Mandatory Upstream Inputs and Upward Pricing Pressure: Implications for Competition Policy

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ABSTRACT

The competition and regulatory economics literature has developed indicators that detect whether a vertically-integrated provider (VIP) is engaging in market exclusion in the form of an anticompetitive price squeeze and non-price discrimination leading to sabotage of downstream competitors. Weisman integrates these indicators by developing a safe harbor range within which a profit maximizing VIP engages in neither form of market exclusion. Downstream retail competition that depends on the VIP's inputs imposes upward pricing pressure on the downstream prices, with the amount of such pressure increasing as the downstream products become more homogeneous (closer substitutes). We analyze the implications of upward pricing pressure for antitrust evaluations of a duty to deal, regulatory policies mandating wholesale inputs for entrants, and vertical mergers. We find, for example, no basis to oppose a merger in which the VIP was previously required to supply inputs to rivals at unregulated prices.

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Vertical Integration; Exclusionary Behavior; Duty to Deal; Competition Policy; Mergers; Antitrust

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INTRODUCTION

The competition law and economics literature has addressed settings in which a vertically-integrated provider (VIP) supplies certain inputs both to itself and downstream rivals offering competing retail products. In the case of unregulated products, an antitrust duty for one firm to supply inputs to a competing firm may be rare, but when such a duty exists there is a concern that the relative levels of the VIP's retail and input prices may not allow for efficient competition for the downstream rivals, i.e., that the relationship avoids an anticompetitive or vertical price squeeze. When regulatory policy mandates that the VIP supply wholesale inputs to competitors on a non-discriminatory basis, the parallel concern is that the VIP's retail prices be sufficiently high so that an equally efficient rival is not foreclosed.

A related concern, often arising primarily in regulated settings, is that if the price of the wholesale input is set too low relative to the VIP's retail price, incentives for non-price discrimination, i.e., sabotage against the rival can arise.[1, 2] These issues can also arise in unregulated settings. For example, the antitrust division of the U.S. Department of Justice investigated whether the data caps instituted by AT&T and Comcast are intended to discourage their customers from switching to online video providers such as Netflix and Hulu that compete with AT&T and Comcast in the downstream, retail market for video entertainment (Catan and Schatz, 2012).[3] The companion issue of "input foreclosure" has also arisen in unregulated settings and will likely figure prominently in the prospective merger between AT&T, a distribution company, and Time Warner, a content provider. Specifically, would a combined AT&T/Time Warner find it profitable to sell content to other distribution companies post-merger? The same issues arise in the ongoing debate over net neutrality. The risk of non-price discrimination may be exacerbated if broadband providers are not permitted to engage in differential pricing for priority delivery of traffic (Weisman, 2015). Similar safeguards to detect and prevent anticompetitive prices have been proposed for regulated and unregulated markets. While these safeguards address the potential anticompetitive conduct that they are designed to detect and correct, competition based on wholesale inputs may result in upward pricing pressure at the retail level.

This analysis also provides insights into the relationship between the VIP's duty to deal with a rival for inputs necessary for downstream production and its prospective merger with that rival.

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[1] A well-known result in the literature, sometimes referred to as the Chicago School critique of vertical foreclosure, is that a VIP does not have an incentive to discriminate against downstream rivals if the profits associated with its market power can be extracted through input sales. This is the case when the market is unregulated and inputs are employed in fixed proportions. The presence of economic regulation and constraints imposed on upstream/downstream prices largely explains why the issue of non-price discrimination or sabotage is of particular concern in this setting (Beard, Kaserman and Mayo, 2001). See Perry (1989) for a survey of the vertical-integration literature and the references cited in the following note. See Langenfeld (2016) for a discussion of these vertical integration issues and the myriad cases in which they have arisen.

[2] The literature on non-price discrimination is relatively new, but also extensive. See, for example, Economides (1998), Mandy and Sappington (2007), Beard, Kaserman, Mayo (2001), and Sibley and Weisman (1998a, 1998b). Sabotage is more than a theoretical concern. For example, Section 271(d)(6)(A)(iii) of the 1996 Telecommunications Act specifies that penalties may be imposed on the VIP for non-compliance in provisioning inputs to competitors, including market expulsion.

[3] See also Baer (2015) for a discussion of the vertically-integrated structure of the cable television industry and the concern that it provides cable companies with "both the incentives and means to use their gatekeeper power to slow innovation to protect their video profits."

Specifically, in a setting in which the VIP is free to set profit-maximizing upstream/downstream prices in competing with a rival, static efficiency is higher under the merger than under the duty to deal. This scenario raises an interesting policy question that concerns whether such a merger violates Section 2 of the Sherman Act (monopolization) despite improvements in economic welfare.

It is instructive to foreshadow the main policy conclusions that follow from this analysis. First, the courts have been reluctant to require VIP's to share inputs with rivals, primarily due to concerns that it (i) discourages investment and innovation (dynamic efficiency) and (ii) imposes heavy administrative burdens on the courts. Second, whereas a policy that requires VIPs to share inputs with rivals may increase the number of downstream market providers, it does not necessarily result in welfare-enhancing competition (allocative efficiency). Mandatory sharing of inputs can lead to upward pricing pressure at the retail level, with this pressure increasing as the downstream products become closer substitutes. A key policy finding is that mandatory sharing of inputs can reduce dynamic efficiency and possibly allocative efficiency as well. This begs the question as to whether such a policy is more effective in protecting the welfare of competitors than fostering the competitive process to enhance the long run welfare of consumers (Robinson and Weisman, 2008). Finally, we find that the government would have no valid economic (static efficiency) basis to oppose a merger between a VIP and an independent rival when the VIP was previously free to set profit-maximizing prices at both the upstream (wholesale) and downstream (retail) levels.

The remainder of this article is organized as follows. The next section reviews previous approaches to detecting exclusionary practices, with particular emphasis on Weisman's (2014) development of a safe harbor range within which a profit-maximizing VIP would not be engaging in market exclusion. The third section applies Weisman's analysis in conjunction with Tardiff and Weisman's (2009) analysis of the upward pricing pressure to a multiproduct firm that offers substitute products with positive price-cost margins. This analysis shows mandatory access unaccompanied by continued regulation of the price of the mandatory input could increase retail prices substantially, especially as the competing products become more homogenous. Moreover, we demonstrate that a merger between the rival and the VIP may well dominate (in the sense of higher economic welfare) a market structure in which mandatory inputs are supplied at unregulated prices. The concluding section explores the antitrust and regulatory policy implications of this source of upward pricing pressure.

SAFEGUARDS AGAINST ANTICOMPETITIVE CONDUCT

Exclusion

When competition takes the form of one firm (referred to as the vertically-integrated provider or VIP) supplying inputs to other firms that compete with the VIP in a downstream market, concerns over the VIP inefficiently foreclosing its downstream rivals have arisen. For example, the United States 1996 Telecommunications Act requires that incumbent monopoly telephone companies lease components of their networks to new entrants at regulatory prescribed prices with the objective of facilitating competition at the retail level.[4] If the incumbent

[4] See, for example, Kahn, Tardiff, and Weisman (1999) and Robinson and Nachbar (2008, Chapter 8).

telephone companies were free to select prices for their retail services and mandated network components leased to competitors, the relationship between the wholesale and retail prices could potentially result in efficient competitors not being financially viable, i.e., the incumbent would be engaging in an anticompetitive price squeeze. Accordingly, regulatory and antitrust analyses have focused on establishing sufficient price-cost margins to facilitate efficient downstream competition.

On the other hand, if the margin between the VIP's retail price and the prices of the inputs sold to competitors is too large relative to its wholesale margins, the VIP may have incentives to sabotage its rivals, e.g., raise their rivals' costs by providing wholesale inputs that are inferior to those used for the VIP's own retail services.[5] The incentive to engage in sabotage can arise when the incremental profit the vertically-integrated provider realizes from selling more retail services is greater than the incremental profit it foregoes in selling fewer mandatory inputs to competitors.

Price Squeeze Safeguards

Detecting and/or preventing price squeezes has been a central focus of the regulatory economics and antitrust literature.[6, 7] Similar to the detection and prevention of predatory pricing, which concerns whether price exceeds the relevant measure of cost, the price squeeze issue raises the question of whether the VIP's retail service is profitable when the opportunity cost of selling fewer units of the input to competitors is included in the cost of the retail service. In the case of homogenous products, the presence of an anticompetitive price squeeze depends on whether the incremental unit profit from the VIP's retail product exceeds the incremental unit profit from selling the input to competitors. If the retail profit exceeds the profit from selling the input, equally (or more) efficient competitors can be profitable and therefore are not foreclosed.

In the case of homogenous products, price squeezes are prevented when the VIP sets the price for its retail service so that the price-cost margin is at least as large as the price cost-margin for the input sold to competitors. This outcome, which is equivalent to the well-known efficient component pricing rule (ECPR) (Baumol and Sidak, 1994), presumes that one unit of the competitor's product displaces precisely one unit of the VIP's retail product.

In the case of heterogeneous products (i.e., imperfect substitutes), the incremental profit determination depends on whether the VIP is increasing the price of the input or decreasing its retail price (Tardiff, 2013). From the first perspective, an input price increase that results in the

[5] The strategy of "raising rivals' costs" is discussed in Salop and Scheffman (1983) and Krattenmaker and Salop (1986). See also Williamson (1968) (noting that a firm might willingly concede to, or even orchestrate, a labor union's demand for a higher wage rate if the higher wage rate serves to increase a rival's marginal cost more than it increases the firm's own marginal cost. This might occur, for example, if one firm's production process is more highly automated than another firm.) See also Sappington and Weisman (2005). For a case study of raising rivals' costs in the U.S. automotive industry, see Weisman (2007a). In *Microsoft*, Judge Jackson explicitly identified Microsoft's efforts "to increase the costs attendant to installing and using Navigator on any PCs running Windows" and thereby hobble its prospective competitors. *United States vs. Microsoft Corp*. (2000, 2.a.i.).

[6] There have been recent calls for eliminating the price squeeze as a violation of Section 2 of the Sherman Act. See Carlton (2008) and Sidak (2008).

[7] The price squeeze is the vertically-integrated counterpart to predatory pricing. As such, a price squeeze can increase consumer surplus in the short run given that consumers experience lower prices, but decrease welfare in the long run when competitors exit the market resulting in increased market power and higher prices.

competitor selling one less unit would increase the VIP's retail volume by less than one unit. Accordingly, such a price increase would change the integrated provider's profits by the difference between the retail price-cost margin times the number of additional retail units (strictly less than one for heterogeneous products) and the input price-cost margin. The input price increase would be profitable if the input price-cost margin was less than or equal to the retail price-cost margin times the retail volume price increase. In other words, the maximum input price-cost margin that results in nonnegative incremental profits is the retail price-cost margin times the retail volume increase associated with a one-unit reduction in the input volume. The resulting input price is Armstrong and Doyle's (1996) generalization of the ECPR for determining a regulated input price (given the existence of a regulated price for the VIP's retail service) and Salop's (2010) Protected Profits Benchmark proposed as a safe harbor in evaluating anticompetitive price squeeze allegations.

Alternatively, regulators have established price floors for the VIP's retail service, assuming the price of the input sold to the competitor has been established. From this perspective, a retail price decrease that results in the VIP selling one more unit would decrease the competitor's retail volume (and the volume of the input sold to the competitor) by less than one unit. Accordingly, such a retail price decrease would change the VIP's profits by the difference between the retail price-cost margin and the input price-cost margin times the decrement in the number of units of the input sold to the competitor (strictly less than one for heterogeneous products). The retail price decrease would be profitable if the retail price-cost margin was greater than the input price-cost margin times the input volume decrease. In other words, the minimum retail price-cost margin that results in nonnegative incremental profits is the input price-cost margin times the input volume decrease associated with a one unit increase in the VIP's retail volume. This calculation yields Weisman's (2002) proposed retail price floor.

Weisman's (2014) Synthesis

Weisman's analysis synthesizes the alternative price floor perspectives and extends the analysis to settings in which the VIP's retail price and the price of the input sold to competitors are not regulated. In particular, Weisman (1) establishes a safe-harbor range within which the VIP is not engaging in an anticompetitive price squeeze or sabotage; and (2) demonstrates that the static profit-maximizing outcome[8] falls within the safe-harbor range. Among the new insights in Weisman's analysis is the demonstration that when the price of the input sold to competitors is lower than the Protected Profits Benchmark (Salop, 2010), which has been proposed as a presumptively procompetitive *ceiling*, the VIP may still be able to increase profits by sabotaging its rivals. That is to say, there is more than one type of market exclusion that should concern policymakers. Retail price-cost margins that are too low can result in an anticompetitive price squeeze, while those that are too high can result in sabotage. This suggests a type of *Goldilocks Condition* in which the retail price-cost margins must be "just right" in order to protect against exclusionary behavior.

In particular, Weisman formalizes the previous discussion by first defining upper and lower bound displacement ratios. The displacement ratio is the absolute value of the change in the output of the independent rival associated with a one-unit increase in the output of the VIP. In

[8] Both the VIP and the competitor are assumed to maximize profits.

the differentiated-products setting under examination, there are two downstream prices and hence two displacement ratios. These displacement ratios serve to delineate the boundaries of the range of safe harbor input prices.

The upper bound displacement ratio (σ_u) recognizes that the one-unit increase in the output of the VIP that displaces the competitor's output is induced by the change in the competitor's retail price.[9] The lower bound displacement ratio (σ_l) recognizes that the one-unit increase in the output of the VIP that displaces the competitor's output is induced by the change in the VIP's retail price.[10] Define the VIP's retail price and retail cost by P_V and c_V, and the input price and cost as w and c_w, respectively. Weisman's finding regarding the safe harbor for price-cost margins may be expressed succinctly as follows:

Equation (1)

$$\sigma_l \leq \frac{\overbrace{P^V - c_w - c_V}^{downstream\ margin}}{\underbrace{w - c_w}_{upstream\ margin}} \leq \sigma_u.$$

When the VIP's retail and input prices satisfy this constraint, no market exclusion, i.e., anticompetitive price squeezes or sabotage occurs. Weisman illustrates this finding with a numerical example that demonstrates that the static profit-maximizing outcome falls within the range defined by Equation (1).[11] As further explained in the following section, however, while the example demonstrates that a profit-maximizing VIP does not engage in market exclusion, competitive entry via inputs sold to rivals can result in upward pricing pressure. Specifically, as we illustrate and explain in greater detail below with a numerical example, selling inputs to rivals (absent regulated input prices) results in upward pressure on the VIP's retail price that is essentially the same as the upper pricing pressure resulting from a merger. That is, just as a post-merger firm considers the effects of price changes on the profitability of the output formerly sold by its erstwhile rival, when the VIP sets both retail and wholesale prices, it considers the profitability of both products. There is an additional, second-order percentage increase in the rival's retail price resulting from double-marginalization, which decreases with product

[9] This is the relevant displacement ratio for determining whether the VIP has an incentive to engage in sabotage because it establishes a retail price ceiling of the form $P^V - c_w - c_V \leq \sigma_u(w - c_w)$. Specifically, the profit the VIP realizes from selling an additional unit of downstream output cannot exceed the foregone profits the VIP would realize from selling the displaced upstream input. In this case, the displacement metric is based on a change in the competitor's retail price induced by raising the competitor's cost through sabotage (and/or increasing the effective price of the wholesale input).

[10] This is the relevant displacement ratio for determining whether the VIP has engaged in a vertical price squeeze because it establishes a retail price floor of the form $P^V \geq c_w + c_V + \sigma_l(w - c_w)$. Specifically, the VIP's retail price must not fall below the sum of its direct cost from selling the retail output plus the opportunity cost of not selling the displaced downstream input. In this case, the displacement metric is based on a change in the VIP's retail price because that is the mechanism that serves to place an additional unit of output on the market.

[11] This is the vertically-integrated counterpart to the well-known result from the predatory pricing literature that a firm maximizing static profits would not run afoul of standard predatory pricing safeguards (i.e., prices equal to or greater than incremental or marginal cost). Predation is not rational in a static or one-shot game because there is no future in which the predator can recoup its losses incurred during the predation stage and leverage its new-found market power through higher prices. See, for example, McGee (1980) and Joskow and Klevorick (1979).

homogeneity. Further, upward pricing pressure increases as the competing products become more homogenous (i.e., closer substitutes).[12] This invites the question as to whether "competition" obtained through mandatory sharing of inputs is the type of competition that policymakers should want.

INPUT/RETAIL PRODUCT SUBSTITUTABILITY AND UPWARD PRICING PRESSURE[13]

The Model

Following Weisman (2014, p. 229, Equation 1), the profit of the VIP from selling both a retail product and an input to its rival is the following:[14]

Equation (2)

$$\pi^V = \underbrace{Q^I(P_I, P_V)(w - c_w)}_{upstream\ profit} + \underbrace{Q^V(P_V, P_I)(P_v - c_w - c_v)}_{downstream\ profit},$$

where π^v is the VIP's profit function, P_j are the retail prices for the competitor ($j = I$) and VIP ($j = V$), Q^j are the demand functions, c_w is the VIP's unit cost of supplying the input to itself or its rival, and c_v is the additional retailing cost of producing the VIP's downstream (retail) product.

The necessary, first-order condition with respect to P_V is the following:

Equation (3)

$$\frac{\partial \pi^V}{\partial P_V} = \frac{\partial Q^I}{\partial P_V}(w - c_w) + Q^V + \frac{\partial Q^V}{\partial P_V}(P_V - c_w - c_v) = 0.$$

The Lerner Index (L) is a measure of upward pricing pressure for the VIP's retail service:

Equation (4)

$$L = \frac{(P_V - c_w - c_v)}{P_V}.$$

[12] In our example, as products become more homogeneous, both prices and total volumes of retail products increase. This result is driven by the cross-elasticity of the products and not by the sale of inputs *per se*. That is, for a particular degree of product substitutability, selling inputs to rivals (absent input price regulation) results in higher prices than if the rival were able to self-provision the input (at the same cost as the VIP).

[13] Analysis of upward pricing pressure has figured prominently in the economic evaluation of prospective mergers. See, for example, Farrell and Shapiro (2010).

[14] Weisman's profit function also includes a term for raising a rival's cost, which is excluded here without loss of generality.

Solving Equation (3) for the Lerner Index results in the following:

Equation (5)

$$L = \frac{(P_V - c_w - c_v)}{P_V} = -\left(\frac{1}{\frac{\partial Q^V}{\partial P_V}P_V}\right)\left(\frac{\partial Q^I}{\partial P_V}(w - c_w) + Q^V\right).$$

Recognize in Equation (5) that the first term in the denominator on the right-hand side is the product of the own elasticity of the VIP's demand with respect to its retail price and the VIP's retail quantity since

Equation (6)

$$\frac{\partial Q^V}{\partial P_V}P_V = \frac{\partial Q^V}{\partial P_V}\frac{P_V}{Q_V} \times Q^V = \varepsilon^{VV} \times Q^V.$$

The cross elasticity of the demand for the rival's product with respect the VIP's price is given by

Equation (7)

$$\varepsilon^{IV} = \frac{\partial Q^I}{\partial P_V}\frac{P_V}{Q^I}.$$

Equation (5) can be therefore be rewritten as follows:

Equation (8)

$$L = \frac{(P_V - c_w - c_v)}{P_V} = -\left(\frac{1}{\varepsilon^{VV}Q^V}\right)\left(\varepsilon^{IV}\frac{Q^I}{P_V}(w - c_w) + Q^V\right) =$$

$$-\left(\frac{1}{\varepsilon^{VV}}\right)\left(\varepsilon^{IV}\frac{w \times Q^I}{P_V \times Q^V}\left(\frac{(w - c_w)}{w}\right) + 1\right).$$

Finally, since $w \times Q^I$ is the VIP's revenue from selling the input to its rival (R_I) and $P_V \times Q^V$ is the VIP's revenue from selling the downstream product (R_V), Equation (8) becomes

Equation (9)

$$L = \frac{(P_V - c_w - c_v)}{P_V} = -\left(\frac{1}{\varepsilon^{VV}}\right)\left(\varepsilon^{IV}\frac{R_I}{R_V}\left(\frac{(w - c_w)}{w}\right) + 1\right)$$
$$= -\left(\frac{1}{\varepsilon^{VV}}\right) - \frac{\varepsilon^{IV}}{\varepsilon^{VV}}\frac{R_I}{R_V}\left(\frac{(w - c_w)}{w}\right).$$

Equation (9) is equivalent to Tardiff and Weisman's main finding that the price discipline faced by the multiproduct firm is softened when (1) the firm offers a substitute product (in this case the input which allows its rival to compete with the VIPs retail product), (2) the substitute product has a positive price-cost margin, and (3) the substitute product generates relatively high revenue (Tardiff and Weisman, 2009, p. 522, Equation 3).[15, 16] To see this, note that the two terms on the rightmost side of Equation (9) are of the same sign in the case of substitutes (i.e., $\varepsilon^{IV} > 0$). Hence, the upward pricing pressure is compounded in the case of substitutes, *ceteris paribus*.

Equation (9) can also be viewed through the lens of the effective retail own price elasticity facing the VIP when it sells an input to its rival, which is simply the inverse of the Lerner index depicted in Equation (9). Absent selling the input to the rival, the effective elasticity would be ε^{VV}, i.e., upward pricing pressure is reflected in the familiar inverse elasticity rule. The provision of the input to the rival, which is equivalent to the VIP introducing a substitute product, reduces the effective elasticity (in absolute value) as indicated by the fact that the second term in the middle expression on the right-hand side of Equation (9) increases beyond 1.0, with the increase being larger when the rival's product is a closer substitute (high positive cross-elasticity, $\varepsilon^{IV} > 0$) and the margin from selling the input $(w - c_w)$ increases.[17]

Example

A simple numerical example illustrates the upward pricing pressure associated with selling an input to a rival at an unregulated price — pressure that increases as the rival's product becomes more homogeneous (i.e., closer substitutes). The example employs a symmetric linear demand system:

Equation (10)

$$Q^V = A - b\,P_V + d\,P_I$$

Equation (11)

$$Q^I = A - b\,P_I + d\,P_V.$$

[15] Equation 9 can also be derived from the first equation presented by Hausman (2011).
[16] See also Tirole (1988, pp. 69-70) and Weisman (2007b, pp. 239-240).
[17] The cross-elasticity between the VIP's and entrant's retail products results in upward pricing pressure, even when the input price is exogenous. For example, with a symmetric linear demand model and the input price fixed at its incremental cost, the profit maximizing price for the VIP would be $P = \frac{A+bc}{2b-d}$, where *A* is the constant term in the linear demand function, *b* is the absolute value of the own price coefficient, *d* is the cross-price coefficient, and *c* is the incremental cost of the product (inclusive of the cost of the input). As the competing products become closer substitutes (*d* increases), the retail prices increase (because for a particular value of *b*, the denominator, *2b – d*, decreases). More formally, we observe that $\frac{\partial P}{\partial d} = \frac{A+bc}{(2b-d)^2} > 0$.

In the results presented below, the intercept (A) is 20, the own price coefficient (b) is -2 and the cross-price coefficient (d) ranges between 0.5 and 1.95 as the products become more homogeneous.[18, 19] It is assumed that the VIP incurs a cost of 1 to produce a unit of the input and an additional retailing cost of 1 for each unit of its retail product. The downstream rival incurs a cost equal to the price charged by the VIP for the input plus an additional retailing cost of 1 per unit of its competing retail product. The VIP is assumed to be the price leader and the rival is the price follower in a setting that permits only non-discriminatory, linear prices.[20] Table 1 illustrates how upward pricing pressure increases as the competing products become more homogeneous.

Table 1: Effect of Product Homogeneity on Upward Pricing Pressure

Cross-Price Coefficient	VIP Price	Input Price	Rival Price	VIP Quantity	Rival Quantity	Own Elasticity	Cross Elasticity	Effective Elasticity	Lerner Index
0.00	6.00	5.00	8.00	8.00	4.00	-1.50	0.00	-1.50	0.67
0.50	7.67	6.67	9.79	9.56	4.25	-1.55	0.45	-1.35	0.74
1.00	11.00	10.00	13.25	11.25	4.50	-1.71	1.22	-1.22	0.82
1.20	13.50	12.50	15.80	11.96	4.60	-1.85	1.76	-1.17	0.85
1.40	17.67	16.67	20.02	12.69	4.70	-2.10	2.63	-1.13	0.89
1.60	26.00	25.00	28.40	13.44	4.80	-2.63	4.33	-1.08	0.92
1.80	51.00	50.00	53.45	14.21	4.90	-4.27	9.37	-1.04	0.96
1.90	101.00	100.00	103.48	14.60	4.95	-7.59	19.38	-1.02	0.98
1.95	201.00	200.00	203.49	14.80	4.97	-14.25	39.39	-1.01	0.99

As the products become more homogeneous, i.e., as the cross-price coefficient shown in the first column approaches the own price coefficient of 2 (in absolute value), a modest expansion in output shown in the fifth and sixth columns (the result of increasing product substitutability) is accompanied by a pronounced increase in the retail prices and input prices (shown in the second through fourth columns) charged by the profit-maximizing VIP and its rival.[21, 22]

[18] Linear demand systems are commonly used in evaluating upward pricing pressure in the context of mergers (Moresi and Salop, p. 196, note 34).

[19] We also provide the results when there is no cross elasticity i.e., the VIP is a monopolist in its retail market and sells an input to a competitor that is a monopolist in another market.

[20] For the rival, the necessary, first-order condition with respect to its retail price is $\frac{\partial \pi^I}{\partial P_I} = Q^I + \frac{\partial Q^I}{\partial P_I}(P_I - w - c_i) = 0$, where c_i is the rival's downstream (retailing) cost. Therefore, $P_I = P_I(P_V, w)$. (Note that the partial derivatives of the rival's price with respect to the VIP's retail price and the input price are $\left(\frac{d}{2b}\right)$ and 0.5, respectively, for a linear demand model.) The VIP's necessary, first-order condition with respect to its retail price appears in Equation 3 above, subject to the rival's price satisfying the rival's first order condition: $\frac{\partial \pi^V}{\partial P_V} = \left(\frac{\partial Q^I}{\partial P_I}\frac{\partial P_I}{\partial P_V} + \frac{\partial Q^I}{\partial P_V}\right)(w - c_w) + Q^V + \left(\frac{\partial Q^V}{\partial P_V} + \frac{\partial Q^V}{\partial P_I}\frac{\partial P_I}{\partial P_V}\right)(P_V - c_w - c_v) = 0$. Similarly, the necessary, first order condition with respect to w is $\frac{\partial \pi^V}{\partial w} = \left(\frac{\partial Q^I}{\partial P_I}\frac{\partial P_I}{\partial w}\right)(w - c_w) + Q^I + \left(\frac{\partial Q^V}{\partial P_I}\frac{\partial P_I}{\partial w}\right)(P_V - c_w - c_v) = 0$.

[21] The rival firm's prices are somewhat higher than the VIP's retail prices. With a symmetric linear demand system, formulas for the respective prices are the following:

The remaining columns of Table 1 present the components indicated by Equation (9) that are necessary to calculate the effective elasticity (shown in the second-to-last column). The retail product revenues (not shown) are the simple products of retail prices and quantities (second and fifth columns for the VIP and fourth and sixth columns for the rival). The remaining components are the VIP's own-price elasticity (seventh column) and the cross-price elasticity of the rival's volume with respect to the VIP's price (eighth column).[23] As explained by Equation (9), the increasing cross-elasticity and input price margins substantially reduce the effective elasticity for the VIP's retail service.[24] The last column exhibits a concomitant increase in the Lerner index, which approaches 1 in the limiting case (i.e., perfect substitutes).[25] The reduction in the effective elasticity is essentially a measure of upward pricing pressure. When the services are substitutes, the contraction in the VIP's retail output resulting from a price increase is partly offset by the expansion in wholesale input sales to its rival. The more substitutable are the retail services the more complete the offset and the stronger the incentive for the vertically-integrated provider to raise price, *ceteris paribus*. Intuitively, we can conceive of this phenomenon in terms of the VIP's cost of raising the retail price being "subsidized" by the increased demand for (positive-margin) inputs. As the products become more substitutable, the "subsidies" increase and the incentive to raise the retail price becomes stronger.

- $P_V = 0.5 \left(\frac{A}{(b-d)} + (c_w + c_v) \right)$
- $w = P_v - c_v$
- $P_I = \frac{[A + b\,(c_i + w) + d\,P_V]}{2b}$

where A is the intercept of the demand model, b and d are the absolute values of the own- and cross-price coefficients, c_w is the cost for the upstream input, c_v is the cost of the VIP's downstream input, and c_i (which equals c_v in our example) is the cost of the rival's downstream input. Note that the input price and the VIP's retail price include the same absolute margin, thus satisfying the "equal margin rule" (Weisman, 2014), which was one of the earliest formulations of ECPR (Baumol and Sidak, 1994).

The overall pattern of upward pricing pressure remains under some constraints on the VIP's pricing flexibility. For example, if the VIP is constrained so that the marginal retail profit from an increase in the input price (which diverts sales from the rival) is offset by the loss in profit from selling fewer units of the input, the linear model used to produce the results in Table 1 produces the same retail prices for the VIP, accompanied by (1) somewhat lower prices for the input sold to the rival and the rival's retail price and (2) equal volumes for the VIP and its rival. This pricing constraint is Weisman's (2014) price ceiling constraint, which is identical to Salop's (2010) Protected Profits Benchmark.

[22] *Blue Cross & Blue Shield of Wisc. v. Marshfield Clinic* (7th Cir. 1995). ("Consumers are not better off if the natural monopolist is forced to share some of his profits with potential competitors.")

[23] The own-price elasticity equals $\frac{\left[-b + \left(\frac{d^2}{2b}\right)\right] P_V}{Q^V}$, where b equals 2, P_V appears in the second column, and Q^V appears in the fifth column. The cross-price elasticity equals $\frac{\left(\frac{d}{2}\right) P_V}{Q^I}$, where d appears in the first column, P_V appears in the second column, and Q^I appears in the sixth column.

[24] The input price margin is the input price (third column) minus its cost (1 in this example), with the difference then divided by the input price.

[25] The Lerner index is the VIP's retail price (second column) minus its cost (2 in this example), with the difference then divided by the retail price. The Lerner index also equals the negative of the reciprocal of the effective elasticity shown in the adjacent column.

Additional insight into the nature of the upward pricing pressure illustrated in Table 1 can be obtained by comparing the prices and volumes resulting from unregulated retail and wholesale prices with two alternative scenarios. In the first scenario, the rival firm is able to self-provision the input at the same cost as the VIP (i.e., the market structure is a symmetric duopoly). The firms then compete by maximizing profits, taking into account the cross-elasticity between their products.[26] The second scenario depicts a merger of the firms represented in the first scenario (assuming no scale effects). Specifically, the same symmetric demand system and cost assumptions used in Table 1 are maintained for these scenarios. Table 2 compares the prices, outputs, and profits for these two scenarios with the corresponding results from Table 1, in which a vertically-integrated rival supplies a wholesale input to a rival firm. These results demonstrate that policies that require VIPs to supply downstream rivals with wholesale inputs result in upward pricing pressures similar to those involving mergers of formerly independent firms.

Table 2: Upward Pricing Pressure Comparison: Mergers versus Wholesale Inputs

	Two Firms (Pre-Merger)			Single Firm (Post-Merger)			Vertically-Integrated Firm/Downstream Rival				
Cross-Price Coefficient	Price	Volume	Profits	Price	Volume	Profits	Average Price	Volume	VIP Profits	Total Profits	Rival Profit Margin
0.00	6.00	16.00	64.00	6.00	16.00	64.00	6.67	12.00	46.22	59.56	36%
0.50	6.86	19.43	94.37	7.67	17.00	96.33	8.32	13.81	76.26	91.32	31%
1.00	8.00	24.00	144.00	11.00	18.00	162.00	11.64	15.75	139.50	156.38	24%
1.20	8.57	26.29	172.73	13.50	18.40	211.60	14.14	16.56	188.09	205.72	20%
1.40	9.23	28.92	209.14	17.67	18.80	294.53	18.30	17.39	269.99	288.40	16%
1.60	10.00	32.00	256.00	26.00	19.20	460.80	26.63	18.24	435.20	454.40	12%
1.80	10.91	35.64	317.49	51.00	19.60	960.40	51.63	19.11	933.72	953.73	6%
1.90	11.43	37.71	355.59	101.00	19.80	1960.20	101.63	19.55	1932.98	1953.39	3%
1.95	11.71	38.83	376.93	201.00	19.90	3960.10	201.63	19.78	3932.60	3953.22	2%

In particular, the second through fourth columns present the price, total volumes, and total profits for the two firms before a merger. With a symmetric demand system, prices and volumes for the two firms are identical.[27] Accordingly, the volumes and profits listed in the third and fourth columns are twice the volumes and profits of an individual firm. Under the assumption maintained in the example, both volumes and prices are increasing as the products provided by the pre-merging firms become more homogeneous.[28]

The middle three columns represent the results of a merger of the two firms. The table reveals that the post-merger (non-discriminatory) prices charged by the merged firms are identical to the price charged by the VIP shown in Table 1. This result indicates that when input

[26] This scenario can also be viewed as mandating that the input be provided at cost while ignoring the regulatory and dynamic efficiency costs of such a mandate as well as the expected increase in the effective input cost resulting from sabotage. See note 5 *supra*.

[27] With symmetric demand, the price charged by each firm = $\frac{A+b\,(c_w+\,c_v)}{(2b-d)}$, with the variable definitions the same as in note 21 *supra*.

[28] Increasing prices and volumes do not appear to be driven by symmetric demand, i.e., the same phenomenon is observed when we tested demand functions and prices that differed for the two firms.

prices are unregulated the presence of the rival does not increase actual competition.[29] Comparing the three columns for the unmerged firms with the three columns (middle) for the newly-merged firm across the same row illustrates the upward pricing pressure and concomitant volume loss frequently identified in analyses of prospective mergers. Such effects become increasingly pronounced as the products become more homogeneous.[30]

Finally, the last five columns summarize the prices, outputs, and profits when a VIP supplies an input to a rival, i.e., the same scenario depicted in Table 1. The average price is the volume-weighted price and the quantity is the sum of the volumes of the VIP and the rival. Due to double marginalization, prices are somewhat higher and volumes somewhat lower than the corresponding results for the merged firms. In addition, the VIP's profits with unregulated input prices approach the profits realized by the merged firms in the limit as the products become perfectly homogenous. This is explained by the fact that the choice of input price becomes a closer proxy for the choice of the rival's output price as the degree of product homogeneity increases. The numerical simulations reveal that the rival's percentage mark-up of price over cost (inclusive of the input price) approaches zero in the limit as the products become perfectly homogenous (i.e., as $d \to b$).

IMPLICATIONS FOR COMPETITION POLICY

The issue of preventing price squeezes and other exclusionary conduct has arisen in both unregulated and regulated industries. In the former case, courts have generally determined that even for firms with monopoly power, the obligation to supply essential inputs to downstream rivals is rare.[31] Courts[32] and antitrust scholars[33] have emphasized the disincentive to invest and innovate (dynamic efficiency) and the possibility that enforcing sharing obligations may impose unreasonable administrative burdens on courts.[34] The upward pricing pressure highlighted in the discussion here reinforces these concerns over the advisability of mandating access to essential inputs.

In a setting in which the input monopoly has been acquired on the *merits*, the VIP would presumably be able to set profit-maximizing upstream/downstream prices.[35] This market structure may well be dominated (in the sense of providing for higher levels of economic welfare) by a market structure in which the duty to deal is terminated and the VIP merges with

[29] As described in the following paragraph, average prices and total volumes are slightly higher than would be the case if two independent rivals merged. This result suggests that under these conditions the government should not be concerned with a proposed merger between the two firms. In fact, a merger would be marginally preferred to a market structure in which the VIP is required to provide wholesale inputs to its rival at unregulated prices.

[30] In other words, the greater the substitutability between the products of the merging firms, the greater the concern that the merger would have anticompetitive effects, *ceteris paribus*.

[31] See, for example, Robinson (2002).

[32] "Compelling such firms to share the source of their advantage is in some tension with the underlying purpose of antitrust law, since it may lessen the incentive for the monopolist, the rival, or both to invest in those economically beneficial facilities." *Verizon Communications Inc. v. Law Offices of Curtis V. Trinko, LLP* (2004).

[33] "The right to share a monopoly discourages firms from developing their own alternative inputs." Areeda and Hovenkamp (2006, p. 7-86).

[34] "No court should impose a duty to deal that it cannot explain or adequately and reasonably supervise." *Trinko*, quoting Areeda (1989, p. 853).

[35] See Robinson (2002, pp. 1192-93).

its independent rival. The static efficiency gains from this change in market structure are due to the elimination of double marginalization.[36] An outstanding question for further analysis concerns whether such an arrangement violates Section 2 of the Sherman Act given that it simultaneously monopolizes the downstream market and increases static efficiency.

When the independent rival is not dependent on inputs supplied by the VIP for downstream production, the prospective welfare gains from a merger would turn on more traditional analysis. Specifically, the analysis would seek to determine whether scale/scope economies coupled with dynamic efficiency improvements (e.g., innovation, product quality improvements, etc.) are sufficient to overcome any adverse effects of increased market concentration on market power.

In setting forth limiting principles for essential facilities, Professor Areeda recommended that "No one should be forced to deal unless doing so is likely substantially to improve competition in the marketplace by reducing price or by increasing output or innovation" (Areeda, 1989, p. 852). The examples presented herein suggest mandatory access unaccompanied by continued regulation of the price of the mandatory input could increase retail prices substantially, especially as the competing products become more homogenous. Such an effect, in addition to the investment disincentives and administrative burdens previously recognized, would seemingly counsel circumscribing even further the reach of mandatory sharing and the need for safe harbors when such obligations exist.

This discussion serves to underscore the critical distinction between competition and mere rivalry (Posner, 2000, 18). Specifically, increased competition can be expected to give rise to consumer welfare gains, while increased rivalry may not.[37] In other words, forced sharing of inputs can give rise to "competition" in name only given that increased competition is not typically associated with higher prices, *ceteris paribus*.

In the case of regulated industries, the policy implications are somewhat different. The typical evolution of competition when mandatory access is in effect is for the price of the inputs to be price-regulated initially,[38] with increasing deregulation of retail prices occurring over time as competition from entrants using the inputs provided through mandatory access and other entrants not dependent on such inputs takes hold. With respect to retail price deregulation, economists have recognized that the existence of mandatory inputs might well call for the deregulation of retail prices. For example, Joseph Farrell, the Federal Communications Commission's chief economist when mandatory access rules were adopted, observed that "Smoothly functioning wholesale regulation permits and indeed almost demands, retail deregulation" (Farrell, 1997, p. 730).[39] Similarly, Alfred Kahn observed that the wholesale input

[36] Allowing a firm with upstream market power to merge with a downstream firm may result in similar static efficiency gains. While the precise details are beyond the scope of this article, to the extent that Time Warner has market power in the provision of content, certain elements of this analysis may well have implications for the pending merger between AT&T and Time Warner.

[37] Judge Robert Bork argues 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. He therefore, rejects the idea that "competition" is synonymous with "rivalry." See Bork (1978, p. 58) and Werden (2014, p. 720).

[38] See, for example, Kahn and Taylor (1994, pp. 230-233).

[39] Professor Farrell defines "smooth functioning wholesale regulation" as including (among other things) cost-based input prices defined independent of retail prices. Notably, as discussed above, cost-based input prices can give rise to incentives for non-price discrimination. Pricing inputs below costs, which was a concern with the implementation

provisions of the 1996 Telecommunications Act render "deregulation of the retail operations of the [vertically integrated providers] … not just possible but mandatory" (Kahn, 1998, pp. 57-58).

Professors Farrell and Kahn agree that at least initially prices for the wholesale inputs should remain regulated. Kahn (1998, p. 58) would limit such obligations to those *pre-existing* facilities providing the mandatory inputs so that proper incentives for investment in new facilities are provided. Farrell's assessment of whether wholesale inputs can eventually be deregulated is contingent on whether the existence of retail competition depends on those inputs being available (in which case the duration of the mandatory obligation would be indefinite) or whether the mandatory inputs serve as a "stepping stone" to retail competition from entrants that are not dependent on mandatory inputs (Robinson and Weisman, 2008). In the latter case, Farrell (1997, p. 736) indicates that wholesale deregulation may be called for, perhaps with a continuing obligation to provide inputs provisioned over existing facilities.[40]

It is noteworthy that entry into the markets formerly dominated by US incumbent local exchange carriers (the vertically-integrated providers or VIPs in the terminology of this article) no longer depends on mandatory wholesale inputs.[41] For example, the FCC's (2014) most recent local competition report reveals that by the end of 2013, new entrants had captured 44 percent of retail demand, with 75 percent of that amount requiring no inputs from VIPs. In these circumstances, apart from regulatory obligations, there would be no duty to deal, since retail competition has proven feasible without such an obligation.[42] This outcome, in conjunction with our finding that wholesale price deregulation can result in upward pricing pressure suggests that wholesale price deregulation could have the effect of speeding up the "stepping stone" process in favor of entry that is not dependent on mandatory inputs.[43] That is, temporarily higher retail prices resulting from deregulated wholesale inputs would provide stronger incentives for investment that would render mandatory inputs increasingly unnecessary for retail competition.[44, 45] This underscores the above concern that mandatory sharing of inputs may be a policy that is more effective in promoting competitor welfare than consumer welfare.

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of the 1996 Telecommunications Act (Kahn, Tardiff and Weisman, 1999), would be expected to further exacerbate these adverse incentives.

[40] To the extent that these existing facilities are phased out over time, the obligation may continue in the form of requiring the VIP to supply comparable functionality over next-generation networks. This approach addresses the problem that the VIP may strategically accelerate the phase out of existing facilities to avoid sharing obligations (which can decrease allocative efficiency) while ensuring that such sharing obligations do not attach to innovative, next-generation services (which can decrease dynamic efficiency.)

[41] The fact that entry no longer depends on mandatory wholesale inputs does not necessarily imply that the intensity of retail competition absent such mandates is sufficient to justify deregulation of retail markets.

[42] The Supreme Court has noted that if the VIP does not have monopoly power in the retail market at issue, there is no antitrust duty to deal. *Pacific Bell Telephone Company, et al. v. LinkLine Communications*, Inc., et al. (2009, p. 448 n.2).

[43] It is noteworthy that the pervasive entry of cable television providers into telecommunications markets with their "triple play" of voice, broadband and video appears to have accelerated in the United States only after the FCC announced the termination of pervasive network unbundling and signaled its intent to move toward more rational pricing of network elements (Hazlett, 2006).

[44] As Professor Alfred Kahn (2001, p. 22) observes:

> Second, wherever mandatory sharing, for the sake of jump-starting the entry of competitors, would interfere with the more creative and dynamic investment in facilities-based competitive entry and innovation by incumbents and challengers alike, it is the latter that must take primacy.

Similarly, Professor James Bonbright (1961, p. 107) observed, "This latter, dynamic effect of competition has been regarded by modern economists as far more important and far more beneficent than any tendency of 'atomistic' forms of competition to bring costs and prices into close alignment at any given point of time."

[45] In deciding whether to mandate input sharing, policymakers should optimally balance the social cost of making two types of errors. The first type of error is to mandate input sharing when it is not necessary for competition. The second type of error is not to mandate input sharing when it is necessary for competition. The optimal balance turns on which type of error is more amenable to self-correction. For example, if sharing is mandated when it is not necessary for competition, competitors may fail to invest in their own facilities and a dependence on the regulatory process may continue indefinitely. Conversely, if sharing is not mandated when it is necessary for competition, policymakers can always step back into the market and mandate input sharing to correct for any market failure. This may be thought of in terms of "regulatory contestability" given that the mere threat of regulatory intervention may be sufficient to instill the requisite competitive discipline. Alternatively stated, whether competition is possible absent mandatory input sharing is discoverable with a policy that strictly limits mandatory input sharing, but it is not discoverable with a policy of permissive mandatory input sharing. Indeed, as Judge Frank Easterbrook (1984, p. 15) has observed: [T]he economic system corrects monopoly more readily than it corrects [regulatory] errors. . . . in many cases, the costs of monopoly wrongly permitted are small, while the costs of competition wrongly condemned are large.

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