Economics Letters 195 (2020) 109429

Contents lists available at ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

On the welfare impact of mergers of complements: Raising rivals' costs versus elimination of double marginalization

Uğur Akgün [a], Cristina Caffarra [a], Federico Etro [b,a,*], Robert Stillman [a,1]

[a] Charles River Associates, United Kingdom
[b] University of Florence, Italy

ARTICLE INFO

Article history:
Received 28 April 2020
Received in revised form 13 July 2020
Accepted 17 July 2020
Available online 23 July 2020

JEL classification:
L1
L4
L5

Keywords:
Mergers
Raising rivals' cost
Complements
Antitrust

ABSTRACT

A common view in antitrust analysis is that mergers of complements can have raising rivals' costs and elimination of double marginalization effects, with the net effect on consumer welfare thus unclear. We revise this view in the context of a merger between a monopolist in one market and a duopoly producer of a complement good. With linear demand and imperfect substitutability, while such a merger increases the price of the monopolized component, elimination of double marginalization dominates any raising rivals' costs effects, increasing consumer welfare. We discuss a variety of extensions.

The impact on consumer welfare of mergers between producers of complement goods when there is competition in the markets for one or both goods is a recurrent topic in antitrust analysis. A common view is that while such mergers can create beneficial effects for consumers when they lead to the elimination of double marginalization (EDM effect), they can also harm consumers through raising rivals' cost (RRC) effects, and thus the net effect on consumer welfare is unclear.[2]

We reconsider this common view in examples where there is a monopolist in one market, duopolistic competition with product differentiation in the market for a second product that is used by consumers in 1-to-1 fixed proportions with the first product, and where the monopolist merges with one of the competing firms in the second market. These cases generate both EDM effects and RRC effects, but, contrary to what is commonly assumed in antitrust analysis, their magnitude is not independent. Moreover, in standard models of product differentiation, the impact of these mergers on consumer welfare is positive because the EDM effect limits and compensates the RRC effect by strengthening competition in final goods.

Our main example is based on a merger of complement goods under simultaneous price competition and a symmetric linear demand system with imperfect substitutability (as in Singh and Vives, 1984). The merged firm reduces the price of its final composite good (EDM effect). Due to strategic complementarities in prices, the price of the final composite good of the rival is also lower despite an increase in the price of the monopolized good (RRC effect) and this benefits consumers. Only in the limit case of perfect substitutability the effects of the merger on consumer surplus are neutral because the monopolist already extracts all the industry profits before the merger and the One Monopoly Profit Theorem sets in. In the opposite case where the goods are independent there are no RRC effects to counter the EDM effect. In all intermediate cases with this demand system, the merger *reduces* the total price paid by consumers for the two complements (regardless which of the duopoly products is purchased), with the net downward effect being larger when there is less substitutability between the competing goods. This suggests that, contrary to a related widespread view in antitrust analysis, mergers of complements when there is a monopolist in one of the markets tend to be more beneficial for consumers when competition in the duopoly market is weaker and pre-merger profit margins are higher (see Inderst and Valletti, 2011, for a related point).

* Correspondence to: Florence School of Economics and Management, Via delle Pandette 32, Florence, 50127, Italy.
E-mail address: federico.etro@unifi.it (F. Etro).

1 We are thankful to Serge Moresi and Helen Weeds for helpful discussions. The usual disclaimer applies.

2 The EDM insight goes back to Spengler (1950) while the RRC insight goes back to Salinger (1988), Ordover et al. (1990) and others. The common view that the net effect of mergers of complements requires weighing EDM effects against RRC effects is reflected in the vGUPPI analysis developed by Moresi and Salop (2013) and in the EU and US guidelines for assessment of vertical mergers.

https://doi.org/10.1016/j.econlet.2020.109429

We show that these results hold also under demand asymmetries if the monopolist can set differentiated prices for the two composite goods, and we discuss extensions concerning the role of entry and input substitution (as in Choi, 2008). Moreover we relate our findings to recent models of vertical mergers with sequential pricing. As noticed by Lu et al. (2007), Arya et al. (2008), Domnenko and Sibley (2019) and Das Varma and De Stefano (2020) a merger between an upstream monopolist and one of two competing downstream producers (served by the same monopolist) is also beneficial for consumers under linear demand, but a crucial difference is that such a vertical merger does not create any RRC effect (see also Moresi and Schwartz, 2017).

Our results extend also to standard models of product differentiation with heterogeneous agents. In a vertical differentiation model, we show that a merger of the monopolist with the high-quality duopoly producer has a neutral effect on prices, while a merger with the low-quality producer leads to a lower price of the low-quality good thereby improving consumer welfare.

1. A model of merger of complements

The composite goods 1 and 2 are sold at final prices P_i facing demand functions $Q_i = Q_i(P_i, P_j)$ for $i, j = 1, 2$, decreasing in the own price and increasing in the other price. Each good requires two components that are perfect complements. There are three firms, for simplicity without costs. Firms 1 and 2 sell two substitute components at prices p_i for $i = 1, 2$ and the monopolistic firm 3 sells the complement component at price w, so that the final prices of the two goods $i = 1, 2$ are $P_i = w + p_i$.[3] The profits of the three firms are:

$$\pi_1 = Q_1(P_1, P_2)p_1$$
$$\pi_2 = Q_2(P_2, P_1)p_2$$
$$\pi_3 = [Q_1(P_1, P_2) + Q_2(P_2, P_1)]\, w$$

All three firms set prices p_1, p_2 and w simultaneously and we analyze the impact of a merger between either firm 1 or 2 and the monopolistic firm 3.

Notice that the alternative situation in which the monopolist provides a component only for good 1, while firm 2 produces both components for good 2 is widely considered in antitrust analysis.[4] Differently, here we consider a situation where the component of firm 3 "serves" both duopolists and the merger generates both EDM and RRC effects with a net impact that is usually regarded as a "horse race" between the two effects. Indeed, at this level of generality, we cannot exclude that the merger could generate an increase of the final price of the non-merging firm with an ambiguous impact on consumer welfare. However, our purpose is to show that common microfoundations of the demand system exclude this possibility.

2. Mergers under product differentiation with linear demand

Consider a representative consumer with symmetric quasilinear quadratic preferences and inverse demand $P_i = \alpha - Q_i - \gamma Q_j$ where $\alpha > 0$ and $\gamma \in [0, 1]$ parametrizes substitutability, which is null for $\gamma = 0$ and perfect for $\gamma \to 1$, so that the direct demand is:

$$Q_i(P_i, P_j) = \frac{1}{1+\gamma}\left[\alpha - \frac{1}{1-\gamma}\left(P_i - \gamma P_j\right)\right]$$

as in Singh and Vives (1984). The profits are:

$$\pi_1 = \frac{\alpha - \frac{1}{1-\gamma}(P_1 - \gamma P_2)}{1+\gamma} p_1$$
$$\pi_2 = \frac{\alpha - \frac{1}{1-\gamma}(P_2 - \gamma P_1)}{1+\gamma} p_2$$
$$\pi_3 = \frac{2\alpha - P_1 - P_2}{1+\gamma} w$$

Pre-merger, the best response functions are:

$$p_i\left(p_j, w\right) = \frac{(1-\gamma)(\alpha - w) + \gamma p_j}{2} \quad \text{and} \quad w\left(p_1, p_2\right) = \frac{2\alpha - p_1 - p_2}{4}$$

providing equilibrium prices:

$$w = \frac{\alpha}{3-\gamma} \qquad P_1 = P_2 = \frac{2-\gamma}{3-\gamma}\alpha$$

Notice that the equilibrium exhibits double marginalization for both goods, except for the extreme case of perfect substitutability in which firm 3 collects the full monopolistic profits of the industry and firms 1 and 2 make no profits. The equilibrium profits are:

$$\pi_1 = \pi_2 = \frac{(1-\gamma)\alpha^2}{(1+\gamma)(3-\gamma)^2}$$
$$\pi_3 = \frac{2\alpha^2}{(1+\gamma)(3-\gamma)^2}$$

After the merger between firm 3 and, say, firm 1, the merged entity sets:

$$p_1\left(p_2, w\right) = \frac{(1-\gamma)(\alpha - 2w) + \gamma p_2}{2} \quad \text{and} \quad w\left(p_1, p_2\right) = \frac{2\alpha - 2p_1 - p_2}{4}$$

which provides the best-response functions:

$$p_1^M\left(p_2\right) = \frac{p_2}{2} \quad \text{and} \quad w^M\left(p_2\right) = \frac{\alpha - p_2}{2}$$

while the best-response of the non-merging firm is unchanged. The new equilibrium prices are:

$$w^M = \frac{(2+\gamma)\alpha}{6} \geq w \quad P_1^M = \frac{\alpha}{2} \leq P_1 \quad P_2^M = \frac{(4-\gamma)\alpha}{6} \leq P_2$$

The RRC effect of the merger is present, but its impact is "elusive" in the sense that the merger ultimately leads to a lower final price also for the non-merging firm, namely a *Reducing Rivals' Price* effect. Nevertheless, the merger increases the joint profits of the merging firms to:

$$\pi^M = \frac{(13+5\gamma)\alpha^2}{36(1+\gamma)}$$

and hurts the non-merging firm reducing its profits to:

$$\pi_2^M = \frac{(1-\gamma)\alpha^2}{9(1+\gamma)}$$

To understand the rationale for this result, notice that there is no shift in the merged entity's optimal choice of w against pre-merger equilibrium levels of p_1 and p_2, i.e. there is not a first order incentive to raise rival's cost. However, the RRC effect occurs as a reaction to the reduction in non-merging firm's price. The merged entity reduces the final price of its good (EDM effect) and, due to strategic complementarity, the non-merging firm reacts by reducing also the price of its component. It is this reaction

[3] The assumption of a common price by the monopolist reflects contexts where it is not possible to price discriminate between consumers based on which complement product they purchase. This assumption prevents the monopolist to optimally differentiate prices before the merger, but this is not an issue with full symmetry.

[4] In such a case, the impact of mergers is well understood: a merger of firms 1 and 3 would create an EDM effect reducing both final prices and benefiting consumers, while a merger of firms 2 and 3 would create an RRC effect increasing both final prices and hurting consumers.

that induces the merged entity to increase the component price. Only in case of independent goods ($\gamma = 0$) the EDM effect fails to impact the price of the non-merging firm. With imperfect substitutability despite the RRC effect the merger reduces the final price of the rival good because the slope of $w^M(p_2)$ is larger than -1. This strengthening of competition is what generates a positive impact of the merger on consumer surplus.[5] Only in case of perfect substitutability ($\gamma = 1$), all prices remain the same as before the merger: in such a case the One Monopoly Profit Theorem applies, and the merger is neutral. Accordingly, and contrary to a widespread view, more substitutability generates at the same time higher margins for the monopolist and lower benefits from the merger for consumers.[6]

2.1. Demand asymmetries

With asymmetries in the demands of the goods, when the monopolist is constrained to set a common price, pre-merger it cannot optimally differentiate prices across consumers purchasing different goods. The merger allows such price discrimination, generating an ambiguous impact on consumer welfare when pre-merger the discriminatory price for the monopolized component would be higher for use with the non-merging component. Nevertheless, we now show that if we allow the monopolist to set different prices w_1 and w_2 for its component depending on the provider of the complement component, so that the price of good i = 1, 2 is $P_i = w_i + p_i$, the merger always benefits consumers.

With asymmetries our earlier inverse demand becomes $P_i = \alpha_i - \beta_i Q_i - \gamma Q_j$, and the direct demands are given by:

$$Q_i(P_i, P_j) = \frac{(\alpha_i - P_i)\beta_j - \gamma\left(\alpha_j - P_j\right)}{\beta_i\beta_j - \gamma^2}$$

We restrict our analysis to $\gamma \geq 0$ so that when $\alpha_1 = \alpha_2$, $\gamma^2/\beta_1\beta_2$ captures the degree of substitutability ranging from zero (when $\gamma = 0$ and the goods are independent) to one (when $\gamma = \beta_1 = \beta_2$ and the goods are perfect substitutes).

Pre-merger the best response functions become:

$$p_i\left(w_i, p_j + w_j\right) = \frac{(\alpha_i - w_i)}{2} + \frac{\gamma\left(\alpha_j - w_j - p_j\right)}{2\beta_j} \quad \text{and} \quad w_i(p_i) = \frac{\alpha_i - p_i}{2}$$

leading to:

$$w_i = \frac{\beta_i\left(3\alpha_i\beta_j + \alpha_j\gamma\right)}{9\beta_1\beta_2 - \gamma^2} \quad P_i = \frac{\alpha_i\left(6\beta_1\beta_2 - \gamma^2\right) - \alpha_j\beta_i\gamma}{9\beta_1\beta_2 - \gamma^2}$$

The merged entity sets:

$$P_1^M = \frac{\alpha_1}{2} \leq P_1$$

and its best response for the other price remains:

$$w_2^M(p_2) = \frac{\alpha_2 - p_2}{2}$$

leading to:

$$w_2^M = \frac{2\alpha_2\beta_1 + \alpha_1\gamma}{6\beta_1} \geq w_2 \quad P_2^M = \frac{4\alpha_2\beta_1 - \alpha_1\gamma}{6\beta_1} \leq P_2$$

confirming the earlier results. Because the pre-merger prices of the monopolized component reflects the price discrimination incentives the same mechanism as in the symmetric demand case with a common price for the monopolized component operates. In particular, against the pre-merger p_2 the merged firm reduces price of its composite good but does not change the price it charges for its component in the rival composite good.[7] At equilibrium this price increases only because p_2 reduces and, therefore, the equilibrium prices of the composite goods are lower than their premerger levels and consumers benefit from the merger.

2.2. Entry

Next, we investigate the role of entry and differentiation in the monopoly market under the baseline model. Consider that the monopolist faces potential entry of a rival producing a substitute component at a positive marginal cost. With perfect substitutability if the competitive constraint is binding before the merger, the monopolist must set its price just below the cost of the rival and post-merger keep the same price not to lose sales of that component for the rival composite good. Then, there is only the EDM effect and the merger benefits consumers.[8]

When the monopolist produces two differentiated varieties of the component there are four possible combinations of composite goods. Using the linear demand system of Choi (2008), a merger of the monopolist with one of the producers of the other component still reduces all final prices, as in our baseline example. However, as already shown by Choi (2008), when there are two competing firms providing the two varieties, the merger of one of them with one of the producers of the complement can harm consumers when substitutability between composite goods is high.[9] This result resonates well with our earlier findings: not only more substitutability between goods, but also more competition in the monopolized component make it less likely that a merger of complements will benefit consumers. The RRC effect can dominate with additional goods because RRC incentives between goods for which the merged firm supplies only one component come into play and there are no EDM effects to neutralize those.[10]

2.3. Comparison with a vertical merger

Consider the baseline example under sequential competition where first the input price w is set and then downstream competition takes place. This turns the merger of the upstream monopolist and one of the downstream firms into a vertical merger. The first-mover advantage for the monopolist strengthens the beneficial effect of the merger on consumers because pre-merger the double marginalization problem is amplified leading to a

[5] Notice that full foreclosure never takes place in this model (without fixed costs), since the production of the non-merging firm decreases from $Q_2 = \frac{\alpha}{(3-\gamma)(1+\gamma)}$ to $Q_2^M = \frac{\alpha}{3(1+\gamma)}$.

[6] Similarly, Inderst and Valletti (2011) criticize the common view that low upstream margins and high downstream margins are likely to generate harmful mergers arguing that the source of different margins matters.

[7] The best response function determining w_2 does not change due to the merger.

[8] Nevertheless, entry can exert additional effects on endogenous investments by the monopolist and the rival producers of final goods (see Etro, 2019).

[9] In Choi (2008) the demand for a composite good with components of varieties $i, j = 1, 2$ and $k, l = 3, 4$ is $P_{ik} = \alpha - Q_{ik} - \gamma(Q_{jk} + Q_{il} + Q_{jl})$. The merged firm adopts mixed bundling, reducing the price of the composite good including both its products, and increasing the prices of its standalone products, while the non-merging firms set a unique price for their standalone products. The merger harms consumers in case of low substitutability (high γ). We have verified that the result holds also when the non-merging firms charge different prices for their components for different composite goods.

[10] We should remark that all these models rely on perfect complementarity of the components of each good. With one monopoly good that is a complement to two goods that are imperfect substitutes to each other the merger between the monopolist and one of the other suppliers generates only EDM effects. In the vertical version, imperfect complementarity would amount to downstream suppliers having access to an imperfect substitute to the input controlled by the monopolist and a merger would be less likely to lead to an increase in the price of the input to the downstream rival.

stronger EDM effect and intensification of competition due to the merger (Lu et al. 2007). Pre-merger the equilibrium input price is:

$$w = \frac{\alpha}{2}$$

which is higher compared to the case of simultaneous pricing, and the vertical merger reduces the equilibrium input price to:

$$w^M = \frac{(8+\gamma^3)\alpha}{2\left(8+\gamma^2\right)}$$

Accordingly, there is no RRC effect in this kind of vertical merger, both final prices fall and consumers benefit (see Arya et al., 2008, for a discussion of the asymmetric case in a related context).

3. Mergers under vertical differentiation

To verify that our results extend to other frameworks, let us consider consumers with heterogeneous preferences over vertically differentiated goods. Consumers of type θ have utility:

$$U(\theta) = 1 - P_i + q_i\theta$$

from purchasing good $i = 1, 2$ of quality q_i at total price $P_i = w + p_i$, and zero utility otherwise. We assume $q_1 > q_2 \geq 1$. The preference parameter θ is uniformly distributed on the unit interval. Given the cut-offs $\theta_1(P_1, P_2) = \frac{P_1 - P_2}{q_1 - q_2}$ and $\theta_2(P_2) = \frac{P_2 - 1}{q_2}$ the profits are:

$$\pi_1 = [1 - \theta_1(P_1, P_2)]\, p_1$$
$$\pi_2 = [\theta_1(P_1, P_2) - \theta_2(P_2)]\, p_2$$
$$\pi_3 = [1 - \theta_2(P_2)]w$$

Pre-merger prices are:

$$w = \frac{2q_1 + q_2 + 3q_1q_2}{6q_1} \quad P_1 = \frac{1+q_1}{2} \quad P_2 = \frac{4q_1 - q_2 + 3q_1q_2}{6q_1}$$

implying higher price (and higher markup) for the higher quality good. The equilibrium profits of the firms in function of the quality levels q_1 and q_2 can be computed as follows:

$$\pi_1 = \frac{(1+3q_1)^2(q_1 - q_2)}{36q_1^2}$$
$$\pi_2 = \frac{q_1 - q_2}{9q_1q_2}$$
$$\pi_3 = \frac{(2q_1 + q_2 + 3q_1q_2)^2}{36q_1^2q_2}$$

The profits of the high (low) quality firm are increasing (decreasing) in its own quality, but the profits of the monopolist are decreasing in the high quality level and increasing in the low quality level, due to the direct and indirect effects of quality on the size and elasticity of its demand.

A merger of the monopolist with the high-quality firm is neutral on prices. Since the individual profits of the two merging firms are not affected by each other's strategies, the merger cannot change their choices or those of the non-merging firm. This neutrality result relies crucially on the assumption that the monopolist must set a common price on purchases of both goods, which eliminates any impact of the price of the monopolized component on the competition between firms for the marginal customer.

A merger of the monopolist with the low quality firm is not neutral. When prices are required to be non-negative, the merged entity raises the cost of the monopolized component to:

$$w^M = \frac{1+q_2}{2}$$

reducing its own good's final price to:

$$P_2^M = \frac{1+q_2}{2}$$

and leaving unchanged the final price of the non-merging firm at:

$$P_1^M = \frac{1+q_1}{2}$$

Therefore, the merger benefits consumers who buy low quality post-merger while keeping consumers who buy high quality post-merger no worse-off.[11]

4. Conclusion

We have shown that the impact on consumers of a merger between a monopolist and a producer of a complement good in competition with others is positive in standard models of competition with product differentiation. This happens even if the merger generates a raising rivals' cost effect, and the reason is that the elimination of double marginalization strengthens competition, which creates benefits for consumers. It would be important to extend the analysis to multiple firms and more general demand systems.

References

Arya, A., Mittendorf, B., Sappington, D.E.M., 2008. Outsourcing, vertical integration, and price vs. quantity competition. Int. J. Ind. Organ. 26 (1), 1–16.
Choi, J.P., 2008. Mergers with bundling in complementary markets. J. Ind. Econ. 56 (3), 553–577.
Das Varma, G., De Stefano, M., 2020. Equilibrium analysis of vertical mergers. Antitrust Bull. 1–14.
Domnenko, G., Sibley, D.S., 2019. Simulating Vertical Mergers and the Vertical GUPPI Approach. Mimeo, University of Texas at Austin.
Etro, F., 2019. Mergers of complements and entry in innovative industries. Int. J. Ind. Organ. 65 (C), 302–326.
Inderst, R., Valletti, T., 2011. Incentives for input foreclosure. Eur. Econ. Rev. 55 (6), 820–831.
Lu, S., Moresi, S., Salop, S.C., 2007. A Note on Vertical Mergers with an Upstream Monopolisti: Foreclosure and Consumer Welfare Effects. Mimeo, Charles River Associates.
Moresi, S., Salop, S.C., 2013. vGUPPI: Scoring unilateral pricing incentives in vertical mergers. Antitrust Law J. 79, 185–214.
Moresi, S., Schwartz, M., 2017. Strategic incentives when supplying to rivals with an application to vertical firm structure. Int. J. Ind. Organ. 51, 137–161.
Ordover, J.A., Saloner, G., Salop, S.C., 1990. Equilibrium vertical foreclosure. Amer. Econ. Rev. 80 (2), 127–142.
Salinger, M., 1988. Vertical mergers and market foreclosure. Q. J. Econ. 103 (2), 345–356.
Singh, N., Vives, X., 1984. Price and quantity competition in a differentiated duopoly. J. Econom. Theory 15 (4), 546–554.
Spengler, J.J., 1950. Vertical integration and antitrust policy. J. Polit. Econ. 58 (4), 347–352.

[11] With no common price requirement for the monopolized component, pre-merger the monopolist would set a higher price for use with the high quality good so the merger benefits also consumers who post-merger buy the high quality good. In a vertical merger (with either downstream firm) the input price to rival would decrease and final prices of both goods would reduce.