.

[6] Fred Kahn has suggested an alternative interpretation in which the A to B route is treated as an input for the B to C route and vice versa. Under this interpretation, the incentive for the "vertical" component of this merger is the elimination of double marginalization rather than the internalization of demand externalities.

traditional measures of market concentration can cause policymakers to block mergers that actually enhance consumer welfare and vice versa.[7] Third, there is a measurable trade-off between merger economies and demand complementarities. These findings may have important implications for recent consolidation trends,[8] particularly in network industries, and should serve to inform the design of efficient antitrust policy in the "new economy" (Posner, 2001).

The remainder of this paper is organized as follows. Section 2 examines the evolution of thought concerning market concentration from the earliest days of the new republic through the DOJ's HMG. The traditional Cournot analysis and the significance of market concentration and merger efficiencies are summarized in section 3. A generalized pricing rule that accounts for multi-market participation and demand interdependence is discussed in section 4. Section 5 discusses the policy implications of these findings. Section 6 summarizes the main findings and concludes.

2. Market Concentration

This section examines the evolution of thought on the political economy of market concentration and its underpinnings in the HMG of the DOJ. While this material will likely be familiar to most antitrust scholars, its inclusion serves to render the discussion self-contained. A key objective of this discussion is to explain the reticence on the part of policymakers to accept the idea that increased market concentration may actually enhance consumer welfare, despite the absence of merger economies.

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[7] See Crandall and Winston (2003) for some recent evidence that antitrust merger policy does not enhance consumer welfare.

[8] White (2002) conducted a recent analysis of aggregate concentration trends in the U.S. economy. Despite significant merger activity in selected industries, he finds no evidence of a wholesale increase in aggregate market concentration.

A. Historical Perspectives

Concerns and general suspicion about market concentration and monopolies have a long history in the United States, dating back to the earliest days of the new republic. That economic and political liberties were seen as inextricably linked fostered the sentiment that the concentration of economic power invariably leads to the concentration of political power. As Dirlam and Kahn (1954, p. 17) observe:

> Clearly we are not devoted to a competitive system only for "economic" reasons. It is also associated with such social and political ideals as the diffusion of private power and maximum opportunities for individual self-expression. If the economy will run itself, government interference in our daily life is held to a minimum.

Thorelli (1955, p. 37) contends that this sentiment was perhaps even more pronounced among the early colonists than it was in the English common law:

> Grants or patents of monopoly not related to invention have generally been opposed with even greater vigor in the American colonies and in the United States than in Great Britain. This was so because one of the main reasons for leaving the mother country in many instances had been the aversion to unjustified privilege, more strongly felt among the emigrants than any other group of Anglo-Saxon society, and because monopoly was the antithesis of the very spirit of individualistic pioneering characteristic of life on the new continent.

These ideas trace their origins back to the writings of Jefferson and Paine and their support for small businesses and the "virtues" of the agrarian life (Jefferson, 1998, pp. 258-261). There was a resurgence of these ideas during the Populist movement in this country in the mid-nineteenth century.[9] This was a time when agricultural interests were

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[9] There is an important distinction between populist principles and the principles espoused by Jefferson and Paine. Populists are opposed to economic concentration and the accumulation of wealth and power regardless of how they are achieved (Posner, 2001, pp. 23-28). In contrast, Paine and Jefferson were concerned with economic concentration and the accumulation of wealth and power that derives from the exercise of undue privilege, but not necessarily that which derives from the exercise of superior talent and ability. In support of this hypothesis, recognize that their opposition to "hereditary succession" was based

purportedly being exploited by the monopolistic business practices of the railroads (Thorelli, 1955, pp. 58-62).

Despite these early concerns with the concentration of economic power, the founders recognized the need for the government to protect the rights of the citizenry to acquire property in accordance with their individual skills and abilities. To wit, writing in *Federalist 10*, James Madison observed that:

> The diversity in the faculties of men, from which the rights of property originate, is not less an insuperable obstacle to a uniformity of interests. The protection of these faculties is the first object of government. From the protection of different and unequal faculties of acquiring property, the possession of different degrees and kinds of property immediately results; and from the influence of these on the sentiments and views of the respective proprietors ensues a division of the society into different interests and parties. …The regulation of these various and interfering interests forms the principal task of modern legislation and involves the spirit of party and faction in the necessary and ordinary operations of government.

The founders understood the role of government, both in preserving desirable incentives to acquire property and in "regulating" the resultant clash of competing interests. The primary antitrust laws in this country—the Sherman Act and the Clayton Act—embody the same fluidity that the founders wrote into the constitution. And much like the constitution, the antitrust laws are required to referee the struggle between competing interests while recognizing the that "the referee's role must be appropriately circumscribed" (Klein, 1998, p. 12).

The multi-faceted question of whether the antitrust laws should be used for socio-political as well as economic ends has evoked a spirited debate. Judge Robert Bork (1978, p. 51) has argued that "The only legitimate goal of antitrust law is the

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on the idea that the most talented members of each generation should be allowed to assume leadership in their society (Kramer, 2000, p. xi; Paine 1995, Chapter II). It would be logically inconsistent for Paine and Jefferson to support rewarding superior talent and virtue in the "market" for political leaders, while disavowing the very same principle in markets for other goods and services.

maximization of consumer welfare."[10] The courts have not always adhered to this

doctrine. In the landmark *Alcoa* case, Judge Learned Hand observed that:

> We have been speaking only of the economic reasons which forbid
> monopoly; but . . . there are others, based on the belief that great industrial
> consolidations are inherently undesirable, regardless of their economic
> results. In the debates in Congress, Senator Sherman himself . . . showed that
> among the purposes of Congress in 1890 was a desire to put an end to great
> aggregates of capital because of the helplessness of the individual before
> them.[11]

In *Brown Shoe*, the court ruled that the Congress intended for smaller firms to be

protected, even it resulted in higher prices:

> Of course, some of the results of large integrated or chain operations are
> beneficial to consumers. Their expansion is not rendered unlawful by the
> mere fact that small independent stores may be adversely affected. It is
> competition, not competitors, which the Act protects. But we cannot fail to
> recognize Congress' desire to promote competition through the protection of
> viable, small, locally owned, businesses. Congress appreciated that
> occasional higher costs and prices might result from the maintenance of
> fragmented industries and markets. It resolved these competing
> considerations in favor of decentralization.[12]

It is significant that a key premise contained in Senator John Sherman's resolution, a

precursor to the passage of the Sherman Act, is that the antitrust laws should serve to

prohibit arrangements that "tend to advance the cost to the consumer…."(Thorelli, 1955,

p. 166).[13, 14] Hereafter, we refer to this condition as the *non-increasing price condition.*

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[10] He further states that: "Competition," for purposes of antitrust analysis, must be understood as a term of art signifying any state of affairs in which consumer welfare cannot be increased by judicial decree. Bork therefore rejects the idea that "competition" is synonymous with "rivalry" (p. 58).

[11] *United States v. Aluminum Co. of America*, 148 F.2d 416, 428, 429 (2d Cir. 1945).

[12] *Brown Shoe Co. v. United States*, 370 U.S. 294, 344 (1962).

[13] Tracing the origins of the Sherman Act back to the common law, Kleit (1993) contends that the Congressional goal of this legislation was not the welfare of consumers (consumers' surplus), but rather economic efficiency. In contrast, Lande (1982) argues that, in passing the Sherman Act, Congress was primarily concerned with wealth transfers from consumers to producers. Kleit (1993, p. 647) concedes that more recent antitrust policies have applied a "welfare of consumers" standard.

[14] Indeed, as Dirlam and Kahn (1954, p. 15) observe, the "sponsors of the Sherman Act were not hostile to mere size or market power."

It is beyond the scope of this paper to evaluate the various arguments that have been advanced concerning the proper role of the antitrust laws. It suffices to recognize that concerns with market concentration have historically included socio-political as well as economic considerations. This observation notwithstanding, Judge Richard Posner (2001, p. 35) observes that "After a century and more of judicial enforcement of the antitrust laws, there is a consensus that guidance must be sought in economics." In the same vein, it is critical that overly-simplistic economic models not be used to validate concerns with market concentration that are inherently non-economic in nature. We turn now to a brief review of the DOJ's merger guidelines with this issue foremost in mind.

B. DOJ Merger Guidelines

Concerns about the adverse economic effects of market concentration figure prominently in the HMG of the DOJ (1992). These guidelines make allowances for countervailing effects, including ease of entry, merger economies and substitute products, but these are probably best characterized as exceptions to the general rule that non-trivial increases in market concentration typically confer greater market power, at least in moderately concentrated and highly concentrated industries.

The merger guidelines rely extensively upon the Herfindahl-Hirschman Index (HHI) of market concentration to establish the relevant benchmarks.[15] For example, the guidelines state on page 11 that:

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[15] The guidelines state on page 10 that "Unlike the four-firm concentration ratio, the HHI reflects both the distribution of the market shares of the top four firms, and the composition of the market outside the top four firms." We will argue subsequently that a careful assessment of the merits of a proposed merger requires that antitrust authorities go even further—to investigate the distribution of market concentration across SMPs and MMPs, post-merger.

Where the post-merger HHI exceeds 1800, it will be presumed that mergers producing an increase in the HHI of more than 100 points are likely to create or enhance market power or facilitate its exercise.

Moreover, even in moderately concentrated industries, defined as industries with an HHI of between 1000 and 1800, the HMG specify that changes in the HHI of 100 points or more "potentially raise significant competitive concerns." Nonetheless, the DOJ's merger guidelines (1992, p. 11) appear to recognize the prospective limitations of an exclusive focus on market concentration:

The post-merger level of market concentration and the change in concentration resulting from a merger affect the degree to which a merger raises anticompetitive concerns. However, in some situations, market share and market concentration data may either understate or overstate the likely future competitive significance of a firm or firms in the market or the impact of a merger.

It is noteworthy that the interaction of multi-market participation and demand interdependence, the principal focus of this discussion, is not explicitly referenced in these guidelines as a possible limitation. Moreover, whereas market power is increasing with market concentration in the simple Cournot model of oligopoly, this property does not arise in other, no less plausible, models of oligopoly behavior (e.g., Bertrand competition).

3. Traditional Cournot Analysis

In the simple Cournot model of oligopoly, there is assumed to be a single market in which each firm chooses an output level with the belief that its choice of output has no influence on the output choice of its rivals.[16] Suppose that inverse market demand is given by $P(Q)$, where P is price, Q is quantity with $Q = q_1 + q_2 + ... + q_n$ and q_s is the

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[16] The firms in this model compete in a standard strategic substitutes Cournot game with homogenous output (Bulow *et al.*, 1985; Vives, 1999).

output of firm s, $s = 1, \dots n$. The cost function for firm s is given by $C_s(q_s) = c_s q_s$. Each firm s chooses a level of output, q_s, to maximize its profit, Π_s, or

(1) $\displaystyle\max_{\{q_s\}} \Pi_s = q_s[P(Q) - c_s]$, $s = 1,\dots,n$.

It is straightforward to show that in the Cournot-Nash equilibrium,[17] the mark-up of price over marginal cost, a measure of market power, is given by

(2) $\dfrac{P - c_s}{P} = \dfrac{s_s}{\varepsilon}$,

where $s_s = q_s/Q$ is the market share of firm s and $\varepsilon = -(dQ/dP) \times (P/Q)$ is the own price elasticity of demand (Martin, 1993, p. 21). The left-hand side of (2) is the familiar Lerner index of market power (Lerner, 1934; Carlton and Perloff, 2005, p. 283). Equation (2) indicates that the mark-up of price over marginal cost for firm s is increasing with its market share, *ceteris paribus*. This is the basis for the claim that "market share is synonymous with market power."

The relationship in (2) must hold for each of the n firms in the market. Multiplying both sides of the expression in (2) by s_s and summing over all n firms in the market yields

(3) $\dfrac{\displaystyle\sum_{s=1}^{n} s_s(P - c_s)}{P} = \dfrac{P\displaystyle\sum_{s=1}^{n} s_s - \displaystyle\sum_{s=1}^{n} s_s c_s}{P} = \dfrac{P - \displaystyle\sum_{s=1}^{n} s_s c_s}{P} = \dfrac{\displaystyle\sum_{s=1}^{n} (s_s)^2}{\varepsilon}$,

since $\displaystyle\sum_{s=1}^{n} s_s = 1$. Appealing to the definition of the Herfindahl-Hirschman Index, we obtain

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[17] In the Nash equilibrium of the Cournot game, each firm chooses an output level that maximizes its profit given the output choice of each of its rivals. A Nash equilibrium thus represents a simultaneously rational choice of output for each firm in the market.

$$(4) \ \frac{P - \bar{c}}{P} = \frac{H}{\varepsilon},$$

where $\bar{c} = \sum_{s=1}^{n} s_s c_s$ is the weighted average industry marginal cost and H is the Herfindahl-Hirschman Index. Equation (4) indicates that the mark-up of price over average industry marginal cost is increasing with market concentration, *ceteris paribus* (Schmalensee, 1988, p. 660). This is a primary cause for concern with increasing market concentration.

Suppose now that all firms in the market have the same marginal cost, c, and that the price elasticity of demand, ε, is a constant. Rearranging the terms in (4) and solving for the market price yields

$$(5) \ P = \left[\frac{\varepsilon}{\varepsilon - H} \right] \times c.$$

Equation (5) implies that an increase in market concentration $(\Delta H > 0)$ must induce greater efficiencies $(\Delta c < 0)$ if market price is to be non-increasing, post merger. Notably, as discussed above, the HMG explicitly allow merger efficiencies to be used as a defense for a proposed merger.

The final question that we address in this section concerns the precise nature of the trade-off between market concentration and merger efficiencies necessary for the *non-increasing price condition* $(\Delta P \leq 0)$ to be satisfied, post-merger. Taking the total differential of (5), setting the resulting expression to be less than or equal to zero, and simplifying yields

$$(6) \ \frac{dc}{dH} \bigg|_{dP \leq 0} \leq -\frac{c}{\varepsilon - H} \Rightarrow \frac{dc}{c} \frac{H}{dH} \leq -\frac{c}{\varepsilon - H} \frac{H}{c} \Rightarrow \frac{\%\Delta c}{\%\Delta H} \leq -\frac{H}{\varepsilon - H}, \ \text{or}$$

(7) $\%\Delta c \leq -\left[\dfrac{H}{\varepsilon - H}\right] \times \%\Delta H.$ [18]

Equation (7) indicates that the *non-increasing price condition* is satisfied when each 1 percent increase in H is accompanied by a reduction in c of at least $H/(\varepsilon - H)$ percent.

The following is an example.

Example 1. Let $c = 8$, $\varepsilon = 2$ and $H = 0.4$. This yields an equilibrium market price of 10 upon appeal to (5). Suppose that a merger is proposed that would increase market concentration by 10% to $H = 0.44$. Absent any change in marginal cost, price would rise to approximately 10.26. Conversely, if costs decrease to 7.8, a reduction of 2.5%, following the increase in market concentration, the market price remains unchanged as may be confirmed by (5). It follows from (7) that costs must fall by at least 2.5% in order for a 10% increase in H not to generate an increase in market price.

4. A Generalized Pricing Rule

The traditional analysis discussed in the previous section is based on the strong assumption that there is only a single market and hence no scope for multi-market provisioning or demand interdependence. A more realistic assumption is that there are multiple markets and there is demand interdependence across markets. The primary purpose of this section is to present just such a generalization.

A. Economic Analysis

Suppose that there are z distinct markets, where $z > 1$ is a positive integer, with inverse demand functions, $P^i(Q^1, \ldots, Q^z)$, where Q^i is the output in market i, $i = 1, \ldots, z$. There are n_s^i identical SMPs and n_m^i identical MMPs, where $n_s^i \geq n_m^i.$ [19] The output of each SMP and each MMP in market i is q_s^i and q_m^i, respectively. The cost functions for the

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[18] See Williamson (1968) for an early formal analysis of the trade-off between market concentration and merger efficiencies.

[19] A SMP in market i serves only market i. A MMP in market i serves market i and at least one other market h, $i \neq h$.

representative SMP and MMP are given, respectively, by $C_s(q_s^i) = c_s q_s^i = c q_s^i$ and

$C_m(q_m^i) = c_m q_m^i = (1-\sigma)c q_m^i$, where $\sigma < 1$.

The generalized mark-up rule, the multi-market counterpart to (4), is derived formally in Weisman (2003) and is given by:

(8) $\quad \dfrac{P^i - \overline{c}}{P^i} = \dfrac{H^i}{\varepsilon_{ii}} - \displaystyle\sum_{m=1}^{n_m^i} s_m^i \left(\sum_{h \neq i}^{z} \dfrac{s_m^h}{\varepsilon_{ih}} \dfrac{R^h}{R^i} \right), \quad i, h = 1, ... z,$ [20]

where $\overline{c}$ is the weighted-average industry marginal cost. The left-hand side of (8) is once again the familiar Lerner index. The first term on the right-hand side of (8) is identical to that in (4), where H^i is the Herfindahl-Hirschman Index in market i and ε_{ii} is the own price elasticity of demand in market i as previously defined. The second term on the right-hand side of (8) is an adjustment to the simple mark-up rule to account for multi-market participation and demand interdependence across markets. The term s_m^i is the market share of the representative MMP in market i and s_m^h is the market share of the representative MMP in market h, where $h \neq i$. The term $\varepsilon_{ih} = (\partial P^h / \partial Q^i)^{-1} \times (P^h / Q^i)$ in (8) is the cross-demand elasticity.[21] In the case of complements, $\varepsilon_{ih} > 0$, and in the case of substitutes, $\varepsilon_{ih} < 0$.[22] R^h and R^i denote the revenues in markets h and i, respectively.

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[20] Tirole (1988, p. 70) derives a mark-up rule for a multi-product monopolist with interdependent demands. When the goods are complements, the multi-product monopolist sets a lower price than a single-product monopolist operating independently in each market. The complementary nature of demand forces the multi-product monopolist, but not the single-product monopolist, to account for the fact that a higher price in market i reduces demand in market h. See also Allen (1938, pp. 59-62) for an early analysis of the behavior of complementary-demand monopolists. The logic underlying this analysis is similar except that it is cast in terms of MMPs and SMPs rather than multi-product and single-product monopolists, respectively.

[21] The cross-demand elasticity measures the percentage change in quantity demanded in market i with respect to a one percent change in demand in market h. This differs from the more familiar cross-price

Recognize that when there is no multi-market participation, $s_m^i = 0$ for all markets i

and the generalized mark-up rule in (8) reduces to the simple mark-up rule in (4). In

addition, when the products in markets i and h are independent,[23] the generalized mark-

up rule in (8) again reduces to the simple mark-up rule in (4).

A careful examination of the right-hand side of (8) reveals that the first term is

positive and the second term is negative in the case of complements, $\varepsilon_{ih} > 0$. Hence, the

larger the footprint of the MMPs in complementary (substitute) markets, as measured by

the term in braces in (8), the lower (higher) the equilibrium price in market i, *ceteris*

paribus. Furthermore, a necessary condition for an increase in market concentration to

result in a decrease in the equilibrium price when demands are complementary is that the

collective market share of the MMPs increases, post-merger. This suggests a trade-off

between market concentration and multi-market participation. We turn now to a careful

examination of this trade-off.

Solving (8) for P^i yields the generalized pricing rule, or

$$(9)\ P^i(n_s^i, n_m^i) = \left[1 - \frac{H^i}{\varepsilon_{ii}} + \sum_{m=1}^{n_m^i} s_m^i \left(\sum_{h \neq i}^{z} \frac{s_m^h}{\varepsilon_{ih}} \frac{R^h}{R^i} \right) \right]^{-1} \times \bar{c},\ i, h = 1,...z,$$

where $P^i(n_s^i, n_m^i)$ denotes the equilibrium market price when there are n_s^i SMPs and n_m^i

MMPs serving market i.

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elasticity, which measures the percentage change in quantity demanded in market i with respect to a one
percent change in price in market h.
[22] It is important to recognize that the degree of complementarity (substitutability) increases as the cross-
demand elasticity decreases in absolute value.
[23] Under these conditions, a change in quantity in market i has no effect on (inverse) demand in market h,
or $\partial P^h / \partial Q^i = 0 \Rightarrow \varepsilon_{ih} \to \infty$.

B. Symmetric Costs

In this section, we assume that costs are symmetric so that $\sigma = 0$ and hence there are neither economies nor diseconomies associated with multi-market provisioning. To facilitate the exposition without significant loss of generality, we make two simplifying assumptions. First, we assume that the own and cross price elasticities, ε_{ii} and ε_{ih}, are constants. Second, we assume that all markets i are identical. We are primarily interested in the conditions that must prevail in order for the *non-increasing price condition* to be satisfied, or

(10) $P^i(n_s^i, 0) \geq P^i(0, n_m^i)$.

In other words, under what conditions will a market that is served exclusively by n_m^i MMPs result in an equilibrium price that is no higher than a market served exclusively by n_s^i SMPs?[24]

Satisfaction of the condition in (10) implies from (9) that

(11) $\dfrac{\varepsilon_{ii}}{\varepsilon_{ii} - H_{n_s^i}^i} \times c \geq \left[1 - \dfrac{H_{n_m^i}^i}{\varepsilon_{ii}} + \sum_{m=1}^{n_m^i} s_m^i \left(\sum_{h \neq i}^{z} \dfrac{s_m^h}{\varepsilon_{ih}} \dfrac{R^h}{R^i} \right) \right]^{-1} \times c,$

where $H_{n_s^i}^i$ and $H_{n_m^i}^i$ correspond to the Herfindahl-Hirschman Index when the market is served exclusively by n_s^i SMPs and when the market is served exclusively by n_m^i MMPs, respectively. Simplifying (11) upon recognizing that $\sum_{m}^{n_m^i} s_m^i = 1$ and $R_m^h = R_m^i$ since the markets are identical yields:

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[24] It is possible to examine this trade-off when SMPs and MMPs operate simultaneously in a given market, but this requires imposing additional structure on the demand functions. For example, Weisman (2005 forthcoming) derives a simple expression for the marginal rate of substitution of MMPs for SMPs that depends only on the parameters of the symmetric, linear demand functions.

$$(12) \quad \frac{1}{n_s^i \varepsilon_{ii}} \geq \frac{1}{n_m^i \varepsilon_{ii}} - \frac{z-1}{n_m^i \varepsilon_{ih}},$$

since $H_{n_s^i}^i = 1/n_s^i$ and $H_{n_m^i}^i = 1/n_m^i$ when all SMPs are identical and all MMPs are identical, respectively. Solving (12) for $\varepsilon_{ih} > 0$ yields, after some algebraic manipulation,

$$(13) \quad \varepsilon_{ih} \leq \frac{n_s^i (z-1) \varepsilon_{ii}}{n_s^i - n_m^i}.$$

Equation (13) provides an upper bound on the cross-demand elasticity sufficient for the *non-increasing price condition* to be satisfied. A number of other useful results follow directly from (13).

First, a market served exclusively by n_m^i MMPs yields a lower equilibrium price than a market served exclusively by $n_s^i = n_m^i$ SMPs when demands are complementary.[25] To see this, recognize that when $n_s^i = n_m^i$, the right-hand side of (13) approaches infinity. Hence, the condition in (13) is always satisfied. This result derives from the fact that the complementary nature of demand disciplines the pricing behavior of the MMPs, but exerts no corresponding discipline on the behavior of the SMPs. In other words, the MMPs have an incentive to internalize demand externalities through lower prices, while there is no comparable incentive affecting the behavior of the SMPs. The following is an example.

Example 2. Let $c = 10$, $\varepsilon_{ii} = 1.5$, $\varepsilon_{ih} = 3$ and $z = 2$. Suppose that market i is initially served by 4 SMPs and 0 MMPs so that $n_s^i = 4$ and $n_m^i = 0$. This implies that $H^i = 0.25$. A merger is proposed that would result in the market being served exclusively by MMPs.

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[25] The opposite result holds when demand are substitutable.

It follows from (9) that $P^i(0, n_m^i) \leq P^i(4, 0) = 12$ for all $n_m^i \geq 2$.[26] Moreover, when $n_m^i = 2$, $P^i(0, 2) = P^i(4, 0) = 12$ and $H^i = 0.5$. Hence, the Herfindahl-Hirschman Index doubles with the proposed merger while the market price is unchanged. In contrast, traditional merger analysis applied to these data would predict a post-merger market price of 15, or a price increase of 25%. Hence, in the case of complementary demands, traditional merger analysis overstates the upward pricing pressures resulting from higher market concentration.[27]

Second, the larger is ε_{ii} and the smaller is ε_{ih}, the more likely (13) is to be satisfied, *ceteris paribus*. The economic intuition is as follows. The larger is ε_{ii} the fewer the absolute number of market providers required to sustain any given level of pricing discipline. The smaller is ε_{ih}, the greater the demand complementarities and the stronger the pricing discipline exerted by the MMPs' participation in complementary markets.

Third, if z is "sufficiently large" and ε_{ih} is "sufficiently small," the equilibrium price will be lower in a market served by a monopoly MMP than in a relatively unconcentrated market served exclusively by SMPs. The following is an example.

Example 3. Let $c = 10$, $\varepsilon_{ii} = 1.5$ and $\varepsilon_{ih} = 3$. Suppose that market i is initially served by 4 SMPs and 0 MMPs so that $n_s = 4$ and $n_m = 0$. This implies that $H^i = 0.25$ and $P^i = 12$. A proposed merger would result in the market being served exclusively by a monopoly MMP. It is straightforward to show from (9) that $P^i(0, 1) < P^i(4, 0) = 12$ for all $z \geq 3$.[28] Observe further that since this relation holds for symmetric costs, it must also hold for multi-market diseconomies that are "sufficiently small."[29]

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[26] The data imply that $P^i(0, n_m^i) < P^i(4, 0)$ for all $n_m^i > 2$ when costs are symmetric ($\sigma = 0$). It follows from the continuity of the price function that this relationship must also hold for multi-market diseconomies "sufficiently small" (*i.e.*, values of $\sigma < 0$, but small in absolute value). For example, it follows from (9) that $P^i(0, 3) < P^i(4, 0) = 12$ for all values of $\sigma > -0.0667$.

[27] Alternatively, if $\varepsilon_{ih} = -3$ then $P^i(0, 2) = 20 > 15$, *ceteris paribus*. Hence, in the case of substitutes, traditional merger analysis understates the upward pricing pressures resulting from higher market concentration.

[28] The critical value of z is actually 2.5, but recall that z is constrained to take on only integer values.

[29] See the related discussion in note 26 *supra*.

C. Asymmetric Costs

In this subsection, we relax the assumption of symmetric costs and allow for the possibility that there are economies ($\sigma > 0$) or diseconomies ($\sigma < 0$) associated with multi-market provisioning. Following (9), $P^i(n_s^i, 0) \geq P^i(0, n_m^i)$ whenever

$$(14) \left[\frac{\varepsilon_{ii}}{\varepsilon_{ii} - 1/n_s^i} \right] \times c \geq \left[1 - \frac{1}{n_m^i \varepsilon_{ii}} + \frac{z-1}{n_m^i \varepsilon_{ih}} \right]^{-1} \times (1 - \sigma)c,$$

since $H_{n_s^i}^i = 1/n_m^i$ and $H_{n_m}^i = 1/n_m^i$. Solving (14) for $\varepsilon_{ih} > 0$ yields, after some algebraic manipulation,

$$(15) \ \varepsilon_{ih} \leq \left[\frac{n_s^i (z-1)\varepsilon_{ii}}{n_s^i - n_m^i} \right] \times \left[\frac{n_s^i - n_m^i}{(n_s^i - n_m^i) - \sigma n_m^i (n_s^i \varepsilon_{ii} - 1)} \right],$$

when $\sigma > 0$.[30] Equation (15) provides an upper bound on the cross-demand elasticity sufficient for the *non-increasing price condition* to be satisfied when there are multi-market economies.[31] Comparing (13) and (15) reveals that

$$(16) \ \varepsilon_{ih} \leq \frac{n_s^i (z-1)\varepsilon_{ii}}{n_s^i - n_m^i} < \left[\frac{n_s^i (z-1)\varepsilon_{ii}}{n_s^i - n_m^i} \right] \times \left[\frac{n_s^i - n_m^i}{(n_s^i - n_m^i) - \sigma n_m^i (n_s^i \varepsilon_{ii} - 1)} \right],$$

since $(n_s^i - n_m^i)/[(n_s^i - n_m^i) - \sigma n_m^i (n_s^i \varepsilon_{ii} - 1)] > 1$ for $\sigma > 0$ "sufficiently small." Equation (16) confirms that when there are economies associated with multi-market provisioning, the demand complementarities required to satisfy the *non-increasing price condition* are smaller than those indicated by (13). That is, the upper bound on ε_{ih} is correspondingly

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[30] Note that the condition in (15) collapses to that in (13) when $\sigma = 0$.

[31] Note that for $\sigma > 0$ "sufficiently large," the right-hand side of (15) will be negative. In this case, a merger will satisfy the *non-increasing price condition* provided that demand substitutability is not too strong, or $\varepsilon_{ih} < 0$ is "sufficiently small."

higher.[32]   This implies that there is a trade-off between multi-market economies and demand complementarities. The following is an example.

Example 4. Assume the same data set as in *Example 2*, except $\sigma = 0.1$ and ε_{ih} is now a variable. The marginal cost for the representative MMP is given by $(1-0.1) \times 10 = 9$. It follows from (9) that $P^i(0,2) \leq P^i(4,0) = 12$ for all $\varepsilon_{ih} \leq 6$. Recall from *Example 2* that $P^i(0, 2) \leq P^i(4,0) = 12$ for all $\varepsilon_{ih} \leq 3$. Hence, the upper bound on ε_{ih} is increasing with σ, *ceteris paribus*. In other words, the greater the multi-market economies, the weaker the demand complementarities required to satisfy the *non-increasing price condition*.

D. Summary

A brief summary of the main findings of this analysis is useful for the discussion of policy implications in the next section.

1) When demands are complementary, multi-market participation provides a countervailing influence on the *price-increasing effect* of higher market concentration. Traditional merger analysis will tend to overstate the upward pricing pressures resulting from higher market concentration under these conditions. The implication is that higher market concentration (including possibly market monopolization) need not lead to higher prices, even in the absence of merger economies.

2) When demands are substitutable, multi-market participation compounds the *price-increasing effect* of higher market concentration. Traditional merger analysis will tend to understate the upward pricing pressures resulting from higher market concentration under these conditions.   The implication is that higher market concentration will lead to higher prices unless accompanied by non-trivial merger economies.

3) The *non-increasing price condition* is satisfied if the equilibrium price when the market is served exclusively by n_m MMPs is no higher than the equilibrium price

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[32] In the case of multi-market diseconomies $(\sigma < 0)$, $(n_s^i - n_m^i)/[(n_s^i - n_m^i) - \sigma n_m^i(n_s^i \varepsilon_{ii} - 1)] < 1$ and the upper bound on ε_{ih} is correspondingly lower.

when the market is served exclusively by $n_s \geq n_m$ SMPs. The greater are multi-market economies and the stronger are demand complementarities, the smaller the number of MMPs, required to satisfy the *non-increasing price condition*. The implication is that there is a trade-off between multi-market economies and demand complementarities.

4) The potential for error from the use of traditional merger analysis is likely most pronounced when there is a high degree of demand interdependence and the footprint of the MMPs is large.

5. Policy Implications

The findings in the previous section attest to the fact that demand complementarities provide a countervailing influence on the upward pricing pressures typically associated with increased market concentration. In the case of complementary demands, the larger footprint of the MMP forces it to account for the fact that a higher price in market i reduces demand in market h. As a result, equilibrium prices may be decreasing while market concentration is increasing, even in the absence of merger economies

These findings suggest that antitrust guidelines that place undue emphasis on market concentration can lead policymakers to block mergers that have the potential to enhance consumer welfare and vice versa—an outcome seemingly at odds with the goals of the antitrust laws.[33] Moreover, these findings indicate that even consolidation to monopoly can potentially benefit consumers through lower prices.[34] This possibility, while perhaps intriguing, would still have to be reconciled with the specific wording contained in Section 7 of the Clayton Act which proscribes acquisitions "wherein any line of

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[33] Recall that Senator Sherman argued that the antitrust laws should serve to prohibit arrangements that "tend to advance the cost to the consumer…." (Thorelli, 1955, p. 166).

[34] Recognize that this type of market consolidation would pose no difficulties for Judge Bork's definition of "competition." See note 10 *supra*.

commerce or in any activity affecting commerce in any section of the country, the effect of such acquisition may be substantially to lessen competition, or tend to create a monopoly."[35] Hence, it may be necessary for policymakers to go beyond calculating simple measures of market concentration and investigate the distribution of market concentration across SMPs and MMPs, post-merger.

A. Contemporary Applications

In terms of current applications, mergers in network industries,[36] including telecommunications (Lehman and Weisman, 2000),[37, 38] commercial airlines (Morrison and Winston, 2000),[39] and railroads (Grimm and Winston, 2000; Park et. al., 2001) would seem to be particularly noteworthy. This is the case because increased traffic flows from node *A* to node *B* on a telecommunications or transportation network generate increased traffic flows from node *B* to node *A* and also increased traffic flows between other nodes on the network as illustrated in Figure 1. It is significant that each of these industries is

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[35] 15 USCS § 18, (2003).

[36] This is not to suggest that the applications discussed herein are necessarily restricted to network industries. Consider, for example, the possibility that consumption of a particular good in location (market) *A* increases the likelihood of consumption of that good in location (market) *B*.

[37] Empirical demand analysis in the telecommunications industry confirms the existence of demand complementarities in the form of point-to-point traffic patterns. See, for example, Taylor (1994) and Larson *et. al.* (1989).

[38] There is some evidence of revisionist thinking among policymakers as it relates to mergers in the telecommunications industry, although the rationale—financial distress and competition—is different from that suggested herein. In 1997, shortly after AT&T and SBC announced a proposed merger, Reed Hundt, then chairman of the Federal Communications Commission (FCC), remarked that a merger between AT&T and a Bell Company would be "unthinkable." See Telecommunications Reports, June 23, 1997. Recently, Michael Powell, the current FCC chairman, stated that no telecommunications merger proposal would be "deemed unthinkable" by his agency. In addition, Deborah Majoras, Deputy Assistant Attorney General for Antitrust, intimated recently that a more lenient policy toward mergers in the telecommunications industry may be in the offing (Kaplan, 2002). See Huber *et al.* (1999, Chapter 7) for a review of the specific standards governing mergers and acquisitions in the telecommunications industry.

[39] These findings may have implications not only for mergers, but also for alliances between commercial airlines. For example, Brueckner and Whalen (2000) found that international alliances can reduce interline airfares without necessarily raising fares in those markets in which the alliance partners compete directly.

characterized by demand complementarities and multi-market participation of the sort shown to be most damning to traditional merger analysis.

With respect to the telecommunications industry, and wireless telecommunications, in particular, the industry appears poised for significant consolidation as market providers seek to expand the size of their footprint.[40] There are currently five wireless telecommunications providers in the U.S. with a "national footprint,"[41] and a large number of non-national or regional providers.[42, 43] It is anticipated that any wholesale movement to consolidate would invite antitrust scrutiny as policymakers may be concerned that higher levels of concentration will lead to higher prices.[44] The findings of this analysis suggest that the *price-decreasing effect* of multi-market participation may dominate the *price-increasing effect* of greater concentration. In other words, reducing the number of independent providers through consolidation will allow for the internalization of demand externalities and possibly lower prices, despite reduced competition.

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[40] The recent merger between AT&T Wireless and Cingular created the largest cellphone provider in the U.S. See Latour *et al.* (2004), The Wall Street Journal (2004A) and FCC (2004B).

[41] These are Cingular, Nextel, Sprint PCS, T-Mobile, and Verizon Wireless. See FCC (2004A, ¶ 36). At the time of this writing, a merger between Nextel and Sprint PCS is pending. See The Wall Street Journal (2004B).

[42] These carriers collectively operate 3,123 wireless systems in the U.S. and serve in excess of 173.7 million subscribers as of January 5, 2005. See CTIA at http://www.ctia.org/and CTIA (2004).

[43] According to the FCC, 276 million people, or 97 percent of the population in the U.S., live in counties in which there are 3 or more wireless providers. Approximately 250 million people, or 87 percent of the population in the U.S., live in counties in which there are 5 or more wireless providers. More than 216 million people, or 76 percent of the population in the U.S., can now choose from among 6 or more different wireless providers. Finally, 84 million people, or almost 30 percent of the population, live in counties served by 7 or more different wireless providers. See FCC (2004A, ¶ 49). This increasing competition has led to a pronounced reduction in prices. For example, average revenue per minute declined from $0.47 per minute in 1994 to $0.10 at the beginning of 2003, a reduction of 79 percent. See FCC (2004A, ¶ 171).

[44] Latour *et al.* (2004) caution that "industry consolidation could lead to higher prices for consumers."

Concerns about the possible adverse effects of further consolidation among railroads recently led the Surface Transportation Board (STB) to revise its policies governing mergers and acquisitions.[45]

> Our revised rules reflect a significant change in the way in which we will apply the statutory public interest test to any major rail merger application. Because of the small number of remaining Class I railroads, . . . we believe that future merger applicants should bear a heavier burden to show that a major rail combination is consistent with the public interest. Our shift in policy places greater emphasis in the public interest assessment on enhancing competition while ensuring a stable and balanced rail transportation system.[46]

> However, we know from the last round of mergers that another merger involving two very large railroads would not likely be an isolated event, but instead would trigger responsive proposals that, if granted, could lead to a transcontinental railroad duopoly.[47]

The STB further noted that it "would require applicants in future merger proceedings to present proposals that enhance, not merely preserve, competition, in order to secure our approval."[48, 49] The key premise underlying the STB's revised merger policy is apparently that reduced competition in the industry would necessarily lead to higher prices, in part, because the "efficiencies … likely to be realized from further downsizing of rail route systems are limited" (STB, 2001, p. 14). The findings of this analysis suggest that further consolidation among railroads—even consolidation to a "transcontinental railroad

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[45] As a result of consolidation, the number of Class I railroads in the U.S. declined from 40 in 1980 to 12 in 1993 (Association of American Railroads, 1981, p. 2; 1994, p. 3). [Class I railroads are defined by operating revenue thresholds that are adjusted annually for inflation. In 2002, a class I railroad was defined as any railroad with at least $272 million in annual revenues (Association of American Railroads, 2003, p. 3)] In 2003, there were only seven remaining Class I Railroads in the U.S. These are the Norfolk Southern, the Kansas City Southern, the Burlington Northern/ Santa Fe, the Canadian National, the Soo Line (owned by the Canadian Pacific), the Union Pacific and CSX Transportation (STB, 2002, p. 3).

[46] STB, 2001, p. 9.

[47] STB, 2001, p. 43.

[48] STB, 2001, p. 10.

[49] The STB goes on to note that whereas their previous policy statement on mergers focused on "greater economic efficiency" and "improved service" as the most likely and significant public service benefits, the new policy statement adds enhanced competition as an important public interest benefit (STB, 2001, p. 14).

duopoly"—could potentially lead to lower prices even if such consolidation fails to yield

merger economies.[50]

B. Policy-Relevant Information

The findings of this analysis may also serve to influence the type of information that

antitrust authorities rely upon in evaluating proposed mergers. For example, it is

conceivable that evidence of demand complementarities could substitute, at least in part,

for evidence of merger economies. This flexibility is potentially important given well-

known problems with asymmetric information and the speculative nature of expected

efficiency gains:

> Efficiencies are difficult to verify and quantify, in part because much of the
> information relating to efficiencies is uniquely in the possession of the
> merging firms. Moreover, efficiencies projected reasonably and in good faith
> by the merging firms may not be realized … Efficiency claims will not be
> considered if they are vague or speculative or otherwise cannot be verified by
> reasonable means.[51]

Nonetheless, it should be recognized that demand complementarities, while perhaps

somewhat less speculative in nature than merger efficiencies, are potentially subject to

measurement problems of their own. These include limited data availability and

econometric estimation of the underlying demand system.

6. Conclusion

Concerns about market concentration have a long and revered history in the United

States—dating back to the earliest days of the new republic and the sentiment that the

concentration of economic power invariably leads to the concentration of political power.

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[50] In fact, despite significant consolidation in the railroad industry, inflation-adjusted, railroad rates have decreased by more than 45 percent since 1984 (STB, 2001, note 11).

[51] Department of Justice (1992, p. 19).

While the more modern interpretation of the proper role of the antitrust laws emphasizes economic over socio-political considerations, concerns over the adverse economic effects of increased market concentration have not abated.

Recent mergers in network industries, including telecommunications and transportation, have triggered a re-examination of age-old questions and prompted interest in new ones. A primary objective of this analysis is to investigate the trade-off between market concentration and multi-market participation when demands are interdependent. A key finding is that mergers that increase both market concentration and multi-market participation may be consistent with non-increasing, equilibrium prices even in the absence of merger economies. The larger footprint of the merging firms provides a countervailing influence on the upward pricing pressures typically associated with greater market concentration. [In the case of substitutable demands, this effect is reversed so that the larger footprint has a compounding influence on the upward pricing pressures typically associated with greater market concentration.] These findings may call into question, at least in certain industries, the emphasis that the HMG place on market concentration in evaluating proposed mergers,.

This paper suggests a plausible, "pro-competitive" rationale for recent consolidation trends in network industries that depends not on the realization of merger economies but on the recognition of demand complementarities. The precise nature of the trade-off between merger economies and demand complementarities and its role in evaluating the merits of proposed mergers is an important topic for further research. The findings of this research should serve to inform the design of efficient antitrust policies in the "new economy."

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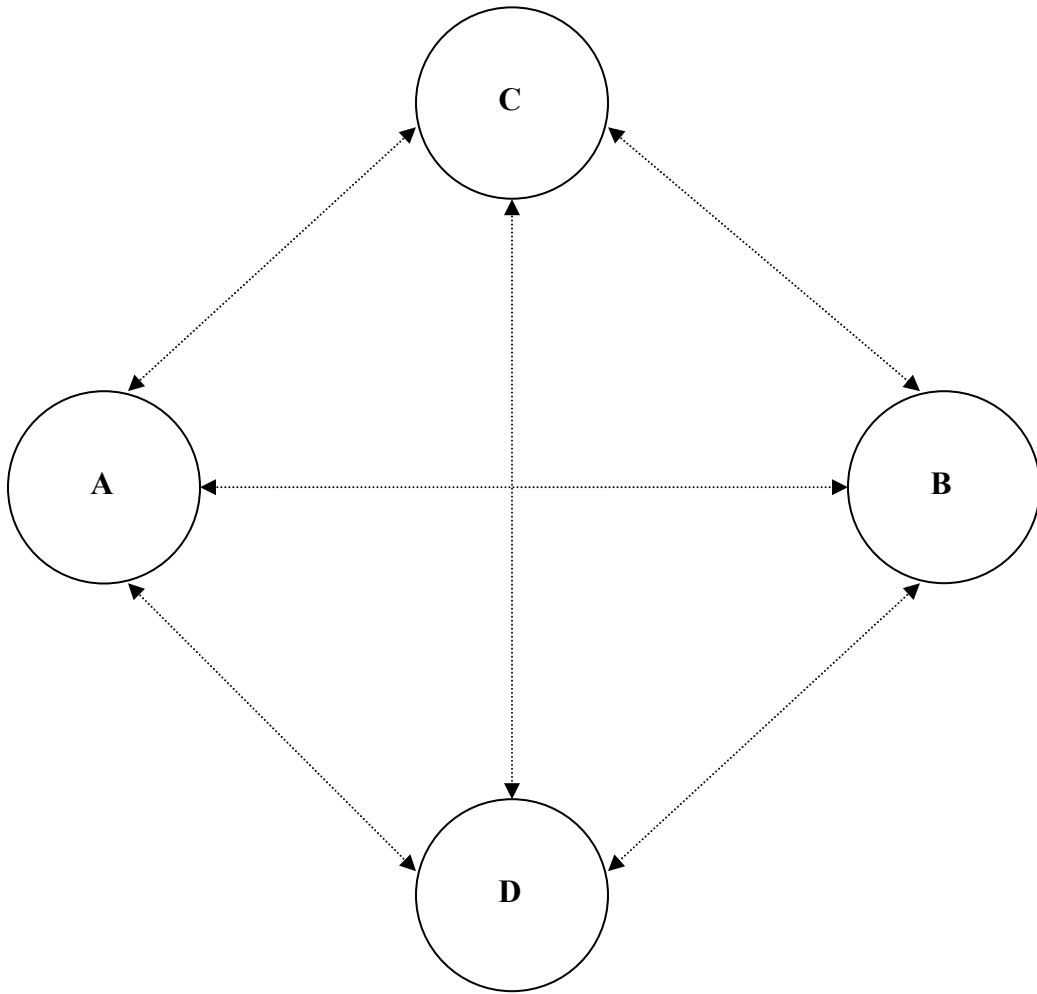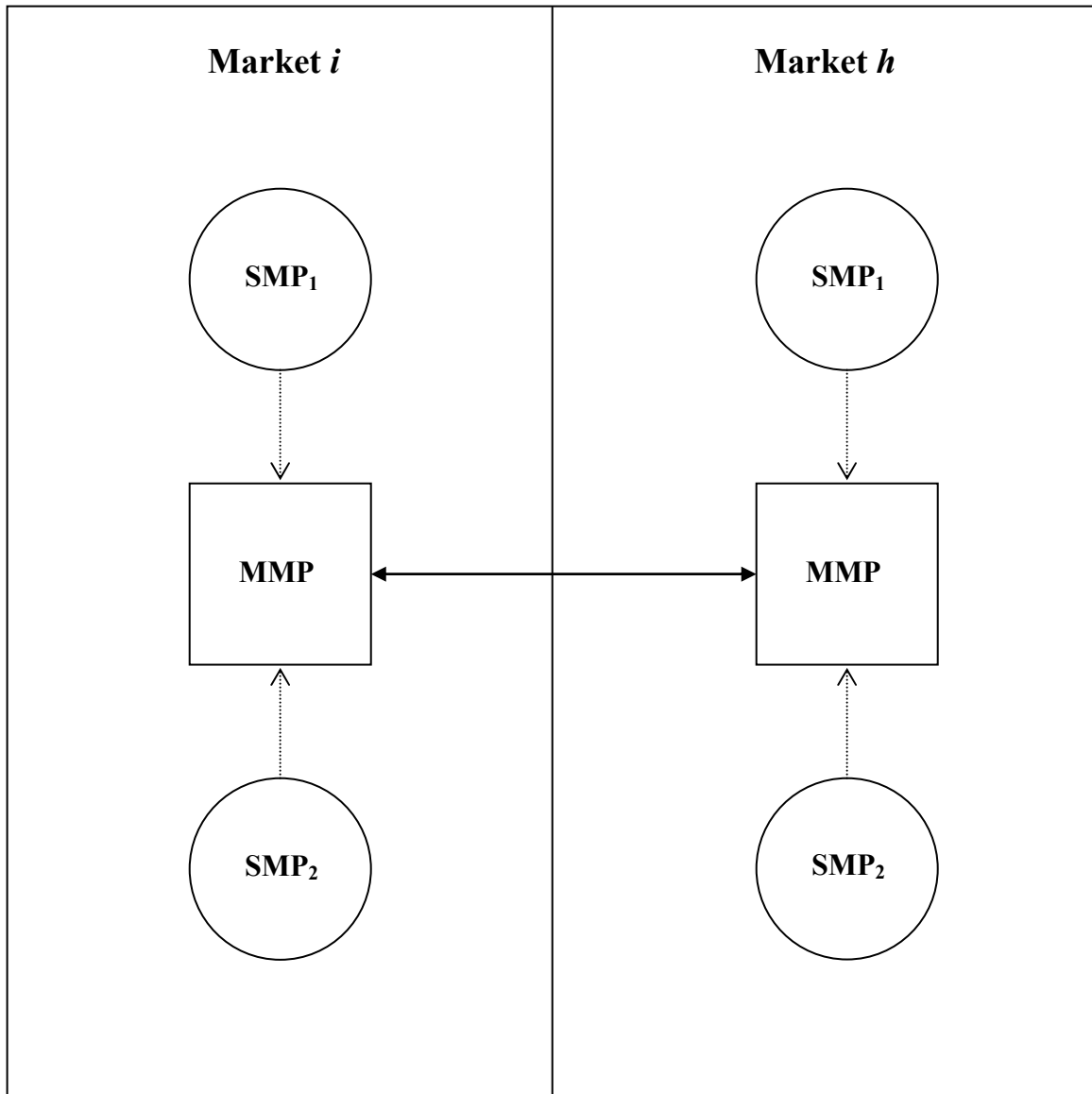
Figure 1. Network Traffic Flows

Figure 2. Merger of Duopoly SMPs into Monopoly MMP