

# Margin squeeze, entry, and “umbrella effect”

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## **Abstract**

The pricing policy of a vertically integrated firm entails a margin squeeze when the difference between the wholesale and retail prices is lower than the downstream unit's incremental cost. A ban on margin squeeze creates incentives for integrated operators to raise retail prices, thus providing "price umbrellas" for downstream competitors. On the other hand, such a ban can bring about efficient entry, and thereby cause prices to fall. We examine the tradeoff in a setting where the integrated firm has a legal duty to deal with downstream rivals and the upstream price is subject to a regulatory cap.

# 1 Introduction

In a series of high-profile cases, European courts and antitrust agencies have found that incumbent, vertically integrated operators have violated competition law by maintaining an insufficient margin between their wholesale and retail prices, even though upstream prices were subject to price-cap regulation. In contrast, the U.S. Supreme Court has vigorously rejected the very idea that a margin squeeze might constitute an independent antitrust infringement, and advocated against the application of competition law in regulated industries. These developments of antitrust jurisprudence, and the persistent transatlantic divide, have focused the discussions on the treatment of margin squeeze under competition law and its articulation with ex ante regulation. Yet the policy debate remains multi-faceted, involving interrelated considerations about law, economics and institutional design.

In the course of the debate, several scholars have pointed out that a ban on margin squeeze tends to soften retail price competition as it forces vertically integrated operators to maintain a minimum spread with the wholesale price, thus protecting entrants from fierce competition. As Sidak (2008) puts it: “After all, one way for the vertically integrated firm to prevent a price-squeeze claim from being filed against it is to raise retail prices to provide a price umbrella for its downstream competitors.” Carlton (2008) also argues against margin squeeze as a theory of antitrust liability, putting forward the umbrella effect: “Where there is a duty to deal under the antitrust laws, application of the theory is likely to create incentives for inefficiency as firms either raise price or cease production to avoid liability.”

This article endorses the umbrella effect argument, but introduces two important considerations that may reverse the picture: entry decisions by downstream competitors and the (possibly imperfect) regulation of the upstream market. In most recent European and American squeeze cases, the vertically integrated firm had a legal duty to deal with downstream rivals and the bottleneck input was subject to price-cap regulation. The regulation, however, was not necessarily perfect: the regulatory cap often exceeded the incremental cost of producing the indispensable input. Such an imperfection may be due to informational asymmetries, regulatory capture, or to the need to preserve the long-run investment incentives of the integrated firm and of her competitors.

We examine the incumbent’s ability and incentives to foreclose the downstream market when the regulatory cap is set at or above cost and margin squeeze can be either allowed or banned. To this end, we set up a static, complete-information, entry model, with the following timing. The regulator first announces the level of the regulatory

cap and the policy as regards margin squeeze. The incumbent must then let potential entrants know about the level of the access charge through a public statement, which is subject to regulatory approval. Then entry decisions are made, on the basis of the announced access charge. Finally, competition determines the retail price. This timing reflects the incumbent's inability to commit to a retail price prior to the downstream competitors' entry decision.

We show that, depending on how stringent the upstream regulation is, a ban on margin squeeze may bring about efficient entry, thereby causing retail prices to fall. When the regulation is tight, i.e. the regulatory cap is close to the marginal cost of the upstream good, efficient competitors enter the downstream market whether margin squeeze is allowed or banned, and thus a ban does not bring any benefit in terms of entry. Under such circumstances, a ban on squeeze harms consumers through the umbrella effect, in accordance with Carlton (2008)'s claim. On the other hand, when the upstream regulation is loose, it may happen that the incumbent cannot deter entry under a ban on squeeze while entry is deterred absent squeeze prohibition. We show that, for a range of values of the regulatory cap, the entry effect strictly dominates the umbrella effect, and thus a ban on squeeze benefits consumers.<sup>1</sup>

A ban on margin squeeze reduces the incumbent's ability to foreclose the downstream market through the following channel. Once entry has occurred, the vertically integrated operator cannot refrain from competing fiercely,<sup>2</sup> possibly generating a margin squeeze. The fear of a squeeze may induce efficient firms to give up entry. As a result, absent squeeze prohibition, the vertically integrated operator may enjoy a monopoly without actually implementing a margin squeeze; entry is deterred through the mere threat of a squeeze. A ban on squeeze eliminates this threat, thus making efficient entry profitable. When the regulation of the access charge is neither too loose nor too tight, a ban on squeeze enhances consumer surplus and total welfare.

In related works, Biglaiser and DeGraba (2001) and DeGraba (2003) discuss the economic effects of allowing a bottleneck input supplier to vertically integrate downstream, assuming, as we do here, that the upstream price is not set at cost. Our perspective, however, is different. The incumbent firm being initially allowed to serve the final market, we investigate the economic consequences of regulatory choices regarding the price-cap level and the squeeze policy. Another important difference is

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<sup>1</sup>When the regulation is very loose (high regulatory cap), entry does not occur regardless of the squeeze policy, and a ban has no effect on consumers.

<sup>2</sup>This is reminiscent of the "meeting competition defence" sometimes invoked by integrated firms, whereby they claim that they are forced to align their strategy on the retail prices charged by their downstream competitors; See Section 6.

worth emphasizing. Biglaiser and DeGraba (2001) assume that the regulator sets the access charge above cost, and hence leaves no discretion at all to the regulated firm as regards the upstream price. The same is true in the “partial regulation” regime considered by Bouckaert and Verboven (2004). In contrast, the present article assumes that the regulator only imposes an access charge ceiling, thus leaving two degrees of freedom to the vertically integrated operator: she can set both the access charge (below the cap) and the retail price. Under these circumstances, we show that the integrated firm may deter or induce entry. The foreclosure theory we develop does not involve predatory pricing.<sup>3</sup>

The underlying, static logic of our entry model is closer the “no regulation regime” of Bouckaert and Verboven (2004), where “the incumbent can squeeze through both access and retail prices, so that foreclosure becomes an additional source of concern.” These authors, however, find that the incumbent forecloses entry if and only if it entails productive inefficiency, and that a ban on squeeze either has no bite or induces inefficient entry. Our conclusions are strikingly different. Bouckaert and Verboven (2004) acknowledge that their results depend on the incumbents’ rivals having no market power and on the absence of entry cost. The present article relaxes these assumptions. We do not assume that the entrant is price taker, and derive retail prices under Bertrand competition. As to the second assumption, entry is our chief concern and the sunk entry cost, together with the regulatory cap, plays a critical role in the analysis.

The article is organized as follows. Section 2 briefly reviews the American and European jurisprudences. Section 3 presents the model, and Section 4 derives the equilibria. Section 5 examines the incumbent’s ability and incentives, absent squeeze prohibition, to deter efficient entry, and describes the economic effects of a ban on squeeze. Section 6 comments on the policy implications of the results.

## 2 The transatlantic divide

### The European doctrine

Recent cases have allowed to consolidate the European doctrine and to clarify the principles underlying the construction of margin squeeze tests. It is now well established that the relevant cost benchmark is the downstream cost of the vertically integrated

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<sup>3</sup>See the second part of Biglaiser and DeGraba (2001) for a discussion of a vertically integrated operator’s incentives to engage in predation.

operator. This approach does not require to agree on some “reasonable” efficiency threshold.<sup>4</sup>

In *Napier Brown*,<sup>5</sup> the European Commission concluded that the dominant undertaking had abused its position by, among other infringements, “reducing its prices for retail sugar to the extent that an insufficient margin existed between its prices for retail and industrial sugar.” The most recent cases involved telecommunication operators.<sup>6</sup> In *Deutsche Telekom*, the Commission describes the squeeze infringement as follows:

“[T]here is an abusive margin squeeze if the difference between the retail prices charged by a dominant undertaking and the wholesale prices it charges its competitors for comparable services is negative, or insufficient to cover the product-specific costs to the dominant operator of providing its own retail services on the downstream market.”

In other words, a squeeze test aims at verifying whether the downstream unit of the vertically integrated operator would make a positive profit, had it to purchase the upstream input at the price she charges to her downstream competitors. The Court of First instance found that the Commission was “correct to analyze the abusive nature of the applicant’s pricing practices solely on the basis of the applicant’s particular situation and therefore on the basis of the applicant’s charges and costs.”<sup>7</sup> The Court noticed that any other approach could be contrary to the general principle of legal certainty, as the incumbent would otherwise need to know the costs of her competitors in order to assess the lawfulness of her conduct. This approach, known as the “as efficient competitor test”, is advocated for by the European Commission in its recent Communication on exclusionary practices.<sup>8</sup>

The prevailing view among European antitrust agencies as regards margin squeezes in regulated environments can be summarized as follows: “On related markets on which competitors buy wholesale services from the established operator, and depend on the established operator in order to compete on a downstream product or service market, there can very well be a margin squeeze between regulated wholesale and retail

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<sup>4</sup>The reference to “reasonably efficient competitors” appeared in old cases, e.g. *National Carbonizing*, 1976 O.J. L 35/6. This approach has been obsolete for a long time now.

<sup>5</sup>Commission decision of July 18, 1988, *Napier Brown - British Sugar*, 1988 O.J. L 284/41.

<sup>6</sup>Commission decision of May 21, 2003, COMP/C-1/37.451, 37.578, 37.579 – *Deutsche Telekom AG*. 2003 O.J. L 263/9 (*Deutsche Telekom*). Commission decision of July 4, 2007, COMP/38.784 – *Wanadoo España vs. Telefónica (Telefónica)*.

<sup>7</sup>Court of First Instance judgment of April 10, 2008, Case T-271/03, *Deutsche Telekom AG v. Commission*, recital 193.

<sup>8</sup>Communication from the Commission - Guidance on the Commission’s enforcement priorities in applying Article 82 of the EC Treaty to abusive exclusionary conduct by dominant undertakings, O.J. C 45/7, Feb. 24, 2009.

prices. The key question is whether the undertaking subject to price regulation has the commercial discretion to avoid or end the margin squeeze on its own initiative.”<sup>9</sup> In *Telefónica*, the European Commission checked that the access charge was not set at a precise level, but was only capped,<sup>10</sup> concluding that the integrated operator could have put the margin squeeze to an end by reducing the upstream price.

## The U.S. approach

The divergent views between the United States and Europe with regards to margin squeeze conducts have crystallized in the U.S. Supreme Court judgment in *linkLine* which ruled that a margin squeeze allegation could not constitute an independent basis for liability under anti-monopolization law.<sup>11</sup> According to the Court, attempted monopolization by a vertically integrated firm, dominant on the upstream market, could arise either from this firm’s refusal to deal at the wholesale level, or from predation on the retail market: “If there is no duty to deal at the wholesale level and no predatory pricing at the retail level, then a firm is certainly not required to price *both* of these services in a manner that preserves its rivals’ profit margins.”

To preserve economic incentives to compete and to invest, the two anticompetitive scenarios considered by the Supreme Court are subject to high standards of proof. As regards predation, the Court noted that “when seeking to impose antitrust liability for prices that are too low, mistaken inferences are especially costly, because they chill the very conduct the antitrust laws are designed to protect”, and accordingly the case-law has set strict conditions to establish predation. As for refusals to deal, the Court noted that imposing antitrust liability on this ground may lessen the incentive for the monopolist, the rival, or both to invest in economically beneficial facilities, and thus such a liability should be imposed only under exceptional circumstances.<sup>12</sup>

Alongside issues related to economic incentives, the *linkLine* judgment raised an institutional concern: “One factor of particular importance is the existence of a regulatory structure designed to deter and remedy anticompetitive harm. Where such a structure exists, the additional benefit to competition provided by antitrust enforcement will tend to be small, and it will be less plausible that the antitrust laws contemplate

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<sup>9</sup> *Telefónica*, Recital 667.

<sup>10</sup>The Commission insists that the Spanish telecommunication regulator “itself confirmed in a letter to the Commission that the prices for GigADSL are maximal prices and that Telefónica has been free to apply for a reduction of its prices.” *Telefónica*, Recital 673.

<sup>11</sup> *Pacific Bell Telephone Co. v. linkLine Communications, Inc.*, 555 US (2009).

<sup>12</sup>The Supreme Court considers that *Aspen Skiing*, the leading U.S. refusal to deal case, is “at or near the outer boundary of antitrust jurisprudence”. See *Verizon Communications Inc. v. Law Offices of Curtis V. Trinko, LLP*, 540 U.S. 398, 410 (2004).

such additional scrutiny.” Because violations of regulatory requirements would require “continuing supervision of a highly detailed decree,” an antitrust court could not be an effective enforcer of the requirements imposed by regulation.

Finally, the Supreme Court also expressed worries about the degree of legal uncertainty that margin squeeze liability would entail for vertically integrated undertakings, as the margin squeeze test provided for by American case-law required a “fair” or “adequate” margin between the wholesale and retail prices,<sup>13</sup> and guidance on how to determine the fairness or adequacy of the margin was missing. Turning to the European, “as efficient competitor” test, according to which “a margin squeeze should be presumed if the upstream monopolist could not have made a profit by selling at its retail rates if it purchased inputs at its own wholesale rates”, the Supreme court made its position unambiguous: “Whether or not that test is administrable, it lacks any grounding in our antitrust jurisprudence.”

### 3 The model

The production of a final good requires the use of a bottleneck input in one-to-one proportions. An incumbent, vertically integrated operator enjoys a monopoly position on the upstream market. We note  $c_0$  and  $c_I$  her upstream and downstream unit costs. Her total production cost per unit of the final good is thus  $c_0 + c_I$ . A competitor, with downstream unit cost  $c_E$ , considers entering the downstream market. Entry entails a positive sunk cost  $f$ . There is no alternative source of input supply, and the entrant cannot challenge the incumbent’s position on the upstream market. The final good is homogenous. The demand function on the downstream market is noted  $D(p)$ .

We assume that the incumbent has a duty to deal with her competitor and that the upstream market is regulated. The upstream price, also called “access charge”, and denoted  $a$ , is supposed to be capped. We treat the regulatory cap,  $\bar{a}$ , as exogenous, and assume that  $\bar{a} \geq c_0$ . The incumbent is thus legally obliged to offer the input at a price  $a$  that lies between  $c_0$  and  $\bar{a}$ .

We consider the following three-stage game, where the regulatory cap on the access charge,  $\bar{a}$ , is exogenous:

1. The incumbent publicly sets the access charge  $a$  subject to  $a \leq \bar{a}$ ;
2. The competitor decides whether or not to enter the downstream market;

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<sup>13</sup>See *Town of Concord v. Boston Edison Co.*, 915 F. 2d 17, 25 (CA1 1990); *Alcoa*, 148 F. 2d 416, 437-438 (CA2 1945).

3. In case of entry, firms simultaneously set retail prices.

The entry decision is made on the basis of the incumbent's public statement as regards the access charge  $a$ . In practice, incumbent operators often set the access charge equal to the regulatory cap, and typically change the access charge only when the regulator updates the cap, a pattern consistent with our main equilibrium result. The timing of the game reflects the incumbent's inability to commit to a retail price prior to the competitor's entry decision: retail prices are set after entry has occurred.

Under squeeze prohibition, the incumbent's pricing policy  $(p_I, a)$  must respect, on top of the regulatory constraint  $a \leq \bar{a}$ , the following constraint:

$$p_I \geq a + c_I. \quad (1)$$

The above constraint on the incumbent's policy is consistent with the "as efficient competitor test." The aim of the article is to understand how the prohibition of margin squeeze affects the entry decision of a potential competitor and, ultimately, its effect on consumer surplus. To this aim, we consider two policy regimes according to whether the prohibition is or is not imposed, i.e. whether constraint (1) is imposed or not, derive the equilibria and compare consumer surplus in each regime.

We assume that, for any value of marginal cost  $c$ , the profit function  $\Pi(p; c) = (p - c)D(p)$  is strictly quasi-concave in  $p$ . Thus, the profit function is maximal for a unique price, noted  $p^m(c)$ , which increases with  $c$ ; the monopoly profit is noted  $\Pi^m(c)$ . We note  $p_I^m = p^m(c_0 + c_I)$  and  $\Pi_I^m = \Pi^m(c_0 + c_I)$  the incumbent's price and profit absent downstream competition.

The extent to which the existing regulation constrains the incumbent's behavior is a core issue in a number of recent squeeze judgments. The subsequent analysis focuses on the case where  $\bar{a} \leq a^m$ , where  $a^m$  denotes the "monopoly access charge", defined as  $a^m = p_I^m - c_I$ . Indeed, when the regulatory cap exceeds the monopoly charge, the incumbent's pricing policy  $(p_I^m, a^m)$  respects both the regulatory cap on the access charge and the no-squeeze requirement. If entry occurs and the entrant serves the downstream market at a price slightly below  $p_I^m$ , the incumbent's profit, earned on the upstream market, is equal to her monopoly profit:  $\Pi_I^m = (a^m - c_0)D(p_I^m)$ . In other words, when  $\bar{a} \geq a^m$ , the regulation of the upstream market, even combined with a ban on margin squeeze, does not prevent the incumbent from earning her monopoly profit. Throughout the article, we assume, without loss of generality, that  $\bar{a}$  lies between  $c_0$  and  $a^m$ . In such situations, the incumbent is at least partially regulated and cannot impose the access charge that would maximize her unconstrained monopoly profit:

$\bar{a} = c_0$  is the strongest possible constraint on the incumbent, whereas  $\bar{a} = a^m$  means there is no constraint at all.

Finally, we make a number of technical assumptions. First, we assume hereafter that the incumbent cannot credibly post a retail price below her total cost  $c_0 + c_I$ . As already mentioned, the essence of our analysis is static and we do not consider dynamic, predation-like strategies. It follows that the retail price will not be lower than  $c_0 + c_I$  in equilibrium. Second, we assume that the entrant, who produces the final good at marginal cost  $c_E$ , does not have a drastic cost advantage:  $a + c_I \leq p^m(a + c_E)$  for any  $c_0 \leq a \leq a^m$ . As an illustration, this assumption holds for the iso-elastic demand  $D(p) = p^{-\varepsilon}$  if and only if the cost difference satisfies:  $c_I - c_E < (c_0 + c_I)/\varepsilon$ . Third, Bertrand competition with homogenous products generically leads to equilibria where only one firm is active on the retail market. By convention, we suppose that when the competitor is indifferent between serving or not the retail market, he decides to serve it. Similarly, when the competitor is indifferent between entering or not the downstream market, he decides to enter.

## 4 Characterizing equilibria

### Equilibria in the downstream market

We solve the game by backward induction, considering first subgames starting after the potential competitor has entered the downstream market and incurred the sunk cost  $f$ . The following lemma presents the possible retail prices in entry equilibria, for a given level of the access charge  $a$ .

**Lemma 1.** *Suppose that the competitor has incurred the sunk entry cost  $f$ . For any given level of the access charge  $a \in [c_0, a^m]$ , the entrant serves the downstream market if and only if  $c_E \leq c_I$ . When the entrant is active:*

- *Absent squeeze prohibition, any price  $p_E$  between  $\max\{c_0 + c_I, a + c_E\}$  and  $a + c_I$  may prevail in equilibrium.*
- *Under squeeze prohibition, the equilibrium retail price is  $p_E = a + c_I$ .*

*Proof:* The incumbent faces a tradeoff between deterring or accommodating entry. If the competitor serves the retail market, the incumbent earns access revenues  $(a - c_0)D(p)$ ; if she instead serves the final consumers, her retail profit is  $(p - c_0 - c_I)D(p)$ . Accordingly, the incumbent prefers to be active downstream if and only if  $p > a + c_I$ , and hence would undercut the entrant should he set a price above  $a + c_I$ .

Consider first the case without squeeze prohibition. The entrant's variable profit is nonnegative if and only if  $p_E \geq a + c_E$ . If  $c_E > c_I$ , the incumbent finds it profitable to undercut any such price, and thus serves the downstream market in equilibrium.<sup>14</sup> Suppose now that  $c_E \leq c_I$ . Both firms are ready to serve the retail market if the price is larger than  $a + c_I$  and would undercut any price above this level. For any price below  $a + c_E$ , the incumbent prefers its competitor to serve the final market while the latter is not ready to do so. Accordingly, any equilibrium retail price must lie between  $a + c_E$  and  $a + c_I$ . At any such price, the entrant profitably serves the market, has no incentive to deviate to a lower price because his cost advantage is not drastic by assumption, and the incumbent does not undercut as she prefers earning access revenues rather than serving final consumers. Finally, as already mentioned, it is common knowledge that the incumbent will not use a price below her cost  $c_0 + c_I$ , so we rule out equilibrium prices below this level.

Under squeeze prohibition, the incumbent's retail price must remain above  $a + c_I$ . Since the incumbent would undercut any higher price, the only possible equilibrium price under entry is  $a + c_I$ .  $\square$

The multiplicity of equilibria when there is no squeeze prohibition is a standard result (see, in a slightly different context, Choi and Stefanadis (2002) and Carlton and Waldman (2002)). When entry has occurred ( $c_E < c_I$ ), any price between  $\max\{c_0 + c_I, a + c_E\}$  and  $a + c_I$  may prevail in equilibrium. The incumbent's preferred price is  $\max\{c_0 + c_I, a + c_E\}$ , as this price maximizes downstream demand and thus access revenues. Most of the following analysis proceeds under the assumption that the equilibrium price is the incumbent's preferred price. Under this assumption, we must have  $c_0 + c_I > a + c_E$  if the competitor is to enter the market,<sup>15</sup> and the equilibrium price under entry, absent squeeze prohibition, is  $c_0 + c_I$ . We discuss the role of this assumption at the end of Section 5.

## Entry decisions for given levels of the access charge

Anticipating equilibrium prices that will prevail if he enters, the potential competitor, at the second stage of the game, must decide whether or not to enter. Absent squeeze prohibition, we assume, as explained above, that the equilibrium retail price

<sup>14</sup>In fact, the entrant anticipates this outcome and does not incur the entry cost  $f > 0$  in the first place.

<sup>15</sup>Otherwise the entrant's variable profit would be zero and entry would not be profitable given the sunk cost  $f > 0$ .

under entry is  $c_0 + c_I$ . The potential competitor enters if and only if he anticipates a nonnegative net profit:

$$\Pi_E(c_0 + c_I; a + c_E) = (c_0 + c_I - c_E - a)D(c_0 + c_I) - f \geq 0. \quad (2)$$

Under squeeze prohibition and entry, the equilibrium retail price is  $a + c_I$  and the potential competitor enters if and only if he anticipates a nonnegative net profit:

$$\Pi_E(a + c_I; a + c_E) = (c_I - c_E)D(a + c_I) - f \geq 0. \quad (3)$$

As the access charge is greater than or equal to  $c_0$ , the above entrant's profits are both lower than  $(c_I - c_E)D(c_0 + c_I) - f$ . Hence, whether margin squeeze is banned or allowed, a necessary condition for entry to occur is that

$$f \leq (c_I - c_E)D(c_0 + c_I). \quad (4)$$

The above condition expresses that the cost economies generated by entry exceed the sunk cost of entry, the retail price being set at the incumbent's cost –the lowest possible equilibrium price. Throughout the article, we say that entry is “efficient” if condition (4) is met. Irrespective of the squeeze policy, inefficient competitors never enter the downstream market. Under condition (4), inequalities (2) and (3) hold for  $a = c_0$ . As  $\Pi_E(c_0 + c_I; a + c_E)$  and  $\Pi_E(a + c_I; a + c_E)$  decrease with  $a$ , there exist two critical values,  $\hat{a} \geq c_0$  and  $\dot{a} \geq c_0$ , such that

$$(c_0 + c_I - c_E - \hat{a})D(c_0 + c_I) = f \quad (5)$$

$$(c_I - c_E)D(\dot{a} + c_I) = f. \quad (6)$$

The thresholds  $\hat{a}$  and  $\dot{a}$  determine the incumbent's *ability* to foreclose entry on the downstream market, respectively absent and under squeeze prohibition. When the regulatory cap,  $\bar{a}$ , is higher (lower) than the relevant threshold, the incumbent can (cannot) deter entry. The following result presents the equilibria for any given level of the access charge  $a$ , and shows that a ban on squeeze reduces the incumbent's ability to foreclose the downstream market.

**Lemma 2.** *Under each policy regime, for any given level of the access charge, equilibrium prices and entry decisions are as follows:*

- *Absent squeeze prohibition, entry occurs if and only if  $a \leq \hat{a}$ . The retail price is  $c_0 + c_I$  in case of entry,  $p_I^m$  otherwise;*

- Under squeeze prohibition, entry occurs if and only if  $a \leq \hat{a}$ . The retail price is  $a + c_I$  in case of entry,  $p_I^m$  otherwise.

A ban on squeeze broadens the range of access charge values for which entry occurs. Formally:  $\hat{a} < \dot{a}$ .

*Proof:* The first two items follow directly from Lemma 1. We only need to prove that  $\hat{a} < \dot{a}$ . Equalities (5) and (6) imply:

$$f = \Pi_E(c_0 + c_I; \hat{a} + c_E) = \Pi_E(\dot{a} + c_I; \dot{a} + c_E). \quad (7)$$

We proceed by contradiction. If  $\dot{a}$  were lower than  $\hat{a}$ , the profit curve  $\Pi_E(\cdot; \dot{a} + c_E)$  would lie above  $\Pi_E(\cdot; \hat{a} + c_E)$ . It follows from  $\Pi_E(c_0 + c_I; \hat{a} + c_E) = f$  and  $\dot{a} + c_I > c_0 + c_I$  that  $\dot{a} + c_I$  would have to be the upper root of  $\Pi_E(\cdot; \dot{a} + c_E) = f$ . In other words,  $\dot{a} + c_I$  would have to be greater than  $p^m(\dot{a} + c_E)$ , implying that the entrant's cost advantage were drastic, which we have ruled out. It follows that  $\hat{a} < \dot{a}$ .  $\square$

We now turn to the first stage of the game, where the incumbent chooses the level  $a$  of the access charge subject to the regulatory constraint  $a \leq \bar{a}$ .

## The incumbent's choice of the access charge

When there is no squeeze prohibition, the potential competitor chooses to enter if  $a \leq \hat{a}$ . In this case, he serves the downstream market at price  $c_0 + c_I$ , and the incumbent earns access revenues only. Her profit function under entry,  $(a - c_0)D(c_0 + c_I)$ , strictly increases with  $a$  as long as  $a \leq \hat{a} \leq a^m$ . The incumbent thus sets  $a = \hat{a}$  (if  $\bar{a} \geq \hat{a}$ ), and earns:  $\Pi_I^e = (\hat{a} - c_0)D(c_0 + c_I)$ . Using the definition of  $\hat{a}$  in equation (5), the incumbent's profit under entry, absent squeeze prohibition, can be rewritten as

$$\Pi_I^e = (c_I - c_E)D(c_0 + c_I) - f. \quad (8)$$

The profit level  $\Pi_I^e$  corresponds to the variable cost economies generated by entry, net of the entry cost  $f$ , the retail price being set at the incumbent's cost  $c_0 + c_I$ . Recall that a necessary condition for entry, regardless of the squeeze policy, is  $\Pi_I^e \geq 0$  (see equation (4) above).

On the other hand, if the incumbent chooses to deter entry by setting the access charge above  $\hat{a}$ , she serves the downstream market at the monopoly price  $p_I^m(c_0 + c_I)$  and earns the corresponding profit  $\Pi_I^m$ . The comparison between  $\Pi_I^e$  and  $\Pi_I^m$  thus determines the incumbent's *incentives* to foreclose entry on the downstream market.

**Lemma 3.** *When  $\Pi_I^e > \Pi_I^m$ , the vertically integrated firm, absent squeeze prohibition, has no incentive to foreclose the downstream market: entry occurs and the retail price is  $c_0 + c_I$  irrespective of the regulatory cap  $\bar{a}$ . A ban on squeeze harms consumers.*

*Proof:* Absent squeeze prohibition, entry occurs when  $\bar{a} \leq \hat{a}$ , according to Lemma 2. The retail price is  $c_0 + c_I$ , and the incumbent sets the access charge at the regulatory cap  $\bar{a}$ , thus generating a margin squeeze. If  $\bar{a} > \hat{a}$ , the incumbent could deter entry by setting the access charge above  $\hat{a}$  while respecting the regulatory cap  $\bar{a}$ , and thus would earn the monopoly profit  $\Pi_I^m$ . The incumbent, however, has no incentive to do so. She can secure a higher profit, namely  $\Pi_I^e > \Pi_I^m$ , by setting  $a = \hat{a}$  and inducing entry. In equilibrium, the retail price is thus  $p = c_0 + c_I$ , which is lower than  $\hat{a} + c_I$ : the incumbent's pricing policy again entails a margin squeeze.

Under squeeze prohibition, according to Lemma 2, entry occurs if  $\bar{a} \leq \dot{a}$ . The incumbent's profit,  $(a - c_0)D(a + c_I)$ , is maximal for  $a = \min(\bar{a}, a^m)$ . The retail price,  $a + c_I$ , is thus higher than  $c_0 + c_I$ , and consumers are unambiguously worse off than absent squeeze prohibition. If  $\bar{a} > \dot{a}$ , the incumbent can choose to deter or to accommodate entry. If she accommodates entry, she maximizes  $(a - c_0)D(p)$  subject to the constraints  $a \leq \dot{a}$  (entry accommodation) and  $p \geq a + c_I$  (no-squeeze requirement). The solution is  $a = \min(\dot{a}, a^m)$  and  $p = a + c_I$ , hence consumers are worse off than absent squeeze prohibition ( $p > c_0 + c_I$ ). If the incumbent prefers to deter entry, then  $a > \dot{a}$  (entry deterrence) and  $p \geq a + c_I$  (no-squeeze requirement), implying, again, that the ban on squeeze harms consumers.  $\square$

Absent squeeze prohibition, and under the assumption of Lemma 3, namely  $\Pi_I^e > \Pi_I^m$ , the incumbent is better off letting the competitor serve the downstream market. In accordance with the Chicago school "one monopoly profit theory", the vertically integrated incumbent has nothing to gain from driving an efficient rival off the downstream market, as she can extract her monopoly rent at the upstream level through the access charge while benefiting from her rival's efficiency at the downstream level. The retail price is low, and the equilibrium entails a margin squeeze.

A ban on squeeze harms consumers irrespective of the incumbent's decision to deter or accommodate entry, as it provides a price umbrella in the downstream market, encouraging the downstream supplier to increase its price. Indeed, if the incumbent accommodates entry, the equilibrium price rises to satisfy the no-squeeze condition; if she deters entry, the retail price reaches either the unconstrained monopoly level, or a limit price that just discourages the potential competitor from entering.

Next, we turn to the case where the incumbent *does* have an incentive to deter efficient entry.

**Lemma 4.** *When  $0 \leq \Pi_I^e < \Pi_I^m$ , the vertically integrated firm, absent squeeze prohibition, has an incentive to deter entry. The following holds in equilibrium:*

- *If  $\bar{a} \leq \hat{a}$ , entry occurs in both regimes. A ban on squeeze reduces the competitive pressure on the entrant and causes the equilibrium retail price to rise;*
- *If  $\hat{a} < \bar{a} \leq \min(\dot{a}, a^m)$ , a ban on squeeze brings about efficient entry and causes the equilibrium retail price to fall;*
- *If  $\dot{a} < \bar{a} \leq a^m$ , entry never occurs, and the equilibrium price is  $p_I^m$  in both regimes.*

*Proof:* The inequality  $\Pi_I^e < \Pi_I^m$  implies  $\Pi_I^e = (\hat{a} - c_0)D(c_0 + c_I) < \Pi_I^m = (a^m - c_0)D(p_I^m) < (a^m - c_0)D(c_0 + c_I)$ , and hence  $\hat{a} < a^m$ . Since we know from Lemma 2 that  $\hat{a} < \dot{a}$ , we conclude that  $\hat{a} < \min\{\dot{a}, a^m\}$ .

For  $\bar{a} \leq \hat{a}$ , we know from Lemma 2 that entry occurs in both regimes (recall that  $\hat{a} < \dot{a}$ ). Under squeeze prohibition and entry, the incumbent's profit is  $(a - c_0)D(a + c_I)$  and her optimal strategy is to set  $a = \bar{a}$  (recall that  $\bar{a} \leq \hat{a} < a^m$ ). A ban on margin squeeze causes the equilibrium price to rise from  $c_0 + c_I$  to  $\bar{a} + c_I$ .

For  $\hat{a} < \bar{a} \leq \min\{\dot{a}, a^m\}$ , the incumbent, absent squeeze prohibition, chooses the access charge slightly above  $\hat{a}$  and deters entry. She earns profit  $\Pi_I^m$ , which is greater than  $\Pi_I^e$ . Under squeeze prohibition, we know from Lemma 2 that the incumbent cannot prevent entry when she sets  $a \leq \bar{a} \leq \dot{a}$ . Therefore, entry occurs and the equilibrium retail price is  $a + c_I$ . The incumbent's profit amounts to  $(a - c_0)D(a + c_I)$ , which is maximum for the highest authorized value of  $a$ , namely  $\bar{a}$ . In this range of values for the regulatory cap, a ban on margin squeeze brings about efficient entry and causes the equilibrium retail price to fall from  $p_I^m$  to  $\bar{a} + c_I$ .

Finally, if  $\dot{a} < \bar{a} \leq a^m$ , the incumbent's optimal strategy is to deter entry and to set the monopoly price  $p_I^m$  in both regimes.  $\square$

Lemma 4 describes the case where the incumbent has an *incentive* to deter efficient entry. A ban on margin squeeze tends to reduce the incumbent's *ability* to foreclose the market, but is not always effective at promoting efficient entry. The extent to which a ban is effective depends on the upstream regulation.

When the access charge is unregulated or very loosely regulated, a ban on margin squeeze is ineffective at promoting efficient entry, and actually has no effect at all. The incumbent is able to block entry and to earn her monopoly profit even under squeeze

prohibition. When the regulatory cap is set at or close to the upstream cost, entry occurs even absent squeeze prohibition, and a ban on squeeze has the effect of softening competition through the umbrella effect, thereby harming consumers.

Between the above polar cases, there exists an intermediate range for the regulatory cap such that a ban on squeeze brings about efficient entry and benefits consumers. Absent squeeze prohibition, entry is deterred, the monopoly price prevails, and no margin squeeze is observed in equilibrium.<sup>16</sup> Yet a ban on squeeze changes the competitor's anticipations, eliminating the off-equilibrium threat of a squeeze and making entry possible. Under squeeze prohibition, the entrant ends up being the sole producer of the final good, but is not able to charge his monopoly price on the downstream market as he remains subject to competitive pressure from the incumbent. The equilibrium price,  $\bar{a} + c_I$ , stimulates demand and enhances consumer surplus.

## 5 Discussion and extensions

In this section, we first relate the equilibrium outcomes under each policy regime to the primitives of the model, namely the cost and demand parameters, and the regulatory cap. We then discuss the robustness of our findings to a number of modeling assumptions.

### The roles of the cost parameters and of the regulatory cap

We have seen that inefficient entry ( $\Pi_I^e < 0$ ) never occurs in equilibrium. Hereafter, we focus on efficient entry, assuming  $\Pi_I^e > 0$ , or  $f < (c_I - c_E)D(c_0 + c_I)$ , as shown on Figures 1 and 2. The frontiers  $\bar{a} = \hat{a}(f)$  and  $\bar{a} = \dot{a}(f)$  in the  $(f, \bar{a})$ -space are derived from equations (5) and (6). Recall from Lemma 2 that  $\hat{a}(f)$  lies below  $\dot{a}(f)$ . The frontier  $\bar{a} = \hat{a}(f)$  is a straight line, while  $\bar{a} = \dot{a}(f)$  behaves like the inverse demand function.<sup>17</sup> As explained in Section 3, we can focus on the cases where the regulatory cap,  $\bar{a}$ , lies between  $c_0$  and  $a^m$ .

The incumbent's incentives to deter entry, and in turn the impact of a ban on margin squeeze, critically depend on the ordering of  $\Pi_I^e$  and  $\Pi_I^m$ . The following proposition summarizes the above results.

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<sup>16</sup>The monopoly price,  $p_I^m$ , is higher than  $\bar{a} + c_I$ .

<sup>17</sup>Figures 1 and 2 assume an isoelastic demand  $D(p) = p^{-\varepsilon}$ .

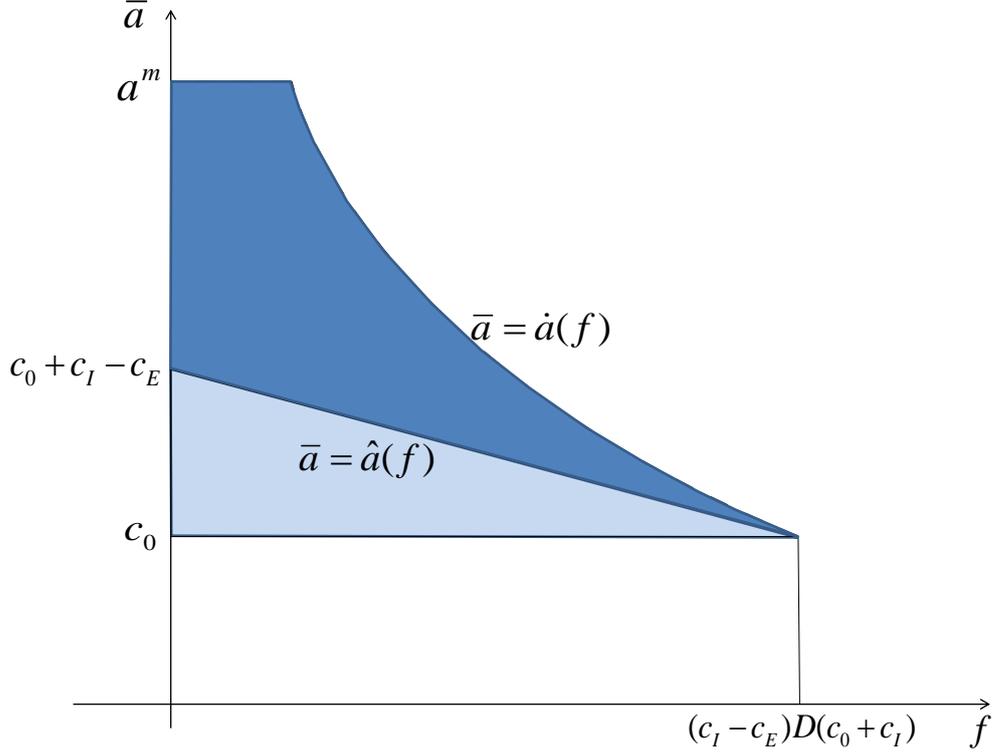


Figure 1: When  $\Pi_I^m > (c_I - c_E)D(c_0 + c_I)$ , a ban on squeeze harms consumers (light shaded area), benefits consumers (dark shaded area), or has no effect (unshaded area).

**Proposition 1.** *When entry is very efficient ( $\Pi_I^m < \Pi_I^e$ ), the incumbent has no incentive to foreclose the market. A ban on margin squeeze lowers both consumer and total welfare through the umbrella effect.*

*When entry is moderately efficient ( $\Pi_I^m > \Pi_I^e \geq 0$ ), the incumbent has an incentive to deter entry absent squeeze prohibition, and the effect of a ban on squeeze depends on the tightness of upstream regulation:*

- *Under tight regulation, a ban lowers consumer surplus and total welfare;*
- *Under loose regulation, a ban has no effect;*
- *If the regulation is neither too tight nor too loose, a ban brings about efficient entry, benefits consumers and enhances total economic surplus.*

A necessary condition for a ban on squeeze to enhance welfare is that the monopoly profit exceeds the cost economies generated by entry net of the entry cost:  $\Pi_I^m > \Pi_I^e$ . Unless the entrant is extraordinarily efficient, the *net cost economies* from entry are likely to be smaller than the *whole* monopoly profit. To be more precise, we distinguish the following two cases.

When  $\Pi_I^m > (c_I - c_E)D(c_0 + c_I)$ , i.e. when the cost difference  $c_I - c_E$  is not too large, the incumbent firm, absent squeeze prohibition, has an incentive to deter efficient entry irrespective of the entry cost  $f$ . This is the configuration shown on Figure 1. When the regulation is neither too tight nor too loose ( $\hat{a} < \bar{a} < \hat{a}$ ), the entry effect dominates the umbrella effect, and a ban on squeeze enhances consumer and total welfare.

The configuration shown on Figure 1 prevails in particular when  $\Pi_I^m > c_I D(c_0 + c_I)$ , a condition that does not involve any characteristics of the entrant. For the isoelastic demand  $D(p) = p^{-\varepsilon}$ , the condition is equivalent to

$$c_0/c_I > (\varepsilon - 1) \left( \frac{\varepsilon}{\varepsilon - 1} \right)^\varepsilon - 1.$$

The right-hand side increases from zero to infinity as  $\varepsilon$  rises from 1 to infinity. For instance, if  $\varepsilon = 2$ , the above condition reads  $c_0 > 3c_I$ . Under this condition, the incumbent, absent squeeze prohibition, has an incentive to deter entry *for any value of  $c_E$  and  $f$  such that entry is efficient*. In particular, the configuration of Figure 1 applies for any  $c_E < c_I$ .

When  $\Pi_I^m < (c_I - c_E)D(c_0 + c_I)$ , i.e. when the cost difference is large, the incumbent, absent squeeze prohibition, has an incentive to deter efficient when  $f > (c_I - c_E)D(c_0 + c_I) - \Pi_I^m$ . Otherwise she has no incentive to foreclose the market, and a ban on squeeze harms consumers through the umbrella effect. The set of parameters  $(f, \bar{a})$  for which a ban on squeeze is welfare-enhancing is shown on Figure 2. In regions A and B (B and C), the vertically integrated firm, absent squeeze prohibition, is not able (has no incentive) to deter efficient entry, and a ban on squeeze harms consumers. In region D, however, the incumbent would have both the ability and the incentive to deter entry, and the prohibition of margin squeeze prevents such a behavior. A ban on squeeze benefits consumers, as efficient entry results in retail prices that are lower than the incumbent's monopoly price that would prevail absent squeeze prohibition.

## Extensions and agenda for future research

We first discuss the assumption that the equilibrium price under entry, absent squeeze prohibition, is the lowest possible equilibrium value, namely  $\max(c_0 + c_I, a + c_E)$ . According to Lemma 1, all values between this lower bound and  $a + c_I$  are possible equilibrium prices. As explained in Section 4, the lower bound maximizes the incumbent's access profit under entry, and is thus her preferred price. It follows from this assumption that we must have  $a + c_E < c_0 + c_I$  under entry, and hence the equilibrium price under entry, absent squeeze prohibition, is simply  $c_0 + c_I$ .

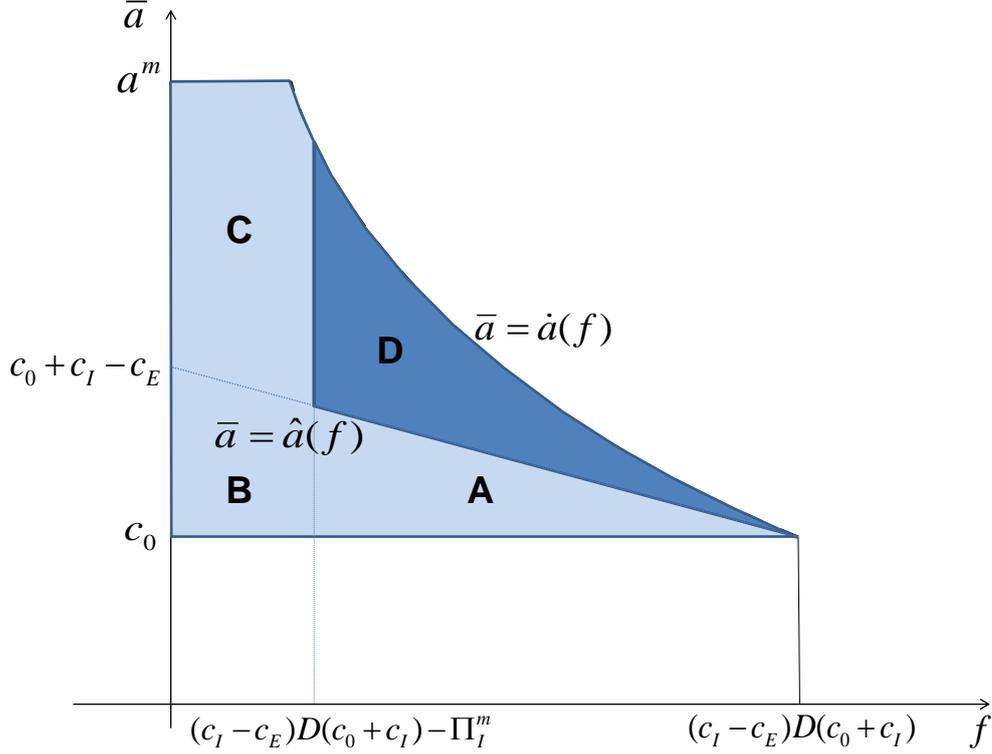


Figure 2: When  $\Pi_I^m < (c_I - c_E)D(c_0 + c_I)$ , a ban on squeeze harms consumers (light shaded area), benefits consumers (dark shaded area), or has no effect (unshaded area).

Relaxing this assumption would lead to an equilibrium retail price higher than  $c_0 + c_I$ . Such a price would yield a higher profit to the entrant and make entry more profitable;<sup>18</sup> consequently, the access charge threshold  $\hat{a}$  would be higher. As the equilibrium price increases to the entrant's preferred retail price,  $a + c_I$ , the critical level  $\hat{a}$  tends to  $\dot{a}$ . The interval  $[\hat{a}, \dot{a}]$  thus shrinks, and vanishes only in the limit case where the equilibrium price is  $a + c_I$  under entry in both regimes. Except in this limit case, there always exists a range for the regulatory cap  $\bar{a}$  where a ban on margin squeeze strictly enhances consumers surplus.

Next, we discuss two extensions of the baseline model. First, suppose that the vertically integrated firm incurs an additional upstream cost to provide access, which we denote by  $c^u$ . The incumbent's main tradeoff, between deterring or accommodating entry, is modified as follows. If the competitor serves the retail market, the incumbent earns access revenues  $(a - c_0 - c^u)D(p)$ ; if she serves the final consumers, her retail profit is  $(p - c_0 - c_I)D(p)$ . Accordingly, the incumbent prefers to be active downstream

<sup>18</sup>This is because the entrant's profit function  $\Pi_E(\cdot; a + c_E)$  is increasing below  $a + c_I$  (recall that, by assumption,  $a + c_I < p^m(a + c_E)$ ).

if and only if  $p > a + c_I - c^u$ , and hence would undercut the entrant should he set a price above  $a + c_I - c^u$ . Slightly adapting Lemma 1, we find that, absent squeeze prohibition, the equilibrium retail price lies between  $\max(c_0 + c_I, a + c_E)$  and  $a + c_I - c^u$ . We maintain hereafter the assumption that the equilibrium price under entry absent squeeze prohibition is  $c_0 + c_I$  (see the above discussion). The no-squeeze requirement (1) must be adapted. We adopt the “economists’ test” of Bouckaert and Verboven (2004):<sup>19</sup>

$$p \geq a + c_I - c^u.$$

Under squeeze prohibition, the equilibrium retail price is  $a + c_I - c^u$  in equilibrium. Efficient entry is now defined as  $f \leq (c_I - c_E - c^u)D(c_0 + c_I)$ , as entry generates additional cost incurred by the incumbent to provide access. The incumbent’s ability to deter efficient entry in each regime is determined by the thresholds  $\hat{a}$  and  $\dot{a}$ . The definition of the critical access charge absent squeeze prohibition,  $\hat{a}$ , remains unchanged, as neither the retail price  $c_0 + c_I$  nor the entrant’s cost  $a + c_E$  are affected by the extra access cost  $c^u$  (see equation (5)). In contrast, the critical access charge under squeeze prohibition,  $\dot{a}$ , must be adapted. As the equilibrium retail price is  $a + c_I - c^u$ , condition (6) becomes:

$$(c_I - c_E - c^u)D(\dot{a} + c_I - c^u) = f.$$

The incumbent’s incentives to deter efficient entry are determined by the ordering of  $\Pi_I^e$  and  $\Pi_I^m$ . The monopoly profit  $\Pi_I^m$  is unchanged whereas  $\Pi_I^e$  is modified as follows:  $\Pi_I^e = (c_I - c_E - c^u)D(c_0 + c_I) - f$ . Figure 1 must be adapted as shown on Figure 3. As the access cost  $c^u$  rises from zero to  $c_I - c_E$ , the two shaded areas shrink and entry becomes less and less likely in each policy regime. As long as  $c^u < c_I - c_E$ , the above results hold, and banning margin squeeze may be welfare enhancing or detrimental depending on the tightness of upstream regulation.

As a second extension of the baseline model, suppose that  $n > 1$  symmetric competitors, rather than just one single firm, consider entering the downstream market. Suppose that the potential competitors simultaneously decide, at the second stage of the game, whether or not to enter. If two or more firms enter, the retail price falls to  $a + c_E$ , entrants earn zero variable profit, and entry is unprofitable because of the positive sunk cost. It follows that there exist  $n$  Nash equilibria in pure strategy, where only one competitor enters the market. The analysis carries over to this case.

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<sup>19</sup>See equation (6) of Bouckaert and Verboven (2004).

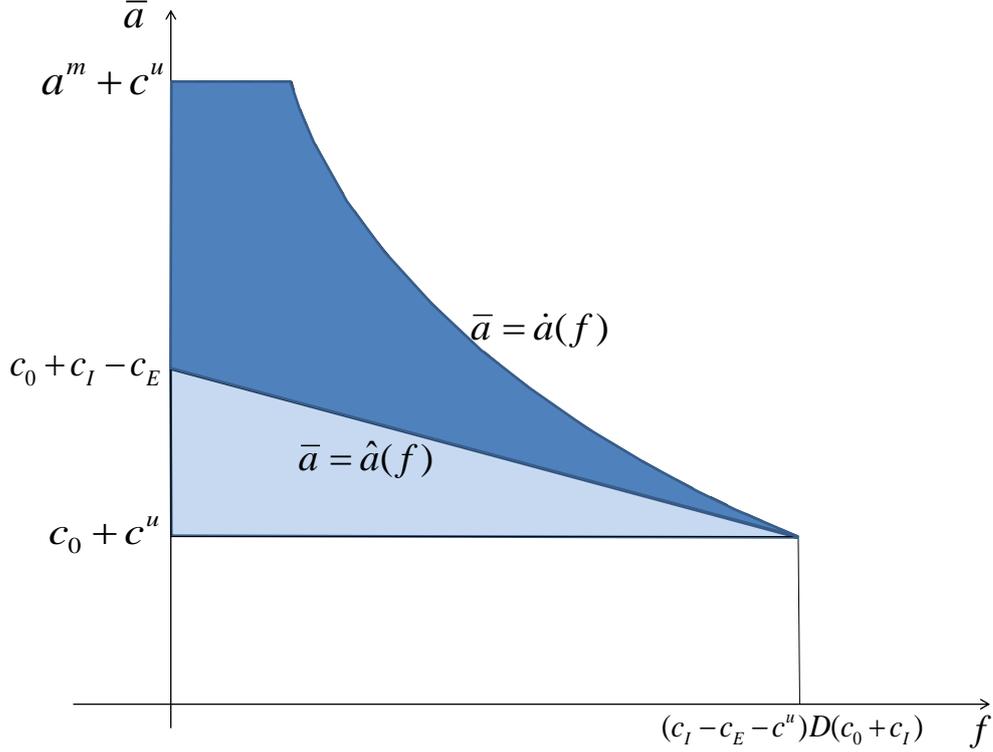


Figure 3: Suppose  $\Pi_I^m > (c_I - c_E - c^u)D(c_0 + c_I)$ , where  $c^u$  is the additional upstream cost of providing access. A ban on squeeze harms consumers (light shaded area), benefits consumers (dark shaded area), or has no effect (unshaded area).

Finally, we have considered a complete information framework. The incumbent's incentives and ability to deter entry depend on the entrant's cost structure, as  $c_E$  and  $f$  enter both the profit level  $\Pi_I^e$  and the critical thresholds  $\hat{a}$  and  $\dot{a}$ . Accordingly, the assumption that the vertically integrated firm knows these cost parameters plays an important role in the analysis. Relaxing this assumption is a challenge for further research. Moreover, we have assumed product homogeneity, as well as fixed proportions, and we have ruled out bypass. In contrast, the access pricing literature (see e.g. Armstrong et al. (1996) and Armstrong (2002)) has introduced product differentiation, and allowed for the possibility of obtaining the key input elsewhere than from the dominant firm ("bypass") as well as of combining inputs in variable proportions. It would be interesting to extend the analysis of squeeze policy to such environments.

## 6 Policy implications

The above results are, in part, consistent with Carlton (2008)’s assertion that “the threat of antitrust liability from a margin squeeze could lead to consumer harm through a price umbrella for [the final good]”. For a given market structure, a ban on squeeze indeed unambiguously harms consumers. A ban may, however, alter the market structure itself. Reducing the competitive pressure that the incumbent is able to exert on downstream competitors may allow the latter to enter the market, thus causing prices to fall. Hence, paradoxically, a softening of competition may benefit consumers. This occurs when the integrated firm, absent squeeze prohibition, has both the ability and the incentive to deter efficient entry.

The most straightforward way to prevent inefficient exclusion, as is apparent from Figures 1 and 2, is to set the access charge at cost. But this may be unfeasible, or even undesirable for long-term reasons.<sup>20</sup> When upstream regulation is loose, a ban on squeeze may be a useful, complementary instrument to safeguard competitors’ incentives to enter downstream markets. The instrument, however, can also play against the interests of consumers, making the regulators’ task all the more difficult. We have shown that the regulatory environment is of critical importance to determine the optimal policy as regards margin squeeze. In particular, if the upstream price (access charge) is set at or close to cost, a ban on squeeze tends to harm consumers. On the contrary, if the upstream regulation is loose, a ban either has no effect or benefits consumers.

The mechanism underlying these results sheds light on the “meeting competition defense” sometimes invoked in antitrust cases, whereby integrated firms claim that they have been forced to match the retail prices charged by their downstream competitors, and that they had no intention to exclude rivals.<sup>21</sup> In practice, it is indeed true that retail prices are easy to change (e.g. using promotions) and that downstream competition pushes them down. The logic of the model reflects this observation: the vertically integrated firm cannot commit to a retail price prior to entry decisions by competitors and cannot refrain from competing fiercely downstream once entry has occurred. At this point of the game, the integrated firm’s intentions are irrelevant. Her intentions, however, do matter at an earlier stage of the game, namely when she sets the access

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<sup>20</sup>Regulators may want to encourage competitors to invest in upstream infrastructures, in a long term perspective.

<sup>21</sup>In *Telefónica*, the European Commission states: “A dominant operator is not strictly speaking prohibited from aligning its prices with those of competitors. However, the meeting competition defence may not legitimize a margin squeeze that enables the vertically integrated company to impose losses on its competitors that it does not incur itself.” See recitals 620 and 637-640.

charge in accordance with the regulatory constraint. At this point indeed, the integrated firm anticipates the subsequent outcome, being aware of the consequences of her choice in terms of entry or exclusion of downstream rivals.<sup>22</sup>

The commitment to enforce a ban on squeeze is critical in the analysis, as it shapes the anticipation of potential entrants. Potential competitors, if they are to enter the downstream market, need to be ex ante confident that the ban on squeeze will be enforced ex post. How the commitment is achieved is not the subject of this article. The ex ante perspective, at first glance, does not fit well with antitrust intervention. The debate on which authority should enforce the rule, however, is essentially of an institutional nature, and its terms differ across countries. As regards the United States, the Supreme court argued in *Trinko* and in *LinkLine* (see footnote 12) that antitrust courts are “ill-suited to act as central planners” and to identify proper prices, quantities, and other terms of dealing –a view shared, for instance, by Sidak (2008). In Europe, the legal procedures and the respective powers of courts, competition agencies, and regulators, may call for different arrangements. The enforcement issue, however, is secondary to the fundamental tradeoff highlighted in this article, between entry and umbrella effect.

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<sup>22</sup>The incumbent’s awareness depends on the complete information assumption (see the above discussion).

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