UNILATERAL PRICE EFFECTS IN HORIZONTAL MERGERS WITH CAPACITY CONSTRAINTS

BY IGNACIO J. NÚÑEZ[1]

1 Email: inunez@crai.com. Charles River Associates, Competition & Antitrust Practice, 200 Clarendon Street, Boston, MA 02116, USA. The author thanks Martino De Stefano for helpful comments. The views expressed in this article are the views of the author only and do not necessarily represent the views of CRA, its affiliates, its employees or its clients.

CPI ANTITRUST CHRONICLE
April 2026

Visit www.competitionpolicyinternational.com for access to these articles and more!

UNILATERAL PRICE EFFECTS IN HORIZONTAL MERGERS WITH CAPACITY CONSTRAINTS

By Ignacio J. Núñez

This article reviews how capacity constraints affect unilateral price effects in horizontal mergers. When capacity constraints fall on merging firms, they mitigate price effects, whereas constraints on non-merging firms enhance price effects. Capacity constraints can be modeled as strict production limits, fuzzy acceptance, or upward marginal costs. Different models have different observable implications and data requirements, and can lead to different price effects. Guidance is provided to select the appropriate model given the available evidence.

I. INTRODUCTION

This article reviews how capacity constraints affect unilateral price effects and different modeling approaches to account for them. Agencies recognize that limited supply responses by non-merging rivals can intensify competitive concerns.[2] The economics literature also notes that constraints on the merging firms can reduce or eliminate pricing pressure.[3] In addition, capacity constraints can be modeled in different ways, which have different observable implications, data requirements, and predicted price effects.

The rest of this article is organized as follows. Section 2 reviews Upward Pricing Pressure (UPP) as a tool to assess unilateral price effects.[4] Section 3 discusses three modeling approaches to capacity constraints and how these affect UPP: strict capacity limits, fuzzy constraints, and upward-sloping marginal costs. Section 4 discusses how practitioners can identify capacity constraints in the data. Section 5 offers guidance on choosing the appropriate modeling approach given the available evidence. Section 6 concludes.

II. UPWARD PRICING PRESSURE

To understand how capacity constraints affect unilateral effects, it is useful to first recall the logic of UPP, which captures the first-order incentive to raise price post-merger. In a horizontal merger involving two firms — call them firms A and B — UPP on firm A reflects the value of sales diverted from firm A to firm B if firm A were to raise its prices. Indeed, before the merger, if firm A raised its prices it would lose sales to customers that switch to firm B or other alternatives in the market. Hence, pre-merger, firm A chooses prices that balance the higher profit from sales it continues to make at higher prices and the lost profit from sales diverted to firm B and other alternatives in the market. Following the merger, however, the sales diverted to firm B are not lost anymore, which makes a price increase by firm A more profitable and therefore creates an incentive to raise its price compared to pre-merger levels.[5]

UPP requires measuring two inputs: (i) the diversion ratio between the products of merging firms, and (ii) the margin earned by each merging firm on additional sales units. Formally, UPP on firm A is calculated as:

$$\mathrm{UPP_A} = (\mathrm{p_B} - \mathrm{c_B})\mathrm{D_{A,B}}$$

where p_B - c_B is firm B's pre-merger margin and $D_{A,B}$ is the diversion ratio from firm A to firm B, which equals the proportion of sales lost by firm A when it raises its price that is then recaptured by firm B.[6] The diversion ratio can be estimated using data from pricing experiments (if available), event studies, or econometric tools, among others. Margins are typically measured using accounting data and calculated as the difference between the average prices and accounting unit costs.[7]

III. MODELING APPROACHES TO CAPACITY CONSTRAINTS

Capacity constraints are limitations on firms' ability to serve additional customers. These limitations may come from physical infrastructure, limited labor, regulation, among other reasons. The economics literature usually models capacity constraints in one of three ways: strict capacity limits, fuzzy constraints, and upward-sloping marginal costs. This distinction matters in practice because different modeling assumptions can lead to different conclusions about the magnitude of unilateral price effects.

2 See 2023 FTC/DOJ Merger Guidelines, p. 38 ("[c]ompetition between merging firms is greater when [...] the supply responses of non-merging rivals are relatively small.").

3 See, for example, Froeb, L. M., Tschantz, S. T., and Crooke, P. S., "Bertrand Competition with Capacity Constraints: Mergers among Parking Lots," *Journal of Econometrics*, 113: 49–67, 2003.

4 Antitrust agencies in the U.S. recognize UPP as a useful screening tool to assess merging firms' unilateral incentives to increase prices following a merger. See, for example, 2023 FTC/DOJ Merger Guidelines, p. 37 ("The ratio of the value of diverted sales to the revenues lost by the first firm can be an indicator of the upward pricing pressure that would result from the loss of competition between the two firms.").

5 UPP approximates how pricing incentives change with a merger. Actual merger price effects also depend on strategic price responses by merging partners and non-merging rivals, cost efficiencies, and demand curvature (or pass-through rates), among other factors. See, for example: Farrell, J., and Shapiro, C., "Antitrust evaluation of horizontal mergers: An economic alternative to market definition," *B.E. Journal of Theoretical Economics,* 10(1), 2010; Hausman, J., Moresi, S., and Rainey, M., "Unilateral effects of mergers with general linear demand," *Economics Letters* 111(2), 119–121, 2011; Jaffe, S., and Weyl, E. G., "The First Order Approach to Merger Analysis," A*merican Economic Journal: Microeconomics*, 5 (4), 188–218, 2013.

6 UPP_A can be divided by firm A's pre-merger price to express it as a percent of firm A's price.

7 Merging parties are typically required to submit these data in a DOJ/FTC Second Request investigation.

A. Strict Capacity Constraints

Under strict capacity constraints, a firm cannot produce above a given maximum level. Therefore, the firm chooses its price taking into account that once its capacity (maximum level) is reached, there is no point in lowering its price to attract more customers. This approach is natural when industry facts speak of firms having hard production limits, such as competition between medical facilities with a fixed number of beds, parking lots with a fixed number of parking spaces, or hotels with a fixed number of rooms.

Suppose a horizontal merger involving two firms, A and B, which offer one differentiated product each, and consider firm A's pricing incentives before and after the merger. Strict-capacity models have three main implications for UPP. First, if firm A is constrained pre-merger, conventional (unconstrained) UPP for firm A can overstate the post-merger incentive to raise prices because some pricing pressure already existed before the merger.[8] In such cases, pre-merger prices may already reflect binding capacity constraints and be sufficiently high so that the merging firms would have low or no incentives to raise prices further. Second, if firm B is capacity constrained, conventional UPP on firm A would again overstate pricing pressure. This is because firm B could not recapture diverted sales from firm A, so the value of diverted sales to B is lower than conventional UPP assumes.[9] And third, if non-merging firms are constrained, the opposite force can arise, so conventional UPP understates pricing pressure. In this case, diverted sales to non-merging rivals could not materialize and would be sent back to the merging firms, making diversion between the merging firms higher than implied by demand alone.

B. Fuzzy Capacity Constraints

Unlike strict constraints, fuzzy constraints reduce the probability that new customers are served, therefore altering effective diversion ratios. Under fuzzy constraints, firms have a baseline capacity level beyond which they can continue serving new customers but not all of them. Hence, the firm accepts only a fraction of new customers and rejects the rest. Rejected customers then try their next-best alternative, and that alternative may itself be constrained.[10] For example, this modeling choice can be appropriate for medical facilities, where accepting new patients depends on the complex interplay between staff availability and discharges. Hence, at the time of choosing prices, facilities may only imperfectly forecast how many patients they can serve.

To provide intuition on how fuzzy constraints change conventional UPP, it is helpful to consider numerical examples. As before, consider a horizontal merger involving two firms, A and B, which offer one differentiated product each. Suppose further that, pre-merger, firms *A* and *B* charge prices equal to 100 each, and that *B*'s margin is 50 percent (i.e. $p_B - c_B = 50$).

Example 1 (No capacity constraints): Suppose a 1 percent increase in *A*'s price causes *A* to lose 100 customers, of which 20 switch to *B* and 80 switch to *C*. Then diversion from *A* to *B* is $D_{A,B} = 20/100 = 0.2$ and UPP on firm A is:

$$\mathrm{UPP_A} = (\mathrm{p_B} - \mathrm{c_B})\mathrm{D_{A,B}} = 50 \cdot 0.2 = 10.$$

That is, UPP on firm A is 10 percent of its pre-merger price (10% = 10/100).

Example 2 (Only merging partner B is constrained): Assume the same facts as in the previous example and suppose that *B* can accept only 25 percent of new customers, and rejected customers choose C next. Thus, only 25 percent of the 20 diverted customers are recaptured by *B*, so the effective diversion is $0.2 \cdot 0.25 = 0.05$. UPP is therefore reduced:

$$\mathrm{UPP_A} = 50 \cdot 0.25 \cdot 0.2 = 2.5.$$

Example 3 (Only non-merging rival C is constrained): Return to the baseline assumption where 's *A*'s 1 percent price increase initially sends 20 customers to *B* and 80 to *C*. Suppose *C* can accept only 25 percent of new customers, so it rejects 75 percent of the 80 customers, rejecting 60 customers. Further, suppose half of these rejected customers choose *A* and half choose *B* next, so 30 go to *A* and 30 to *B* as second-choice

8 See Neurohr, Benjamin, "Upward Pricing Pressure under Capacity Constraints, Kinked Demand and Other Cases of a Constrained Pre-Merger Equilibrium," E*conomics Letters* 139: 49–51, 2016. This paper derives an UPP adjustment when a pre-merger capacity constraint binds and post-merger prices are expected to become unconstrained.

9 See Greenfield, D., and Sandford, J. A., "Upward Pricing Pressure in Mergers of Capacity-Constrained Firms," *Economic Inquiry,* 59(4): 1723–1747, 2021. The authors of this paper show that firm A may raise its prices post-merger when firm B is capacity constrained. They extend UPP by allowing strict capacity constraints and allowing the prices of both merging firms to change post-merger. In this case, if firm A raises its price and diverts sales to firm B, and firm B is capacity constrained, then firm B may raise its price until it is just constrained again. This change in price by firm B increases its profit, which firm A internalizes post-merger and incentivizes it to increase its price.

10 See Núñez, Ignacio J., "Upward Pricing Pressure in Horizontal Mergers with Fuzzy Capacity Constraints," *Economics Letters,* 257: 112643, 2025. This paper introduces UPP calculations with fuzzy capacity constraints.

customers. Then the net changes are: *A* loses 100 - 30 = 70 customers, and *B* gains 20 + 30 = 50 customers. The effective diversion is therefore 50/70 ≈ 0.714 and UPP is therefore increased:

$$\mathrm{UPP}_{\mathrm{A}} = 50 \cdot (50/70) \approx 35.7.$$

C. Upward Sloping Marginal Costs

A third approach treats capacity constraints as soft constraints that make marginal cost rise as output is near or above capacity. This is often appealing because it captures the idea that firms can push beyond normal operating levels, but doing so becomes increasingly expensive (e.g. through overtime labor or using more costly materials).

The key implication of upward marginal costs is that firms' margins vary with output.[11] Again, suppose a horizontal merger involving two rival firms, A and B, which offer one differentiated product each. First, if firm A has upward marginal costs and raised its price, it would lose sales and its marginal cost would fall. In turn, a lower marginal cost increases firm A's margin, which mitigates its incentive to raise its price further because losing sales becomes more costly. Second, if firm B has upward marginal costs and gained diverted sales, its marginal cost would rise and its margin would shrink, which reduces the value of diverted sales from firm A and further weakens A's incentive to raise its price. Lastly, if non-merging rivals face upward-sloping costs, any diverted sales to them would lead these rivals to raise their prices by more than they would if marginal costs were constant. In turn, this can redirect demand back to the merging firms and enhance their incentives to increase their prices post-merger.

IV. HOW TO IDENTIFY CAPACITY CONSTRAINTS

To identify capacity constraints, begin by asking whether the industry relies on infrastructure or inputs that are difficult to expand quickly. Second, assess whether there is evidence that constraints are affecting pricing incentives. Relevant evidence includes facilities used at high utilization rates, observable customer rejections or waitlists, observed production that never exceeds a ceiling, or high prices or margins paired with unusually low output. The following evidence is particularly informative:

- ***Utilization data***: Plant utilization at or near practical limits. This may include occupancy rates, throughput rates, network utilization, labor availability, among others.
- ***Customer rejections***: The data may show unsuccessful attempts to buy a product or book service. Opportunity data may show lost business because of capacity limitations or no resources being available.
- ***Production ceilings***: Production data may show that a firm's production over time never exceeds a maximum level. Similarly, sales data may reveal that a firm's sales are capped over time, which may indicate that a strict capacity limit prevents the firm from increasing its production and sales.
- ***High pre-merger margins and low production***: Capacity constraints affect pre-merger outcomes as well. If a firm is heavily capacity constrained, then, all else equal, the firm should charge substantially higher prices (and therefore obtain higher margins), along with selling lower quantities than would otherwise prevail without the capacity constraint.

V. WHICH MODELING APPROACH FITS WHICH FACTS?

A strict capacity model is appealing due to its simplicity, relatively low data requirements, and for merging parties' advocacy, the possibility that the merger has no unilateral price effects. However, this approach has two main limitations: it does not explain customer rejections naturally if these exist;[12] and external estimates on firms' own-price elasticities are needed to infer pre-merger pricing pressure from the capacity constraints. A strict capacity model is most appropriate when there is evidence showing that production cannot and does not exceed fixed limits, and when customer rejections are rarely observed.

In contrast, a model with fuzzy constraints is more appropriate when customer rejections are observed and, at the same time, a firm's production and sales over time never seems to be capped by a maximum level. The main trade-off is the need to make additional assumptions

11 See Núñez, Ignacio J., "A Guide to Incorporating Capacity Constraints into Upward Pricing Pressure (UPP) Analysis," *SSRN Working Paper*, 2026, available at: https://ssrn.com/abstract=6336498 .This paper shows UPP calculations allowing for upward marginal costs.

12 With strict constraints, a firm would not reject customers explicitly but instead raise its price to profit from excess demand. Hence, firms' prices would be such that firms don't receive "too many" customers, so firms don't turn customers away.

about what customers are rejected, where these customers go next, and how much information customers have about capacity when making choices.

Lastly, a model with upward marginal costs is appealing because it captures the intuitive idea that firms can resort to more expensive strategies to increase production, if they wanted to, and because it does not require assuming maximum production limits. Nevertheless, as with strict capacities, upward marginal costs cannot explain customer rejections. Further, the researcher needs additional information, including how marginal costs would increase with production, which can be complex to estimate.

VI. CONCLUSIONS

Capacity constraints can either mitigate or amplify unilateral pricing incentives, depending on whether they fall on merging firms or rivals. There are different approaches to model capacity constraints, including strict capacity limits, fuzzy constraints, and upward-sloping marginal costs. The appropriate modeling choice should be guided by industry facts, including utilization rates of firms' facilities, evidence of customer rejections, production that never exceeds a maximum level, and unusually high pre-merger margins paired with low production.

CPI COMPETITION POLICY® INTERNATIONAL

CPI Subscriptions

CPI reaches more than 35,000 readers in over 150 countries every day. Our online library houses over 23,000 papers, articles and interviews.

Visit competitionpolicyinternational.com today to see our available plans and join CPI's global community of antitrust experts.