Economics Letters 208 (2021) 110050

Contents lists available at ScienceDirect

Economics Letters

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

There may be no pass through of a merger-related cost efficiency

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ARTICLE INFO

Article history:
Received 28 July 2021
Received in revised form 15 August 2021
Accepted 18 August 2021
Available online 25 August 2021

Keywords:
Merger
Efficiency
Pass through

ABSTRACT

When it is uncertain that a merger will have a cost-reducing efficiency and, should it materialize, the efficiency is private information to the merged firm, equilibrium prices may be at a level corresponding to the absence of the efficiency. In that case, none of the efficiency is passed to consumers.

1. Introduction

Given that a horizontal merger would remove a competitor from the market, the default assessment when the involved firms are not small is that consumers would be harmed due to higher prices. What may prevent harm is that there are efficiencies associated with the merger which will (at least partially) be passed through to consumers. However, as noted by U.S. competition authorities: "Efficiencies are difficult to verify and quantify, in part because much of the information relating to efficiencies is uniquely in the possession of the merging firms. Moreover, efficiencies projected reasonably and in good faith by the merging firms may not be realized".[1] Approval of a merger based on claimed efficiencies can then be problematic because the claims may not be genuine and, even if they are genuine, there is uncertainty as to whether they will be realized. Finally, there is the estimation challenge of determining how much of a cost reduction would be passed through to prices.[2] This paper shows how the situation may be more precarious than just described in that even if there is an efficiency there could be zero pass through to prices.

Suppose the merger parties claim there will be an efficiency that lowers the marginal cost of production. Suppose the claim is legitimate but there is uncertainty as to whether and when it would be realized. If the merger were to occur, it is very unlikely the efficiency would immediately materialize for presumably it only occurs with a restructuring of the production process or a change in contractual arrangements. As the reduction in competition is not so delayed, higher prices are initially expected.[3] If, subsequently, the efficiency occurs, it is likely to be private information to the merged firm. In response to now having lower marginal cost, the merged firm will consider lowering its price. It will realize, however, that the lower price would lead its competitors to infer that there was an efficiency and, therefore, that the merged firm would continue to charge lower prices in the future. Such a belief would cause the merged firm's competitors to decrease their prices. In light of the prospect of competitors reducing their prices, the merged firm may decide to continue to price "as if" there was no efficiency. If this situation should occur, the realization of the efficiency would not lower prices and, consequently, the merger would harm consumers.

The purpose of this paper is to offer a rigorous analysis substantiating this description of post-merger anti-competitive conduct. Assuming there is uncertainty about whether and when the merger will produce an efficiency and that its realization is private information to the merged firm, an equilibrium is shown to exist for which prices are those corresponding to competitive prices in the absence of the efficiency. As discussed in the final section, we do not take this finding as cause to dismiss efficiency claims but rather as an argument for why competition authorities should add ex post merger evaluations to their tool kit and, in particular, to make such an evaluation part of a merger approval decision when sufficient pass through of a claimed efficiency is essential to avoiding consumer harm.[4]

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[1] Horizontal Merger Guidelines of the U.S. Department of Justice and the Federal Trade Commission (August 19, 2010), p. 30.

[2] Assuming static models of oligopolistic competition, the answer depends on properties of the firm demand function. The interested reader is referred to Miller et al. (2016) and references cited therein.

[3] Kim and Singal (1993) show that higher prices due to reduced competition can occur even prior to the consummation of the merger.

[4] From a broader perspective, Katz and Shelanski (2007) discuss and critique the treatment of uncertainty about the post-merger environment during a merger evaluation.

https://doi.org/10.1016/j.econlet.2021.110050
0165-1765/

2. Model

Consider a market right after a merger and, for notational simplicity, assume there are just two firms: firm m (for merged) and firm nm (for non-merged).[5] Let $\pi_m(p_m, p_{nm}, c_m)$ be the profit of the merged firm and $\pi_{nm}(p_{nm}, p_m)$ be the profit of the non-merged firm where p_m and p_{nm} is the price of the merged firm and non-merged firm, respectively. $c_m \in \{c-e, c\}$ is the merged firm's cost where $c > 0$ and $e \in [0, c)$. c is the merged firm's cost without the efficiency and e is the reduction in cost due to the merger-related efficiency.

Assuming differentiated products, standard assumptions are made on firms' profit functions. A firm's profit function is twice differentiable, strictly quasi-concave in its own price, and decreasing in the rival firm's price. Define a firm's best response function:

$$\phi_m(p_{nm}, c_m) \equiv \arg\max_{p_m} \pi_m(p_m, p_{nm}, c_m)$$
$$\phi_{nm}(p_m) \equiv \arg\max_{p_{nm}} \pi_{nm}(p_{nm}, p_m),$$

and assume they are increasing in the other firm's price and $\phi_m(p_{nm}, c_m)$ is increasing in c_m. Nash Equilibrium prices are:

$$p_m^*(c_m) = \phi_m\left(p_{nm}^*(c_m), c_m\right)$$
$$p_{nm}^*(c_m) = \phi_{nm}\left(p_m^*(c_m)\right),$$

and are assumed to be increasing in c_m. Hence, the efficiency results in lower prices:

$$p_m^*(c) > p_m^*(c-e), \quad p_{nm}^*(c) > p_{nm}^*(c-e).$$

The horizon is infinite and firms have a common discount factor $\delta \in (0, 1)$. We will let $\left\{\left(p_m^t, p_{nm}^t\right)\right\}_{t=1}^{\infty}$ denote the sequence of prices. At the start of the post-merger environment, firms are uncertain as to whether there is a merger-related efficiency and, if there is, when it will materialize. More specifically, in each period there is a probability $\theta \in (0, 1)$ that the merged firm's cost is permanently reduced to $c-e$.[6] The realization of that event is private information to the merged firm. A strategy for the merged firm maps from the history of prices and its current cost into the set of prices, while a strategy for the non-merged firm maps from the history of prices into the set of prices. The solution concept is perfect Bayes–Nash Equilibrium (PBNE).

There is previous work that allows for uncertainty or private information about a merger-related efficiency. Modelling the pre-merger evaluation process, Lagerlöf and Heidhues (2005) and Cosnita and Tropeano (2009) assume the efficiency is known to the merger parties but not to the competition authority. The efficiency is unknown to all parties prior to the merger but is public information after the merger in Choné and Linnemer (2008) and Cunha et al. (2014). In the context of a one-period post-merger model, Stennek (2003), Banal-Estañol (2007), Zhou (2008), Amir et al. (2009) Hamada (2012), and Sawaki (2015) assume the informational structure of this paper: the efficiency is private information to the merged firm and unknown to the non-merged firm. However, with a single period, there is no scope for signalling in the post-merger environment which will be crucial to our analysis. The one exception is a brief consideration of a two-period model in Amir et al. (2009). There is also work in the context of a multi-period oligopoly setting where cost is private information; see Mailath (1989), Mester (1992), Athey and Bagwell (2008), and Bonatti et al. (2017). Those models consider a different informational structure and are less well-suited to examining the discrete event of a merger-related efficiency.

3. Equilibrium

The contribution of this study is a possibility result: it is consistent with equilibrium for a merger-related cost efficiency to result in zero pass through to prices (under general demand conditions). Theorem 1 provides a sufficient condition for equilibrium prices to correspond to when the merged firm's cost is c even when it realized the efficiency and has a cost of $c-e$.

Theorem 1. *If*

$$\left(\frac{\delta}{1-\delta}\right)\left(\pi_m(p_m^*(c), p_{nm}^*(c), c-e) - \pi_m(p_m^*(c-e), p_{nm}^*(c-e), c-e)\right) \geq \pi_m(\phi_m(p_{nm}^*(c), c-e), p_{nm}^*(c), c-e) - \pi_m(p_m^*(c), p_{nm}^*(c), c-e) \quad (1)$$

then there exists a PBNE for which $\left(p_m^t, p_{nm}^t\right) = \left(p_m^*(c), p_{nm}^*(c)\right)$ $\forall t$.

Proof. Consider a strategy that has the merged firm price at $p_m^*(c)$ as long as it has never priced below that level, and it prices at the myopic best response to the non-merged firm pricing at $p_{nm}^*(c-e)$ otherwise:

$$p_m^1 = p_m^*(c) \; \forall c_m \in \{c-e, c\}$$
$$p_m^t = \begin{cases} p_m^*(c) & \text{if } p_m^\tau \geq p_m^*(c) \; \forall \tau \in \{1, \ldots, t-1\}, \\ & \forall c_m \in \{c-e, c\} \\ \phi_m\left(p_{nm}^*(c-e), c_m\right) & \text{if } p_m^\tau < p_m^*(c) \\ & \text{for some } \tau \in \{1, \ldots, t-1\}. \end{cases}$$

Thus, on the path induced by this strategy, the two merged firm types pool on a price of $p_m^*(c)$. The non-merged firm's strategy has it price at $p_{nm}^*(c)$ as long as the merged firm has never priced below that level, and it prices at $p_{nm}^*(c-e)$ otherwise:

$$p_{nm}^1 = p_{nm}^*(c)$$
$$p_{nm}^t = \begin{cases} p_{nm}^*(c) & \text{if } p_m^\tau \geq p_m^*(c) \; \forall \tau \in \{1, \ldots, t-1\} \\ p_{nm}^*(c-e) & \text{if } p_m^\tau < p_m^*(c) \text{ for some } \tau \in \{1, \ldots, t-1\}. \end{cases}$$

Finally, the non-merged firm beliefs are:

- If $p_m^\tau \geq p_m^*(c) \; \forall \; \tau = 1, \ldots, t-1$ then $c_m^t = c$ with probability $(1-\theta)^t$.
- If $p_m^\tau < p_m^*(c)$ for some $\tau \leq t-1$ then $c_m^t = c-e$ with probability one.

Note that these beliefs are consistent. Given the merged firm's strategy, the implied path is $p_m^t = p_m^*(c) \; \forall t, \forall c_m \in \{c-e, c\}$. Hence, prices provide no information about the merged firm's cost so belief consistency requires that the non-merged firm assigns probability $(1-\theta)^t$ to $c_m^t = c$. Belief consistency imposes no structure on beliefs for all other price histories. I have assumed that when the price path is always at least as great as $p_m^*(c)$ but exceeds $p_m^*(c)$ in some periods that this is not informative of the merged firm's type. Departures in terms of lower prices

[5] It is also assumed the merged firm only sells a single product rather than the products of the two firms that formed the merger. Again that is a simplification which reduces notation and is not necessary for the paper's main findings.

[6] While it may be more natural to assume that, conditional on the efficiency not having yet occurred, the probability it occurs is decreasing at some point, assuming a stationary stochastic process makes the analysis more tractable and is not essential for the main results.

(i.e., below $p^*_m(c)$) result in the non-merged firm believing that the merged firm has the efficiency.[7]

It is easily shown that the non-merged firm's strategy is optimal. First note that the non-merged firm's current price does not affect the future price path which implies optimality requires choosing a myopic best response. When $p^\tau_m \geq p^*_m(c_m)\ \forall\ \tau = 1,\ldots,t-1$ then the merged firm will price at $p^*_m(c)$; hence, the non-merged firm's price of $p^*_{nm}(c)$ is optimal. When $p^\tau_m < p^*_m(c)$ for some $\tau \leq t-1$ then the non-merged firm believes $c_m = c-e$ and the merged firm will price at $\phi_m\left(p^*_{nm}(c-e), c-e\right) = p^*_m(c-e)$. The non-merged firm's price of $p^*_{nm}(c-e)$ is a myopic best response to $p^*_m(c-e)$.

Let us now turn to the merged firm's strategy. Consider $t=1$ or $p^\tau_m \geq p^*_m(c)\ \forall\ \tau = 1,\ldots,t-1$. If $c_m = c$ then its strategy calls for it to price at $p^*_m(c)$ which is the myopic best response to the non-merged firm's price of $p^*_{nm}(c)$. $p^*_m(c)$ is preferred to any higher price because a higher price delivers lower current profit and the same future profit stream, as both prices implies a future price path of $\left(p^*_m(c), p^*_{nm}(c)\right)$. A merged firm with $c_m = c$ prefers $p^*_m(c)$ to any lower price because the lower price delivers lower current profit and a lower future profit stream. The latter follows from the fact that the merged firm's profit is decreasing in the non-merged firm's price and the non-merged firm's future price is $p^*_{nm}(c)$ when the merged firm prices at $p^*_m(c)$ and is $p^*_{nm}(c-e)$ when the merged firm prices below $p^*_m(c)$.

Continuing with $t=1$ or $p^\tau_m \geq p^*_m(c)\ \forall\ \tau = 1,\ldots,t-1$, now consider $c_m = c-e$ and let us derive a condition to ensure that pricing at $p^*_m(c)$ is optimal. First note that $p^*_m(c)$ is preferred to any higher price p''. Both result in the same future profit stream, while $p^*_m(c)$ delivers higher current profit than p'' because

$$p'' > p^*_m(c) = \phi_m\left(p^*_{nm}(c), c\right) > \phi_m\left(p^*_{nm}(c), c-e\right)$$

and strict quasi-concavity of π_m implies

$$\begin{aligned}\pi_m\left(p'', p^*_{nm}(c), c-e\right) &< \pi_m\left(p^*_m(c), p^*_{nm}(c), c-e\right)\\ &< \pi_m\left(\phi_m\left(p^*_{nm}(c), c-e\right), p^*_{nm}(c), c-e\right).\end{aligned}$$

Now compare $p^*_m(c)$ with a lower price p'. The former is preferred if and only if:

$$\begin{aligned}\frac{\pi_m(p^*_m(c), p^*_{nm}(c), c-e)}{1-\delta} &\geq \pi_m(p', p^*_{nm}(c), c-e)\\ &+ \left(\frac{\delta}{1-\delta}\right)\pi_m(p^*_m(c-e), p^*_{nm}(c-e), c-e). \qquad (2)\end{aligned}$$

By pricing at $p^*_m(c)$ (and with the ensuing price path), the merged firm earns profit of $\pi_m(p^*_m(c), p^*_{nm}(c), c-e)$ in every period; the present value of which is the LHS of (2). By pricing at $p' < p^*_m(c)$, the merged firm earns current profit of $\pi_m(p', p^*_{nm}(c), c-e)$ and a future profit stream of $\pi_m(p^*_m(c-e), p^*_{nm}(c-e), c-e)$ as firms' strategies prescribe futures prices of $\left(p^*_m(c-e), p^*_{nm}(c-e)\right)$. A necessary and sufficient condition for (2) to hold $\forall p' < p^*_m(c)$ is

$$\begin{aligned}\frac{\pi_m(p^*_m(c), p^*_{nm}(c), c-e)}{1-\delta} &\geq \pi_m(\phi_m(p^*_{nm}(c), c-e), p^*_{nm}(c), c-e) \qquad (3)\\ &+ \left(\frac{\delta}{1-\delta}\right)\pi_m(p^*_m(c-e), p^*_{nm}(c-e), c-e).\end{aligned}$$

Note that $\phi_m(p^*_{nm}(c), c-e) < \phi_m(p^*_{nm}(c), c) = p^*_m(c)$ so pricing at $\phi_m(p^*_{nm}(c), c-e)$ does indeed mean pricing below $p^*_m(c)$. Re-arranging (3) gives us (1).

Finally, consider the merged firm's strategy when $p^\tau_m < p^*_m(c)$ for some $\tau = 1,\ldots,t-1$. As the non-merged firm's strategy has it price at $p^*_{nm}(c-e)$ in all periods, the merged firm's optimal price must maximize current profit which is what the prescribed price of $\phi_m\left(p^*_{nm}(c-e), c_m\right)$ does. ■

Examining (1), the RHS is positive which means a necessary condition for it to hold is:

$$\pi_m(p^*_m(c), p^*_{nm}(c), c-e) > \pi_m(p^*_m(c-e), p^*_{nm}(c-e), c-e); \qquad (4)$$

that is, the profit to a merged firm with the efficiency is higher at the equilibrium prices based on the absence of the efficiency than at the equilibrium prices based on the presence of the efficiency. Let us show that (4) holds when the efficiency is not too large. Consider what happens to the merged firm's profit when equilibrium prices are changed in a manner consistent with lower cost but where cost remains fixed at some level c'.

$$\begin{aligned}\frac{d\pi_m(p^*_m(c_m), p^*_{nm}(c_m), c')}{dc_m} &= \frac{\partial\pi_m(p^*_m(c_m), p^*_{nm}(c_m), c')}{\partial p_m}\frac{\partial p^*_m(c_m)}{\partial c_m}\\ &+ \frac{\partial\pi_m(p^*_m(c_m), p^*_{nm}(c_m), c')}{\partial p_{nm}}\frac{\partial p^*_{nm}(c_m)}{\partial c_m}.\end{aligned}$$

Evaluate at $c' = c_m$:

$$\begin{aligned}&= \frac{\partial\pi_m(p^*_m(c_m), p^*_{nm}(c_m), c_m)}{\partial p_m}\frac{\partial p^*_m(c_m)}{\partial c_m}\\ &\quad + \frac{\partial\pi_m(p^*_m(c_m), p^*_{nm}(c_m), c_m)}{\partial p_{nm}}\frac{\partial p^*_{nm}(c_m)}{\partial c_m}\\ &= \frac{\partial\pi_m(p^*_m(c_m), p^*_{nm}(c_m), c_m)}{\partial p_{nm}}\frac{\partial p^*_{nm}(c_m)}{\partial c_m} > 0.\end{aligned}$$

Putting aside the direct effect of a lower cost on profit, the price effect associated with a lower cost reduces the merged firm's profit. This finding is a consequence of there being no first-order effect on the merged firm's profit from adjusting its price (to having a lower cost) but there is a first-order effect from the non-merged firm lowering its price (in response to the merged firm lowering its price due to having lower cost). Consequently, if the efficiency is not too large then (4) is true. Furthermore, given (4) holds then the LHS of (1) is positive and can be made arbitrarily large by setting the discount factor close to one.[8]

Corollary 2. *$\exists\widehat{e} > 0$ such that if $e \in [0, \widehat{e})$ then $\exists\delta_e \in (0,1)$ such that if $\delta \in (\delta_e, 1)$ then there exists a PBNE for which $\left(p^t_m, p^t_{nm}\right) = \left(p^*_m(c), p^*_{nm}(c)\right)\ \forall t$.*

4. Numerical example

Assume the specification from Häckner (2000) so that the demand for product k is:

$$\frac{\alpha(1-\gamma) - (\gamma(n-2)+1)p_k + \gamma\sum_{j\neq k}p_j}{(1-\gamma)(\gamma(n-1)+1)}$$

where there are n products and $\gamma \in [0,1)$. $\gamma = 0(1)$ is the case of independent products (perfect substitutes). With n single-product firms and a common cost c, the symmetric Nash equilibrium price in the pre-merger stage is:

$$\frac{(1-\gamma)(\alpha+c) + (n-1)\gamma c}{2+(n-3)\gamma}.$$

Suppose the merger involves two firms and the merged firm has two products and cost $c-e$. When the efficiency is public information, the symmetric Nash equilibrium prices are:

[7] Alternatively, one could assume that, conditional on having previously charged $p^*_m(c)$, the merged firm pricing above (below) $p^*_m(c)$ causes the non-merged firm to believe for sure that the efficiency has not (has) been realized. Thus, there is more of a symmetric response of beliefs to a non-equilibrium price. With those beliefs, the theorem is still true.

[8] (4), and consequently (1), need not hold when e is sufficiently large. In that case, there may be a pooling equilibrium at a price $p^o \in \left(p^*_m(c-e), p^*_{nm}(c)\right)$ in which case, compared to when the efficiency is public information, price is lower when the efficiency is not realized but price is still higher when the efficiency is realized.

$$p^*_{nm} = (c + \alpha - \gamma e - 4c\gamma - 3\alpha\gamma + 3\gamma^2 e + 3c\gamma^2 + 2\alpha\gamma^2 + cn^2\gamma^2 + 2cn\gamma + n\alpha\gamma - n\gamma^2 e - 4cn\gamma^2 - n\alpha\gamma^2) \times (n^2\gamma^2 - 5n\gamma^2 + 3n\gamma + 5\gamma^2 - 7\gamma + 2)^{-1}$$

$$p^*_m = (2c + 2\alpha - 2e + 7\gamma e - 9c\gamma - 5\alpha\gamma - 3\gamma^2 e + 7c\gamma^2 + 3\alpha\gamma^2 - n^2\gamma^2 e + 2cn^2\gamma^2 - 3n\gamma e + 4cn\gamma + 2n\alpha\gamma + 4n\gamma^2 e - 8cn\gamma^2 - 2n\alpha\gamma^2) \times (2n^2\gamma^2 - 10n\gamma^2 + 6n\gamma + 10\gamma^2 - 14\gamma + 4)^{-1}$$

where p^*_{nm} is the price for the $n-2$ non-merged firms and p^*_m is the price for the two products sold by the merged firm.

Assume $n = 3, \alpha = 100, \gamma = 0.75, c = 50$. The pre-merger price is 56.25 and the post-merger prices when firms price "as if" the merged firm's cost is $50 - e$ are $p^*_m = 59.04 - 0.60e$ and $p^*_{nm} = 57.45 - 0.26e$. Thus, if the firms price as if there is no efficiency ($e = 0$) then the merged firm's price is 59.04 and the non-merged firm's price is 57.45, both of which exceed the pre-merger price of 56.25. Let us find the efficiency such that the merged firm's price is the same as its pre-merger price: $59.04 - 0.60e = 56.25 \Rightarrow e = 4.65$. If the efficiency is at least 4.65 then the merger would lower all firms' prices and consumers would not be harmed. Next, let us find the efficiency such that (4) holds with equality. When it is public information that the merger-related efficiency is e and firms set the corresponding equilibrium prices, demand for each of a merged firm's products can be calculated to be $14.47 + 0.65e$. Equate the merged firm's profit (per product) from firms pricing as if there is no efficiency (LHS) with the profit from pricing as if there is an efficiency e (RHS):

$$(59.04 - (50 - e))\,14.47 = (59.04 - 0.60e - (50 - e)) \times (14.47 + 0.65e) \Rightarrow e = 10.79.$$

Assuming the discount factor is close enough to one, the two-product version of (1) is satisfied when the efficiency is less than 10.79.

In sum, if $e \in (4.65, 10.79)$ – or, equivalently stated, the efficiency reduces cost for the merged firm between 9.30% and 21.19% – then the merger would lower prices if the efficiency is public information but there is an equilibrium whereby prices are higher if the efficiency is private information. Hence, the merger could be approved (on the basis of a static equilibrium model of complete information) and yet consumers are harmed (on the basis of a dynamic equilibrium model of incomplete information).

5. Concluding remarks

If there is uncertainty that a merger-related efficiency will occur and, should it occur, it would be private information to the merged firm then equilibrium prices can be at a level commensurate with the absence of the efficiency, even if the efficiency is realized. A cost-reducing efficiency need not be passed through to lower prices because the merged firm wants to keep the efficiency private information in order to avoid inducing rival firms to lower their prices. While there are likely to be other equilibria, this equilibrium produces the plausible outcome path that the merged firm initially prices as if it does not have the efficiency (which is indeed very likely to be the case right after the consummation of a merger) and maintains that price even if the efficiency materializes.

Given that zero pass through is just a possibility, the finding of this paper is not a reason for dismissing efficiency claims but rather an additional reason for a competition authority to engage in ex post, and not just ex ante, evaluations of mergers. Some commentators – such as Salop (2016) and Patel (2021) – have made a broader case for ex post merger evaluations on several grounds. First, without the prospect of a possible ex post merger evaluation, merger parties are ex ante incentivized to make dubious and unjustified claims of efficiencies because there is no accountability. However, if a consummated merger may ultimately be undone because the promised efficiencies did not occur (and consumers are being harmed), merger parties may be inclined to deliver more accurate information to the competition authority during the merger evaluation process. Second, even if claimed efficiencies were put forth in good faith, there is still uncertainty that the efficiency will be realized and, consequently, consumers may again end up being harmed. An ex post merger evaluation could lead to a remedy that would improve the situation for consumers. Adding to those arguments, this paper showed that even if claimed efficiencies are legitimate and even if efficiencies are realized, the merged firm may not pass any of the efficiency through to consumers. Given the ex ante uncertainty associated with efficiencies and the possible lack of ex post incentives to pass along efficiencies, competition authorities should consider making an ex post merger evaluation part of the approval decision when realization of a claimed efficiency is essential for avoiding consumer harm.

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