# Vertical Mergers:

## A Survey of Ex Post Evidence and Ex Ante Evaluation Methods

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**Abstract:**

This article surveys recent empirical evidence on efficiencies and competitive harm that are associated with vertical mergers. It discusses both ex post or retrospective empirical studies that rely on post–merger data and ex ante or forecasting techniques that use pre–merger data. It develops the idea that, although there is a need for vertical merger screening tools, there are a number of problems that are associated with attempts to adapt horizontal screens to the vertical context. Mergers in the technology, media, and telecom sectors are emphasized because they tend to dominate contested vertical mergers.

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# 1 Introduction

Over time, mergers have grown in size and become more international. Moreover, the developed countries have moved from industrial economies, with giant firms like Standard Oil, US Steel, and American Tobacco that produce physical products, to knowledge economies, with giant firms like Amazon, Microsoft, Facebook, and Google that perform computer based services. Furthermore, whereas competitive concerns involving the former industries were most often horizontal, some of the most publicized concerns involving the latter industries have been vertical.

High profile vertical mergers such as AT&T/Time Warner, Nielsen/Arbitron, Comcast/NBCU, Ticketmaster/Live Nation and Broadcom/Brocade have focused attention on the possibility of harmful vertical mergers. Since the technology, media, and telecom sectors dominate the list of today's largest companies, it is not surprising that those firms also dominate the list of today's largest and most controversial vertical mergers.

Relationships between up and downstream firms have been hotly contested. Indeed, opinions vary from the position that all vertical mergers and restraints are efficient and should therefore be per se legal to a much more skeptical view that foreclosure, entry deterrence, and other anticompetitive motives lie behind most of those arrangements. Furthermore, policy makers are hampered by the fact that the findings from both theoretical models and empirical assessments of those models are most often ambiguous and, even when conclusions are reached, they are apt to be weak.

In order to assess the tradeoff between vertical efficiencies and competitive harm, this article first looks at recent empirical research that attempts to evaluate vertical mergers and integration. That evidence is retrospective in the sense that it relies on post–merger data.

When a merger is proposed, however, competition authorities must have screening and evaluation techniques that rely only on pre–merger data. There are several such techniques that are routinely used in the context of horizontal mergers and it is tempting to modify them to fit the vertical context. Unfortunately, there are many pitfalls that are encountered when attempting to do this. This article also compares and contrasts horizontal and vertical screening and evaluation techniques and reports evidence concerning their performance.

The organization of the paper is as follows: Section 2 contains a discussion of vertical mergers in general as well as in the telecom, media, and technology sectors. In particular, it

looks at vertical merger actions in the US over the last 25 years. Section 3 assesses vertical merger efficiencies in theory and practice with emphasis on the technology, media, and telecom sectors. A similar exercise is performed for competitive harm. Section 4 discusses quantitative techniques for vertical merger assessment and contrasts them with those used to evaluate horizontal mergers. Specifically, upward pricing pressure calculations and merger simulations are considered. Finally, in the last section, some conclusions are drawn.

# 2 Some Facts about Vertical Mergers

One can get a picture of levels and trends in contested vertical mergers by examining merger actions, where actions include challenges as well as certain proposed transactions that are known to have been abandoned in the face of Agency concerns.[2] Salop and Culley (2018) document all US vertical merger actions between 1994 and 2018. That study shows that actions are not a random sample; instead the industries are often characterized by high concentration, economies of scale and scope, two–sided markets, and/or networks. Furthermore, actions tend to be based on foreclosure, elimination of potential entrants, creation of entry barriers, facilitating coordination, and exchange of sensitive information.

Their study can be used to assess levels and trends in vertical merger actions. Table 1, which is organized by decade as well as the entire period, contains my analysis of their findings. In particular, I compare actions in the technology, media, and telecom (TMT) sectors to overall actions as well as the frequency of actions.

The entries in the table are split into three subperiods, roughly the 1990s, 2000s, and 2010s. The first row in the table contains the number of merger actions in each subperiod as well the the total number, the second row shows the number that were in the technology, media, and telecom sectors, and the third contains their ratio — the fraction of actions that were in the industries of interest. Somewhat surprisingly, that percentage, which is over 60%, has not changed much in 25 years.

The next three columns contain the average number of actions per year, the US president who was in office during most of the subperiod, and the years during which that president was in office. Compared to the third row, the numbers in the fourth are more striking.

[2] Priest and Klein (1984) discuss the distinction between litigated disputes and disputes that are settled before or during litigation,. Both classes are included in actions.

Indeed, the action rate during the Clinton years was comparatively large, during the Bush years it was much smaller, and the during the Obama years it was in between.

Table 1: US Vertical Merger Actions, 1994–July 2018

| | (1) 1994–2000 | (2) 2001–2009 | (3) 2010–2018 | (4) All Years |
|---|---|---|---|---|
| Number of VM Actions | 31 | 10 | 18 | 59 |
| Number of TMT Actions | 19 | 6 | 12 | 37 |
| Ratio TMT/VM | 0.61 | 0.60 | 0.67 | 0.63 |
| Actions/year | 4.4 | 1.1 | 2.1 | 2.4 |
| US President | Clinton | G.W. Bush | Obama | |
| Years in office | 1993–2000 | 2001–2008 | 2009–2017 | |

VM stands for vertical mergers.
TMT stands for vertical mergers in the technology, media, and telecom sectors.
US president is the president that was in office during most of the period.
Years in office are the years in which the named president was in office
Adapted from Salop and Culley (2018)

# 3 Ex Post Evidence

There is a large body of empirical work that evaluates the effects of vertical integration. Most of those studies do not assess vertical mergers; instead they compare vertical integration to

separation. That work tends to show that vertical integration is efficient.[3]

However, one should be cautious when using that literature for the purpose of antitrust policy. Indeed, many of the industries studied are workably competitive (e.g., fast food, apparel, and hotels), not the industries where vertical mergers are typically challenged. In addition, some of the benefits that integrated firms enjoy, such as those due to geographic proximity, cannot usually be achieved through merger. Finally, much of the empirical work looks at one side of the problem — costs or benefits — whereas mergers typically involve tradeoffs between the two. Nevertheless, those studies shed light on vertical mergers.

## 3.1 Vertical Efficiencies

In a striking study of vertical integration in US manufacturing, Atalay, Hortacsu, and Syverson (2014) found that one half of upstream establishments do not ship to their integrated downstream divisions.[4] Indeed, the median internal shipment was 0.4% (equally weighted) or 0.1% (value weighted). When no vertical shipments occur, it lessens the strength of certain motives, for example foreclosure and the elimination of double marginalization.

Why would firms integrate vertically when exchange of goods is not involved? Fortunately, four Nobel Prize winners have looked at this question.[5] They emphasize a number of motives, such as mitigating contracting, holdup, and renegotiation costs, facilitating specific investments in physical and human capital, providing appropriate incentives, and allocating risk efficiently.

In addition, vertical mergers can be motivated by the ability to coordinate other aspects of the vertical chain and by the expectation of productivity increases due to knowledge transfers. None of these organizational and supply side motives requires product flows; instead they involve the transfer of intangibles. Unfortunately, that fact complicates the assessment of the effects of vertical integration.

Although there are many efficiencies that can be associated with a vertical merger, the elimination of successive monopoly markups or double marginalization (EDM), an idea that was first formalized by Cournot (1927) and Spengler (1950), tends to dominate antitrust

[3] See Lafontaine and Slade (2007) for a survey of earlier work.

[4] The authors use a broad definition of vertical integration that partially accounts for the strength of this finding.

[5] Ronald Coase, Oliver Williamson, Bengt Holmstrom, and Oliver Hart.

discussions.[6] However, EDM is not a supply side efficiency, one that lowers input requirements or leads to increased productivity. Instead, it is a pricing externality which, although opposite in sign, is similar to the pricing externalities that dominate the discussion of harm in horizontal merger analysis.

There have been a number of recent empirical studies of the technology, media, and telecom sectors that draw conclusions concerning EDM. However, most findings, though consistent with the removal or creation of double marginalization, are not direct tests of that possibility. Instead, they look at the behavior of prices. For example, Gil (2015) finds that movie theater ticket prices rose after forced vertical divestitures and (Chipty, 2001) concludes that prices of program bundles were lower when cable TV providers were vertically integrated.

In contrast to those more suggestive studies, Crawford, Lee, Whinston, and Yurukoglu (2018) estimate a structural model of regional sports TV networks that quantifies the effects of EDM. Moreover, they allow for less than full coordination across divisions of the integrated firm, which might be the case if, for example, vertical divisions of the integrated firm make independent pricing decisions. Although the authors find that efficiencies dominate on average, there is substantial heterogeneity across product markets.

The above evidence on EDM appears to favor vertical integration. However, contrary to what is often claimed, EDM need not be efficient. As Salinger (1991) noted, when firms produce multiple products, although the removal of double marginalization is apt to cause the price of the product whose input was integrated to fall, the price of the other products that the integrated firm produces can rise,[7] and it is even possible for all prices to rise. Since most large vertical mergers in the technology, media, and telecom sectors involve many products, both up and downstream, that ambiguity can be important.

Salinger's possibility is not just a theoretical nicety. For example, Luco and Marshal (2019) find that, when Coke and Pepsi acquired their bottlers, Coke and Pepsi prices fell but the prices of the integrated bottlers' other soft drinks (Dr Pepper products) rose. More surprisingly, the average soft drink price rose. However, the latter increase was not significant. Like so many other factors involved in vertical relationships, the overall effect of EDM

[6] Kwoka and Slade (2020, forthcoming) contains a critique of the application of the simple double monopoly markup model to more realistic situations.

[7] The intuition behind this result is as follows. When double marginilization is eliminated, the products with eliminated margins become relatively more profitable to sell. This gives the firm incentives to divert demand towards those products by increasing the prices of the products for which double marginalization was not eliminated

is therefore ambiguous.

Motives for vertical mergers that involve the transfer of intangibles are important but, unfortunately, they are more difficult to evaluate. However, indirect evidence of the importance of intangibles is provided by Acemoglu, Aghion, Griffith, and Zilbotti (2010), who show that an incomplete contracts model in the spirit of Grossman and Hart (1986) and Hart and Moore (1990) can explain some observed patterns in vertical integration. Specifically, they predict that upstream technology intensity will lower the probability of vertical integration whereas downstream technology intensity will cause it to rise.

The intuition behind their prediction is that, when an input is technologically complex, it is beneficial for its producers to retain residual control rights, whereas when downstream production is relatively more technical, the downstream firm should have the right to make important decisions that involve the production of its input. The Acemoglu et. al. predictions are confirmed by their analysis of UK manufacturing data.

Other consequences of vertical integration that are easier to measure, including effects on cost, price, investment, and quality, are summarized in table 16 in Lafontaine and Slade (2007, p. 674) and most of that evidence is positive. In other words, the evidence in that table leads one to the conclusion that vertically integrated firms tend to be more efficient.

Some more recent studies reinforce those conclusions. For example, Ciliberto (2006) finds that vertical integration between doctors and hospitals leads to greater investment in health care services, Chipty (2001) and Crawford, Lee, Whinston, and Yurukoglu (2018) find that vertical integration can, but need not, lead to increased coverage of some types of TV channels, and Gil and Warzynski (2014) find that vertical integration is associated with the provision of higher quality video games.

## 3.2 Competitive Harm

As with vertical merger efficiencies, competitive harm can be due to many factors including foreclosure and elimination of potential entrants, creation of entry barriers, and facilitation of collusion through exchange of sensitive information. Nevertheless, foreclosure has received the most attention in the antitrust literature.

Foreclosure refers to a dominant firm's denial of access (complete foreclosure), or granting access under less advantageous terms (partial foreclosure or raising rival's costs), to an essential good it produces, with the intent of extending monopoly power from that segment of

the market – the bottleneck segment – to an adjacent segment —the potentially competitive segment (Rey and Tirole, 2007).

As is the case with double marginalization, however, many empiricists do not assess foreclosure directly. Instead, they examine whether the vertically integrated firm favors its integrated products, and a positive finding is interpreted as evidence that is consistent with foreclosure (e.g., Chipty, 2001; Suzuki, 2009; Bilotkach and Huschelrath, 2013).[8] The problem is that, if vertical integration lowers production or transaction costs or if it eliminates double marginalization, any firm will favor the products that it acquires through integration, regardless of market structure or intensions concerning rivals.

Foreclosure is usually considered to be detrimental. Nevertheless, as with double marginalization, foreclosure can be a two edged sword. Indeed, a vertical merger can result in foreclosure while at the same time overcoming the foreclosure that existed prior to the merger.

To illustrate, Suzuki (2009) finds that, prior to the merger between Turner Broadcasting and Time Warner, many of Turner's channels were foreclosed by Time Warner. The merger eliminated that foreclosure. However, it caused the foreclosure of the remaining unintegrated channels (e.g., Fox News and Disney) to worsen. As with most vertical practices therefore, the net effect of foreclosure can be ambiguous and can only be determined empirically.

Much of the empirical evidence concerning foreclosure pertains to the cable TV industry and most authors find evidence that it exists.[9] However, in spite of this fact, efficiencies often dominate so that the net effect of a vertical merger is positive. Nevertheless, Crawford, Lee, Whinston, and Yurukoglu (2018), who estimate a structural model, find that, although consumers gain on average, there is considerable heterogeneity across product markets, with some positive and some negative effects that can depend on the regulatory setting. Competition and regulatory policies thus interact and the respective agencies should work together. In particular, not all problems are best solved by the former.

On the other hand, Rogerson (2018), who assesses a proposed vertical merger in cable TV between Comcast and Time Warner, concludes that the merger would have been harmful. In particular, even though the geographic markets of the two firms did not overlap, he concludes that online video distributors were just beginning to emerge as potentially significant

[8] Earlier empirical assessments of foreclosure are summarized in table 15 in Lafontaine and Slade (2007, p. 672).

[9] e.g., Chipty (2001); Suzuki (2009); Bilotkach and Huschelrath (2013); Crawford, Lee, Whinston, and Yurukoglu (2018).

competitors to the traditional providers of pay–TV services and were particularly vulnerable to attempts by those competitors to disadvantage them.

Some recent econometric studies of the interaction between foreclosure and market structure are also less optimistic. For example, Nishiwaki (2016) assesses incentives to collude in vertically integrated firms in the cement and concrete industry and finds that integration facilitates collusion among upstream firms, which is attributed to the increase in unintegrated firm concentration; Lee (2013) examines exclusivity in the context of video game software and video game providers and concludes that exclusivity is associated with lower sales, which is attributed to the lack of competition that results from incompatibility; and McGowan (2017) finds that a fall in concentration in coal markets leads to less vertical integration between mines and preparation plants for cleaning services because the increase in output due to the removal of double marginalization causes prices to fall and makes vertical integration less profitable.

In an experimental setting, Norman (2011) finds that markets with a vertically integrated firm are less competitive than those without integration. The findings in the last two papers imply that, not only does horizontal market structure effect vertical integration, but also vertical integration affects horizontal market structure.

Most of the empirical investigations of foreclosure are case studies that deal with a particular industry. In contrast, Boehm and Sontag (2019) assess a broad range of vertical relationships among US and international buyers and sellers in many markets. They look at total foreclosure — breaking buyer/seller links after a vertical merger — and find evidence that relationships are more apt to break after a buyer acquires a competitor of the unintegrated downstream firm. Furthermore, they report evidence that indicates that their findings are causal. However, like most of the studies that are discussed in the preceding paragraphs, they do not consider offsetting efficiencies.

# 4 Ex Ante Forecasting

The empirical evidence concerning vertical integration leads one to conclude that most vertical mergers should be efficient. One should not assume, however, that vertical merger policy should be lax. Indeed, some vertical mergers are anticompetitive, most of those mergers are among large firms in concentrated markets, and many are in the technology, media, and

telecom sectors. It is therefore important to have methods that can be used to separate efficient from inefficient mergers, and those methods must rely only on pre–merger data.

There are a number of techniques that are routinely used to forecast the competitive effects of horizontal mergers and it is tempting to conclude that they can easily be modified to handle vertical mergers. Unfortunately, however, the techniques become more complex when applied in a vertical context, especially to the sorts of mergers that receive attention from competition authorities.

I focus on two such techniques, upward pricing pressure and merger simulations. With each, their application in a horizontal setting is sketched before turning to the vertical context. This is done because the vertical analogs are more complex modifications of their horizontal counterparts and thus suffer from the same flaws. The techniques are usually developed in the context of firms that produce differentiated products and engage in Bertrand competition, and that convention is followed here.

Both forecasting techniques are methods of assessing pricing externalities. Indeed, if products are related in demand, when the price of one changes, it has repercussions on the other prices. Moreover, if two goods or services are produced by the same firm, that externality is internalized whereas, if they are not, the externality is not captured. This means that, in order to use those techniques to forecast the impact of merger–related incentives to change prices, one must have estimates of cross price elasticities, slopes of demand functions, or diversion ratios. As is discussed below, however, the two techniques differ in the number of those estimates that are required.

## 4.1 Upward Pricing Pressure

### 4.1.1 Horizontal Upward Pricing Pressure

The upward pricing pressure (UPP) measure due to Werden (1997) and Farrell and Shapiro (2010) is often used in the context of a horizontal merger. In fact, it is embedded in the 2010 DOJ and FTC Horizontal Merger Guidelines. The UPP is not a prediction of post–merger prices; instead, it predicts the direction of price changes – the incentive to change prices.

To illustrate the calculation of UPP, suppose that two firms, each producing one product, will merge. The net upward pricing pressure on product 1 is the price cost margin of product 2 times the diversion ratio from 2 to 1 minus the reduction in marginal cost of 1, where the

diversion ratio measures the effect on 2's sales that results from an increase 1's price. In other words, the diversion ratio is a measure of substitution between the two merging products, and upward pricing pressure measures the value of diverted sales that are associated with a horizontal merger, i.e., the value of the externality that was previously ignored.[10]

In practice, the gross upward pricing pressure index or GUPPI, which is easier to compute, is often used. That measure does not consider efficiency gains. It should be clear that both upward pricing pressure measures rise with 2's profit margin and with the degree of substitutability between the products, and if either is zero, there is no pressure.

UPP suffers from a number of shortcomings. For example, it does not consider the possibility that nonmerging firms will respond by changing prices. Furthermore, it does not incorporate the passthrough from cost to prices that depends on higher order properties of demand. Nevertheless, UPPs are simple to compute, they do not require information on nonmerging parties, and there is no need for market definition.

Garmon (2017) finds that UPPs are more accurate tools for flagging potentially anticompetitive mergers than traditional screening tools such as concentration indices. Furthermore, Miller, Remer, Ryan, and Sheu (2017) use Monte Carlo simulations to identify the circumstances under which UPPs yield accurate predictions of merger effects and conclude that UPPs are not less accurate than predictions from misspecified merger simulations or those that rely on imprecise demand elasticities.

### 4.1.2 Vertical Upward Pricing Pressure

Moresi and Salop (2013) propose analogs of the GUPPI, vGUPPIs, in the context of vertical mergers. Specifically, the vGUPPIu gauges the incentive to raise the *input price* that the upstream division of the merged firm charges *a targeted downstream rival*, the vGUPPIr gauges the incentive of the *targeted rival* to raise its *output price* in response to the higher input price, and the vGUPPId assesses the *downstream integrated division's* incentives to raise or lower its *output price* in response to a merger.

Of the three, the vGUPPIu is closest to the GUPPI and not surprisingly, calculation of the vGUPPIu is similar to that of the GUPPI. They differ, however, in that the two products are not substitutes, they are in an input/output relationship — product 1 is upstream and product 2 is downstream — and the diversion ratio is vertical. In particular, that vertical

[10] If each firm produces multiple products, there are matrices of diversion ratios and UPPs from $i$ to $j$.

diversion ratio is the fraction of the upstream firm's sales that are lost when it raises its price to the downstream rival that are gained by its integrated downstream division, and the vGUPPIu is an indicator of the upstream firm's unilateral incentive to increase its price.[11]

An increase in the upstream firm's price will raise the marginal cost of the targeted rival and the vGUPPIr captures the rival's response to that increase. For this reason the vGUPPIr is derived from the vGUPPIu. However, it also involves the cost passthrough rate of the upstream firm. Finally, the vGUPPId is similar to the upstream measure except for the fact that the diversion ratio is from 1 to 2 and it is multiplied by the upstream firm's margin. Moreover, it contains a term that captures the incentive to eliminate double marginalization.

A vertical GUPPI, while sharing the disadvantages of the horizontal GUPPI, looses some of its advantages. Specifically, there is now a need to have information on nonmerging firms – the targeted rivals that might be harmed – and one must decide which firms are targeted, which is similar to defining a market. In addition, whereas there is only one GUPPI, there are at least three vGUPPIs. Moreover, when there are multiple products, the GUPPI involves one matrix of diversion ratios but the vGUPPIu requires several matrices, one for the merged firm as well as for each targeted downstream rival. Finally, the vGUPPIr also needs a vector of cost passthroughs. The data and estimation requirements are therefore much higher.

With the vGUPPI model of Moresi and Salop (2013), the upstream firm moves first making take–it–or–leave–it offers to the downstream firms. Those firms then take their input prices as given when setting downstream prices. However, a number of researchers have discussed why, in many settings, bargaining between up and downstream firms makes more sense, particularly when there is substantial market power at both stages (e.g, Chipty and Snyder (199), Crawford and Yurukoglu (2012)). Moreover, in the context of a vGUPPI model, bargaining can lead to larges differences in predictions.

Rogerson develops a new competitive effect that arises when bargaining is introduced, which he calls the bargaining leverage over rivals (BLR) effect. The BLR effect occurs because a merger changes the disagreement payoff of the upstream firm when it negotiates with rival downstream firms. The disagreement payoff is now higher because it takes into account the increased profit that its downstream division will earn if the input is withheld from the rival. In contrast, the upstream firm's disagreement payoff is irrelevant when it has

[11] Both horizontal and vertical GUPPIs are often expressed as ratio of monetary values, i.e., in the case of the vGUPPIu, it is the value of sales diverted to the downstream merging partner divided by the value of sales lost by the upstream merging partner.

all of the bargaining power

Although it is possible to maintain the first mover assumption when bargaining is introduced, most researchers adopt the Nash–in–Nash bargaining model that is due to Horn and Wolinsky (1988). That model assumes simultaneous price setting up and downstream. In particular, Nash bargaining games take place upstream at the same time as a Bertrand Nash game occurs downstream and, in each stage, firms take the prices that are set in the other stage as given.

Rogerson (2019) explains why, if simultaneous price setting is assumed in the Moresi and Salop model, there is no raising Rivals' Costs (RRC) effect. This is true because, when negotiating over input prices, firms take downstream prices as given.

In the context of simultaneous price setting, Rogerson goes on to derive a simple formula for calculating the BLR. That formula is one minus the upstream firm's bargaining strength times the product of the downstream rival's margin (price minus marginal cost), the departure rate (the share of the downstream rival's customers that will leave if it does not carry the upstream product), and the diversion rate (the share of the downstream rival's customers that will shift to the downstream integrated division's product). Finally, he discusses how this formula was applied in the Comcast/NBCU merger.

In my view, vertical GUPPIs should not be used as screening tools, that is, as tools for deciding which mergers warrant further investigation. In particular, there are too many decisions to be made:. For example, one must decide on the number and identity of the rivals; the products are potentially disadvantaged; the geographic markets in which foreclosure or raising rivals' costs are likely to occur; the timing of moves, whether simultaneous or first mover; the link between up and downstream: whether bargaining or take–it–or–leave–it offers, and as I discuss in the next section, the need for simultaneous determination of RRC and elimination of double marginalization effects. Nevertheless, vertical GUPPIs can be useful for assessing contested mergers. Indeed, at that stage, a careful study of the markets and practices can be used to justify the assumptions.

My comments are especially applicable to mergers in the technology, media, and telecom sectors. Those mergers usually involve many products both up and downstream, some of which might be susceptible to foreclosure and others which might not be. Screening such complex transactions using vGUPPIs alone could be subject to many type 1 and 2 errors.

## 4.2 Merger Simulations

### 4.2.1 Horizontal Simulations

Unlike upward pricing pressure measures, horizontal merger simulations look at posmerger equilibria. In particular, whereas a GUPPI is evaluated at pre–merger prices, simulations compute post–merger equilibrium prices. Nevertheless, the two techniques are related. Specifically, with a horizontal pricing game, if there are $n$ products and $m$ firms, the $m$ agents choose the prices of the products that they own. A simulation solves the $n$ first order conditions for profit maximization to obtain the $n$ post–merger equilibrium prices. In contrast, a GUPPI evaluates the merger related increment to those first order conditions at pre–merger prices.

Consider a market where each of $n$ firms produces a single differentiated product and engages in Bertrand competition. Each firm will solve its own profit maximization problem, ignoring the effects that its decisions have on the profits of the other firms in the market. However, if firms 1 and 2 merge, the merged firm will capture the pricing externality from 1 to 2 and 2 to 1 but ignore the remaining ones. Since the products are substitutes, the externality will cause $p_1$ and $p_2$ to rise unilateraly.

The new prices will have second order effects on the prices of the nonmergerd products that will be smaller than the first order effects but still positive, and so on. Eventually, the market will settle down into a new equilibrium. Absent efficiencies, prices will rise post–merger by construction. The question, however, is by how much?[12]

A horizontal merger simulation has three components: i) a system of related demand equations, one for each product, ii) a set of marginal costs that are often assumed to be constant and to not change with the merger, and iii) an assumption about the game that the firms are playing (an equilibrium concept), often differentiated products Bertrand.

With those three components, it is possible to write down the profit function of each firm, both pre and post–merger. The $n$ first order conditions can then be solved to obtain post–merger equilibrium prices that can be compared to forecast or actual pre–merger prices. The difference between pre and post is that, if there are $m$ decision makers pre–merger, there are $m - 1$ afterwards.

A number of problems are associated with horizontal merger simulations. First, consider

[12] Early applications of horizontal merger simulations include Hausman, Leonard, and Zona (1994), Nevo (2000), Pinkse and Slade (2004) and Ivaldi and Verboven (2005).

demand. Simulations can be very sensitive to the specification of demand. For example, Cooke, Froeb, Tschantz, and Werden (1999) and Slade (2009) find that demand elasticities from one specification need not lie in the confidence region of those obtained from another.

Second, consider costs. There are several methods of obtaining marginal costs. However, the most popular is to retrieve them from first order conditions. Specifically, the researcher asks the question: given demand, what would costs have to have been to rationalize the equilibrium assumption? This means that, if either demand or the game is misspecified, the costs so obtained can be poor approximations to true costs. Furthermore, if marginal costs are not constant, they will vary with merger related changes in output, and that variation is not captured.[13] In addition, as with a UPP, if cost efficiencies are considered, they are most often obtained exogenously.

Third, consider the game. If the firms are playing a different game from the one that is assumed, price forecasts will be inaccurate. The most troubling possibility is that the game will change post–merger. For example, the market could become more collusive after the merger, a possibility that and Miller and Weinberg (2017) assess and find to be true after a beer joint venture.

Finally, retrospective analysis of horizontal mergers indicates that simulation models have not predicted well (Peters, 2006; Weinberg, 2011; Weinberg and Hosken, 2013; Bjornerstedt and Verboven, 2016). Nevertheless, a merger simulation that incorporates assumptions that are consistent with the market that is studied can be a useful tool.

### 4.2.2 Vertical Simulations

A primary goal of vertical merger simulation models is to assess how the tension between efficiency enhancement due to the removal of double marginalization and competitive harm due to foreclosure interact to determine the net welfare effect of a merger. Moreover, unlike upward pricing models, simulations calculate the equilibrium of the specified game.

As with upward pricing pressure, the extension of a horizontal merger simulation to a vertical merger involves a number of complications. First, a vertical simulation deals with two markets, one up and one downstream and must specify both up and down stream games.

Second, it must specify how the two links in the chain interact, and there are several possi-

[13] Grieco, Pinkse, and Slade (2018) consider endogenous merger–related cost changes that are due to nonconstant returns to scale and technology transfer.

bilities. For example, a simulation could consist of two horizontal Bertrand games with input prices to the downstream affiliate set at marginal costs, while prices that are charged unintegrated downstream rivals are determined by the upstream game. Alternatively, the interface could be a bargaining game with a separate negotiation for each upstream/downstream pair. Furthermore, with both possibilities, the integrated price need not be set at marginal cost, which might be the case if divisions of the integrated firm make separate pricing decisions.

Finally, timing is important. For example, upstream firms could set prices prior to the downstream game and therefore have first–mover advantages, or up and downstream prices could be determined simultaneously. Given that a vertical simulation involves additional assumptions, there are more places where it can be misspecified and thus lead to biased predictions.

Vertical merger simulations should have five components: i) a specification of *downstream* demand, ii) an assumption concerning the upstream horizontal or alternatively bargaining game, iii) an assumption concerning the downstream horizontal game, iv) an assumption about the timing of moves, and v) a method of obtaining marginal costs.

Merger simulations can be Monte Carlo or they can be econometric. With the first, researchers generate data from an assumed data generating process. In contrast, with the second, real world data is used. I discuss the first sort before turning to the second.

#### 4.2.2.1 *Monte Carlo Vertical Merger Simulations*

Das Varma and De Stefano (2018) critique the use of vGUPPIs, noting that, in applications, competition authorities have adopted a three stage process. First the authorities evaluate the foreclosure or raising rivals' costs effect (RRC), second the parties assess the elimination of double marginalization effect (EDM), and third the two are compared to see which is larger.[14] Das Varma and De Stefano argue that there is a problem with this practice. In particular, RRC is not independent of EDM but instead depends on it.

The intuition is as follows. When the price of the integrated downstream product falls due to EDM, the demand for the unintegrated downstream product shifts in. With most demand specifications, this changes the elasticity of rival demand with respect to the upstream input price. For example, with a linear (logit) specification, the inward shift makes demand more (less) elastic with respect to the upstream price, which can reverse (strengthen) the incentive

[14] This process is described in Rogerson (2014) and advocated in Shapiro (2019).

for RRC. The authors also show that the upstream firm's bargaining strength is another important determinant of RRC.

To illustrate the problem, Das Varma and De Stefano use Monte Carlo simulations in the context of an upstream monopolist and downstream duopolists. Downstream demand can be either linear and logit. Finally, they assess bargaining strengths of 1 (the upstream firm has all of the bargaining power), 0.75, and 0.5 in first–mover Nash bargaining games with each rival.

Their examples demonstrate that the merger related change in the equilibrium price that the integrated firm charges its targeted downstream rival, as well as the change in the average equilibrium retail price, can be negative as well as positive. Moreover, a sign reversal is more apt to occur when the price elasticity of rival demand is low and the diversion ratio from the rival to the vertically integrated firm is high. Finally, both prices are more sensitive to specification than the vGUPPI, which is always positive.[15]

Domenenko and Sibley (2018) also use Monte Carlo simulations and their context is similar to that of Das Gupta and De Stefano. However, they modify the latter's assumptions in two ways. First, they endogenize the timing assumption and find that the integrated firm prefers to be a first mover. Second, they assume that the upstream firm has all of the bargaining strength.

Their simulations show that, although the integrated downstream price always falls, both the input price that is charged the remaining rival and that rival's downstream price can rise or fall.. Moreover, both qualitative and quantitative predictions depend on the market share of the upstream firm prior to the merger as well as the demand specification.

Both authors caution against the use of vGUPPIs for merger screening. In particular, they note that the input price that is charged to the downstream rival can fall after a vertical merger and, in those situations, the predictions from a vGUPPIu will have the wrong sign. Moreover, Domnenko and Sibley show that sign reversals are more apt to occur when the premerger share of the downstream merger partner is small.

Although both horizontal and vertical GUPPIs consider only first order effects, with a horizontal merger second order effects are of the same sign and smaller than first order effects, whereas with a vertical merger second order effects can be opposite in sign and can

[15] Note that Das Varma and De Stefano consider only pricing externalities, not conventional efficiencies, which can lower prices in both horizontal and vertical mergers.

even dominate first order effects. Practitioners therefore face a dilemma between using a tool that is simple enough that it can be explained to people who are not familiar with the methods that are used to construct economic models and one that can capture all aspects of the market that could have important implications for consumer welfare.

Finally, Sheu and Taragin (2017) develop a general model with first mover Nash bargaining between the parties and logit demand downstream. Furthermore, they show how one can calibrate the model using data on prices, margins and market shares. Finally, they illustrate how the model can be used to simulate both horizontal and vertical mergers.

#### 4.2.2.1 *Econometric Vertical Merger Simulations*

Unfortunately, in contrast to the horizontal case where there is a large body of econometric work, econometric vertical merger models are scarce. Nevertheless, two recent structural econometric studies simulate vertical mergers.

The first, Crawford, Lee, Whinston, and Yurukoglu (2018), specifies and estimates a structural model of interactions between regional sports networks and programming distributors in US multichannel television markets. The authors assume a Nash in Nash equilibrium and they estimate a flexible discrete choice model of household selection of distributor. Finally, they use their model to simulate vertical mergers and divestitures.

They find that, in the more interesting case where foreclosure is not prohibited by the regulator, although positive on average, consumer welfare gains are not significantly different from zero. Moreover, they find considerable heterogeneity across sports networks, with foreclosure dominating for some types. In contrast, when regulations are in place, there is a significant welfare gain. This means that competition and regulatory agencies should work together. Moreover, behavioral remedies such as access rules, which are relatively easy to enforce, can be appropriate responses to many foreclosure problems.

A novel assumption of the research is that the internal transfer price to the downstream affiliate need not equal marginal cost. In particular, they estimate a parameter that determines the degree of internalization and find that divisions internalize most but not all of the profits of other units. Specifically, divisions internalize \$.79 of each dollar of profit realized by other integrated units.

The second structural econometric study, Cueata, Norton, and Vatter (2019), assesses interactions between private insurers and hospitals in Chile. The authors note that the fact

that consumers interact with both vertical links is an interesting feature of this and many other insurance markets. Specifically, customers choose an insurance plan and, when they become sick, they choose a hospital.

In such markets, there are two motives that lead integrated firms to negotiate higher prices with hospitals. First, integrated firms can steer demand to their integrated *insurers* by negotiating higher hospital prices with rival insurers. This is the standard raising rival's cost effect. Second they can steer demand towards their integrated *hospitals* by negotiating higher hospital prices with rival insurers. The authors call the standard motive the *enrollee steering effect* and the new motive the *patient steering effect*.

Cuesta et. al. assume that the equilibrium is Nash in Nash and they estimate two discrete choice demand equations, one for plans and one for hospitals. They then perform simulations that involve banning vertical integration.

The simulations show that steering effects of both sorts are significant in this market. In addition, this is one of a very few studies that conclude that vertical integration decreases welfare. However, when the authors experiment with counterfactual scenarios, they find that, when consumer price sensitivity is lower and premium sensitivity is higher, vertical integration can increase welfare

I conclude this section by emphasizing that tools that are often applied in the analysis of horizontal mergers, such as upward pricing pressure indices and merger simulations, become much more complex in a vertical context. Given this complexity and the resulting likelihood of inaccurate predictions, I think that one size fits all or other simple models will not be useful and that careful attention must be paid to the institutional details of the markets that are involved and how they interact.

Nevertheless, if properly applied, those tools can be useful complements to more traditional analysis of contested vertical mergers. In particular, the development of a case is a lengthy process, implying that authorities have time to study and industry and its institutions in depth.

# 5 Some Recommendations

Some vertical mergers are likely to be anticompetitive and competition authorities must have ways to separate them from the vast majority of mergers that should not cause concern.

Unfortunately, that is a difficult task and there has not been much guidance on how to proceed. However, on January 10 of this year the US Department of Justice and Federal Trade Commission released a draft of new Vertical Merger Guidelines for public comment. The new Guidelines would replace the 1984 Department of Justice Non–Horizontal Merger Guidelines, which were obsolete and have been withdrawn.

Unlike the old Guidelines, the new ones list market share thresholds for all markets involved in the merger, both up and downstream. Specifically, the agencies are unlikely to challenge a merger where the parties have less than 20 percent, and the product is used in less than 20 percent, of the relevant market. However, mergers in markets that are inside the safety zones can be challenged and those that fall outside of the safety zones will not necessarily be challenged. The zones are therefore a first cut at the analysis of a merger. Finally, the proposed methods for determining relevant markets are the same for vertical as for horizontal mergers and are this subject to all of the same pitfalls.

The EU Guidelines of 2008 also list concentration and market share thresholds that form safety zones. Furthermore, they list circumstances, such as the existence of significant cross-shareholding relationships, the fact that one of the firms is considered to be a maverick, and suspicion that coordination is ongoing, under which mergers that fall into those zones are more likely to be investigated.

Market shares and concentration indices have fallen out of fashion in merger analysis due to the fact that they are often poor predictors of margins, particularly in differentiated products markets.[16] Indeed, for that reason practitioners have turned to other measures, such as upward pricing pressure indices and simulations, to assess mergers in those markets.

Unfortunately, outside of commodity markets, which are usually in the energy, nonfuel mineral, and agricultural sectors, most products are differentiated, and virtually all mergers in the technology, media, and telecom sectors involve differentiated products. It is therefore imperative that methods that can be used to screen mergers in differentiated product markets be developed.

In spite of their deficiencies, I think that market shares and concentration indices should play a role in the initial screening process. Indeed, in order for harm to occur, the merged firm must be able to behave noncompetitively in some market. Furthermore, safety zones

[16] Slade (2004) concludes that, when products are homogeneous, concentration indices predict markups reasonably well.

do not preclude further investigation if warranted by other factors. However, other simple tests are required.

One possibility is that, for each post–merger unintegrated rival in each market, the question of where it can potentially obtain its supplies and/or where it can potentially sell its products, should be assessed. If in each market there will be viable sources of inputs and customers post merger, the merger is unlikely to cause concern. If not, however, further investigation is warranted.

Of course, it is preferable to have a complete set of demand elasticities and marginal costs, but that sort of information can probably only be obtained after a merger has been singled out for further investigation. In particular, the data required for econometric estimation is often not publicly available, in which case it has to be obtained from the parties.

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