

Price Squeezes in a Regulatory Environment

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05 July 2004

Abstract: This paper analyzes the relevance and the scope of price squeeze tests in a regulatory environment. We distinguish between three types of *ex ante* regulation (full, partial or no regulation) to identify the following types of price squeeze: regulatory squeezes, predatory squeezes, and squeezes as foreclosure. We argue that policy makers should use price squeeze tests as an *ex post* instrument, compatible with the *ex ante* regulatory environment. Our analysis implies that policy makers should focus on predatory price squeezes. We propose a predatory squeeze test that respects regulatory choices that have been made previously, in contrast with the earlier proposed tests. We extend our framework to ask at which aggregation level predatory price squeeze tests ought to be applied, a much-debated issue in telecommunications.

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Jan Bouckaert acknowledges the financial support from the University of Antwerp (NOI2003). Frank Verboven acknowledges financial support from the Belgian Science Foundation-Flanders. We thank two anonymous referees, seminar participants at CEFIR (Moscow) and CPB (The Hague), and Massimo Motta and Tomasso Valletti for very useful comments.

1 Introduction

Price squeezes may arise when an incumbent firm sells a vital input to a number of downstream retailers, and at the same time supplies a competing retail service to consumers. The downstream retail competitors may then claim that there is a price squeeze if the margin between the incumbent's retail price and its wholesale price is so small that profitable entry is difficult. While competition authorities have long been concerned with price squeezes in unregulated markets, the issue has recently also received considerable policy attention in the context of regulated industries, such as telecommunications and electricity. This paper aims to analyze the relevance and the scope of price squeeze tests, by explicitly taking into account the role of the existing regulatory environment in which firms operate. Taking the existing regulatory environment as fixed, i.e. as the result of previously made regulatory choices, we ask under which circumstances price squeeze tests may or may not be a sensible *ex post* instrument to monitor violations from competition laws, respecting the previously made regulatory choices. For concreteness, we use the telecommunications sector as an illustration, though our analysis also applies to other sectors where price squeezes occur.

Our analysis is of particular relevance since policy makers in the U.S. and Europe appear to have followed somewhat different approaches towards price squeezes in regulated industries. In the U.S. the 1996 Telecommunications Act requires the Federal Communication Commission to consider only whether access rates are cost based; the analysis of price squeezes in regulated industries has largely remained left as an area of competition policy. In contrast, in the European Union the sector-specific regulators have also become actively involved in dealing with price squeeze issues in regulated industries. This has for example been the case in the telecommunications sector, after a 1998 Notice set out some general principles on the treatment of price squeezes (see European Commission, 1998). In both the U.S. and in Europe, the relevant issue is to ensure that there is a consistent policy towards price squeezes, by keeping *ex post* intervention compatible with *ex ante* regulation.

We present our basic framework for analyzing price squeezes under alternative regulatory environments in section 2. In section 3 we review the price squeeze tests as they have been proposed by practitioners and economists. The major theme of sections 4, 5, and 6 is that the nature of a price squeeze depends on the regulatory environment:

- (1) Under full regulation (both wholesale prices and retail prices are regulated), the incumbent has no pricing instruments at its disposal. A price squeeze should therefore be viewed as a *regulatory price squeeze*, i.e. the artifact of the previous choices made by the regulator (e.g. “unbalanced tariff choices” in telecommunications).
- (2) Under partial regulation (wholesale prices are regulated, retail prices are left unregulated), the incumbent can only squeeze through its retail prices, so that the issue is best approached as a *predatory price squeeze*. We propose a predatory price squeeze test that respects the previously made regulatory choices. Our test contrasts with earlier proposed tests by practitioners and economists. It is, however, desirable to use our test in combination with other pieces of evidence collected in standard predation cases.
- (3) Under no regulation (both the wholesale prices and the retail prices are left unregulated), the incumbent can squeeze through both access and retail prices, so that *foreclosure* becomes an additional source of concern. However, price squeeze tests either do not constrain the incumbent’s behavior, or, if they do, lead to additional efficiency losses. Hence, to deal with foreclosure, it is more appropriate to consider other policy instruments than price squeeze tests, e.g. the stimulation of competition at the upstream level.

We conclude that policy makers should focus on predatory price squeeze tests, to be used in combination with other pieces of evidence collected in standard predation cases.¹

¹ One may use our framework to assess previous decisions such as the European Commission’s decision of May 2003 to fine Deutsche Telekom for abusing its dominant position by squeezing entrants. Relevant questions are whether the Commission has respected the existing regulatory environment in Germany, and correspondingly whether the identified price squeeze was of the regulatory, predatory, or foreclosure type.

Section 7 extends our basic framework to situations where the incumbent offers multiple retail services. This extension allows us to address the question at which aggregation level predatory price squeeze tests ought to be applied. In telecommunications there has been an intense debate regarding the question whether a price squeeze test should be applied at the highest level of detail (i.e. at the level of each individual service), or rather at the aggregate portfolio level (i.e. at the level of a group of services). Apart from stressing that only incremental costs should be included at each considered aggregation level, we contribute to this debate in two ways. First, to determine the aggregation level(s) at which the predatory price squeeze test applies, it is necessary to be precise about the specific regulatory environment. Depending on this environment, a price squeeze may be of a predatory nature only at the individual service level, only at the aggregate portfolio level, or at all aggregation levels. Second, the problem of deciding upon the aggregation level of the predatory price squeeze test is related to the problem of defining the relevant antitrust market in standard predation cases. The aggregation level should be sufficiently high to constitute a relevant antitrust market; at a too low aggregation level a firm would not have sufficient market power to actually engage in predatory price squeezes.

2 Basic framework

There is one incumbent firm, owner of a vital input. The incumbent is vertically integrated, using its input to sell a retail product to consumers at a retail price P . At the same time, the incumbent sells its vital input to a set of downstream retailers, or “entrants”, at a wholesale price A . Both the incumbent and the entrant sell a single product; section 7 generalizes the analysis to the case in which firms sell multiple products. Products are homogeneous, so that there is a one-for-one displacement between output sold by the incumbent and the entrants. This assumption allows us to abstract from welfare considerations stemming from the introduction of new products.

Assume the incumbent’s and the entrants’ cost per unit of output is constant, i.e. independent of output. The incumbent’s cost per unit of output can be decomposed in the following parts: C_0 is the basic upstream cost of producing the vital input; C_1 is the downstream cost of producing the retail product; C_2 is the additional upstream cost of supplying the vital input to the entrants. Hence, if the incumbent directly sells

to consumers, it faces a cost per unit of output equal to $C_0 + C_1$; if the incumbent sells its input to an entrant, its cost is $C_0 + C_2$. The entrant faces a downstream cost of producing the retail product equal to c , in addition to the wholesale price A it pays to the incumbent for access to the vital input.

Applied to the telecommunications sector, one can interpret P as the incumbent operator's retail price charged to its subscribers, and A as the incumbent's access or interconnection price charged to an entrant. Furthermore, one may interpret the basic upstream cost C_0 as the incumbent's "local loop" cost per subscriber, i.e. the cost of providing originating and terminating access. The incumbent's downstream cost C_1 includes its remaining backbone network cost and its retail cost (e.g. billing). The additional upstream cost C_2 refers to the additional costs per subscriber for providing an entrant access to the local loop, e.g. costs for obtaining compatibility. Hence, $C_0 + C_1$ denotes the incumbent's cost of providing its end-to-end retail service, while $C_0 + C_2$ denotes the incumbent's cost of providing the entrant access to the local loop. Finally, c refers to the entrant's downstream cost of providing the service, which may include the following components: its own backbone network costs, its own retail costs and any costs for obtaining compatibility with the incumbent's local loop as borne by the entrant.²

A central point of our analysis is that the nature of a price squeeze depends on the regulatory environment, i.e. the extent to which the incumbent is able to freely set its access and/or retail prices. To organize the discussion, we will distinguish between three different regulatory environments:

- (i) full regulation: both the incumbent's access price A and its retail price P are regulated;
- (ii) partial regulation: the incumbent's access price A is regulated, while its retail price P is unregulated;

² We have adopted a notation very close to Armstrong (2002). Armstrong has $C_0 = 0$, so that he interprets C_1 as the incumbent's end-to-end cost, and C_2 as the incumbent's cost of providing access. For concreteness of interpretation, we found it useful to explicitly include C_0 , although the analysis is not affected when C_0 is normalized to zero. Laffont and Tirole's (1996, 2000) notation does not include additional cost for providing an entrant access to the local loop, i.e. (their cost notation on the right hand side) $C_0 = 2c_0$, $C_1 = c_1$, while $C_2 = 0$.

- (iii) no regulation: both the incumbent's access price A and its retail price P are unregulated.

These regulatory environments may differ between countries or sectors. Perhaps more importantly, the degree of regulation may depend on the considered level of aggregation. For example, the prices of individual retail services may be unregulated, while the sum of the retail prices over different services may be regulated. We will come back to this when we discuss the aggregation level in section 7.

3 Price squeeze tests: current practice and economists' view

3.1 U.S.

The issue of price squeezes starts off in the U.S with the well-known *US v Aluminum Co of America* (Alcoa) case.³ Alcoa had a monopoly in the supply of aluminum ingots—a vital input in the production of aluminum sheets. Alcoa often charged its downstream competitors high prices for ingots. As a result, its competitors' total cost of buying the ingots and rolling them into sheets was greater than Alcoa's downstream price for its sheet products, essentially squeezing its downstream competitors.

While the Alcoa case regards a deregulated industry, the issue of price squeezes has also entered regulated industries such as electricity⁴ and more recently also the telecommunications industry. In *Federal Power Commission (FPC) v. Conway* a utility's wholesale customers challenged the regulator's approval decision to increase the upstream firm's access charges. The customers claimed that the charges were set too high, thereby preventing them from competing with the utility's retail market (Spiwak, 1993). The FPC did not consider this petition, arguing that it lacked jurisdiction about the effects of wholesale rates on downstream markets. The Court disagreed with this position. It referred to the Federal Power Act Sections 205 and 206 according to which the FPC must consider allegations about discriminatory and

³ U.S. v. Aluminum Company of America, 148F.2d 416 (2d Cir. 1945).

⁴ See e.g. FPC v. Conway Corp., 426 U.S. 271 (1976).

anti-competitive effects. Yet, the FPC does not need to “resolve price squeeze claims before accepting and suspending a proposed wholesale rate for filing” (Spiwak, 1993).

A similar issue exists in the telecommunications sector, where the Federal Communications Commission (FCC) has up to now declined to impose a requirement on detecting or preventing price squeezes. This is evident from the FCC’s discussion of the price squeeze in its First Report and Order on Implementation of the Local Competition Provisions (1996, paragraphs 848-850); see Grout (2000). The FCC’s current position and legal authority is that it is responsible for assessing whether access rates are cost-based, and not whether market entry is profitable. This is illustrated clearly by the following passage from the FCC (2002):

“AT&T and WorldCom contend that they cannot profitably enter the Vermont residential telephone market using the UNE-Platform in roughly half the state because Verizon’s UNE rates are allegedly inflated. Before analyzing these contentions, we begin with a discussion of a pending remand on the issue of how allegations of a price squeeze should be considered under the public interest of section 271(d)(3)C. In the Commission’s *SWBT Kansas/Oklahoma Order*, the subject of the *Sprint v. FCC* ruling, the Commission declined to consider allegations that a section 271 applicant should fail the 14-point checklist because competitors are unable to make a profit in the residential market using the UNE-platform. The Commission concluded that the Act requires a consideration of whether rates are cost-based, not whether market entry is profitable. The Commission also stated that if it were to focus on profitability, it would have to consider a state’s retail rates, which are generally outside its jurisdictional authority. Appellants asserted that their inability to make a profit in the residential market showed that granting the BOC’s section 271 application was not in the public interest. The court concluded that the Commission’s rejection of the appellants’ profitability argument was not responsive. The court did not, however, vacate the order. Instead, it remanded the Commission’s rejection of the price squeeze for reconsideration.” (paragraph 65)

Both these examples from the electricity and telecommunications sector illustrate that sector-specific regulators in the US see themselves as primarily responsible for wholesale rate setting and not for judging about profitable market entry.

3.2 *European Union*

The European Commission first referred to price squeezes in deregulated markets: the 1975 Decision of the National Carbonising Company and the 1988 Decision of Napier Brown/British Sugar.⁵ In the context of regulated telecommunications markets, price squeezes have received a renewed attention. European regulation appears to have shown a much more active involvement than the FPC or FCC in the U.S.

In its 1998 Notice the European Commission gives two possible definitions of a price squeeze.⁶ The first definition states that

“a price squeeze could be demonstrated by showing that the dominant company’s own downstream operations could not trade profitably on the basis of the upstream price charged to its competitors by the operating arm of the dominant company.” (paragraph 117)

According to this definition, the price squeeze test amounts to testing whether the following inequality is satisfied:

$$P - A \geq C_I. \tag{1}$$

The Commission’s second definition reads as

“the margin between the price charged to competitors on the downstream market [...] for access and the price which the network operator charges in the downstream market is insufficient to allow a reasonably efficient service provider to obtain a normal profit.” (paragraph 118)

According to the second definition, the price squeeze test may be based on the following inequality:

$$P - A \geq c^*, \tag{2}$$

where c^* denotes the downstream cost of a hypothetical “reasonably efficient entrant”. The second definition is vague and leaves room for interpretation, since it is

⁵ See Commission Decision 76/185/ECSC of 29 October 1975, National Carbonising Company and Commission Decision 88/518/EEC of 18 July 1988, Napier Brown/British Sugar.

⁶ European Commission (1998).

not exactly specified what the downstream cost c^* of a hypothetical reasonably efficient entrant is.

In its later ONP Committee document (ONPCOM 01-17) the European Commission (2001) only refers to the first definition:

“The suspicion of a “*margin squeeze*” arises when the spread between access and retail prices of the incumbent’s corresponding access services is not wide enough to reflect *the incumbent’s own downstream costs*. In such a situation, alternative carriers normally complain that their margins are being squeezed because this spread is too narrow for them to compete with the incumbent. [...] Provided access and retail services are strictly comparable, *a situation of a margin squeeze occurs where the incumbent’s price of access combined with its downstream costs are higher than its corresponding retail price.*” (p. 5)

In the same document the Commission emphasizes that the subject matter of the test is not each of the individual prices P and A as such, but the incumbent’s price structure as reflected by the difference between these two prices. It is interesting to note that the Commission motivates this by referring to the above-mentioned Napier Brown/British Sugar Decision. However, this concerns a deregulated environment, i.e. an environment where both P and A are set freely. As discussed further below, when either P or A are already regulated (as in various telecommunications segments), a squeeze test inevitably must refer to the individual prices.

How have European countries applied these general principles set out by the European Commission? We consider a few examples.

In the *Netherlands*, the telecommunications regulator OPTA and the competition authority NMa issue their joint Guidelines (“Richtsnoeren”) of 28 February of 2001 (see OPTA/NMa (2001)). They define a price squeeze (or “constrictive pricing”) as follows:

A price squeeze scenario applies in the event of the margin between the sourcing and selling rates applied by the provider having significant market power, or by a business having economic power, being reduced to such a level as to prohibit (efficient) competitors from marketing their services on a profitable basis. (art. 4)

This definition suggests that OPTA adopts the Commission’s second definition, as given by the above inequality (2). However, the guidelines later specify that the cost

level of a reasonably efficient competitor may be approximated by the cost level of the incumbent operator; see art. 28 in OPTA's Guidelines. This indicates that OPTA specifies $c^* \approx C_I$, so that the price squeeze test would amount to the first test proposed by the Commission.

In the *United Kingdom*, the National Regulatory Authority Oftel (2000a) published its guidelines of January 2000 in "The Application of the Competition Act in the telecommunications Sector", stating that:

"In considering whether an undertaking is engaging in price squeezing in breach of the Competition Act, the Director General will consider whether the dominant undertaking would be profitable in the relevant downstream market if it had to pay the same input prices as its competitors." (paragraph 7.26)

Oftel therefore apparently uses the first definition of the price squeeze test given by the European Commission.⁷

Note that in another document Oftel (2000b) explicitly makes several additional points relating to price squeezes, to which we will come back below. First, it states the purpose of the squeeze test:

"The purpose of a margin squeeze test is to establish that more efficient competitors are not being excluded from the market by an anti-competitive practice. It is therefore clearly important that the tests should be set up in a way that reflects this objective." (paragraph 9.2)

Oftel further elaborates on the importance to be explicit about the proper "relevant market". According to Oftel:

⁷ Note that the competition authority The Office of Fair Trading (OFT) has in a recent case used the same definition. It investigated whether BSkyB was abusing its dominant position in the TV industry. The OFT received complaints from downstream providers that BSkyB was exercising a price squeeze on them in relation to its own downstream channels. OFT (2002) stated that a price squeeze exists when:

"a dominant vertically integrated company wholesales a product to distributors at a price that allows an insufficient margin for them to make a profit even if they are as efficient as the vertically integrated company's own downstream distribution business." (paragraph 4.9)

The market definition is particularly important when tariffs are unbalanced, because if too narrow a definition of the relevant market is adopted, the margin squeeze test might not achieve its objective. In particular, if the relevant retail market is defined as consisting only of the line rental, and excludes call services, the margin squeeze test could result in incumbents being required to provide loops at a price below cost.” (paragraph 9.2)

As a final example, in *Germany* the telecommunications regulator RegTP verifies whether the incumbent’s retail price exceeds its access price plus a 25% surcharge to proxy for retail costs. The German regulator is silent about whether this approach is based on the Commission’s first or second definition: it is not clear whether the 25% surcharge is believed to proxy for the incumbent’s downstream cost C_I or for a hypothetical reasonably efficient competitor’s downstream cost c^* . In its recent decision to fine Deutsche Telekom for squeezing entrants, the European Commission used the first definition (1). This is illustrated by the following argument:

“prices for wholesale access were lower than retail subscription prices but the difference was still not sufficient to cover DT's own downstream product-specific costs for the supply of the end-user services.” (European Commission, IP/03/717).

3.3 Economists’ view

The economists’ approach usually starts by deriving the condition under which the incumbent’s margin, i.e. its retail price P minus its access price A , is efficient. To formulate the price squeeze test, this optimal margin condition is then restated as an inequality, i.e. a floor to the incumbents’ margin. Hence, the economists’ approach to price squeeze tests in regulated industries is often strongly linked to regulatory principles. To illustrate, we derive the efficient margin condition in our simple model with homogeneous products.⁸ Because under homogeneous products either the incumbent firm or an entrant is active, the efficient margin may be derived from comparing the efficient entry condition with the profitable entry condition.

⁸ For a review of the rich literature of optimal access pricing see for example Laffont and Tirole (2000).

Efficient entry happens when the end-to-end cost per subscriber is lower when the entrant provides the retail service than when the incumbent provides the retail service. Formally, efficient entry occurs when $C_0 + C_2 + c \leq C_0 + C_1$, or:

$$c \leq C_1 - C_2. \quad (3)$$

The entrant's downstream cost of providing the service should thus be lower than the incumbent's downstream cost minus its additional upstream cost for providing the entrant access to the local loop.⁹

Profitable entry occurs when the incumbent's retail price is sufficient to cover the competitor's cost, which consists of its access costs A and its downstream costs c . Hence, given the retail price P there is profitable entry when $P \geq A + c$, or:

$$c \leq P - A. \quad (4)$$

Conditions (3) and (4) coincide when their right-hand sides coincide, i.e.:

$$P - A = C_1 - C_2. \quad (5)$$

A regulator can therefore conclude that the incumbent's margin $P - A$ is efficient if and only if it is equal to the incumbent's own downstream cost C_1 net of extra interconnection costs C_2 . This rule is well known as the margin rule, or the imputation rule.¹⁰

To derive a price squeeze test, economists typically start from the margin rule (5) and simply restate this as an inequality, i.e.

$$P - A \geq C_1 - C_2, \quad (6)$$

see for example Hausman and Tardiff (1995), Kahn, Tardiff and Weisman (1999), Gual and Seabright (2000), and Laffont and Tirole (2000). The idea behind writing

⁹ The discussion focuses on the efficiency of entry in the sense of cost reduction. There is also the possibility of improved quality, so that one may speak more generally of surplus enhancement.

¹⁰ Because of our assumption that products are homogeneous, the rule also coincides with the efficient component pricing (ECPR) rule; see Armstrong (2002) for a clear classification. The rule is often written as a condition the access price needs to specify, i.e. $A = C_0 + C_2 + (P - C_0 - C_1)$, stressing that the incumbent's optimal access price is equal the incumbent's cost of providing interconnection $C_0 + C_2$, plus its opportunity cost, i.e. its profit margin $P - C_0 - C_1$ it would earn if it would provide the service directly to consumers.

the margin rule as an inequality is that it constitutes an “efficient” price floor, in the sense of ensuring that the incumbent does not deter efficient entry. However, the efficiency condition (5) only holds under the simplified assumptions of our model. For example, it would require modification to allow for differentiated products, see Armstrong, Doyle and Vickers (1996) and Weisman (2002) for an application to price squeezes.¹¹ Furthermore, while the price floor would ensure efficient entry (in our simple set-up), it would still leave room for inefficient entry.¹²

3.4 A synthesis

U.S. regulators in electricity and telecommunications do not actively resolve price squeeze issues before authorizing or suspending a proposed access charge. They ground this on the fact that they lack the jurisdiction for doing so. In contrast, European telecommunications regulators anticipate the possibility of a price squeeze when setting wholesale rates. By making use of a price squeeze test, European regulators are, as such, much more involved in the competitive effects of access charges on competition in the downstream market.¹³ Apart from this difference between the U.S. and Europe, the European Commission’s two alternative price

¹¹ More specifically, under differentiated products the displacement ratio σ (the amount of sales lost when 1 unit of access is supplied to entrants) is no longer equal to 1. The efficient pricing condition (5) then generalizes to $P - A = C_1 - C_2 + (1 - \sigma)(P - C_1)$. Hence an additional term is added when $\sigma < 1$, so that the efficient margin would be larger under differentiated products.

¹² Inefficient entry may also result from rivals influencing the regulator to peg price floors at higher levels. Although important, we abstract from these issues in our analysis. We refer the reader to Weisman (2002) for a detailed overview of the arguments.

¹³ One possible explanation for the difference between the U.S. and Europe is the general fact that antitrust principles have not penetrated sector-specific regulation as much in the U.S.; see Geradin and Sidak (2003) for a discussion. Another explanation could be the general differences in policy objectives between the two regions. It has sometimes been argued that competition policy in Europe is more oriented towards protecting the individual competitors, instead of protecting the integrity of the competitive process. See e.g. Patterson and Shapiro (2001) for a discussion in the context of the GE-Honeywell decision.

squeeze tests have created a source of confusion, as is also evident from the practice in various countries. Nevertheless, the confusion can be resolved by being more explicit about how to interpret the cost c^* of a reasonably efficient entrant in the second definition. First, one might view a reasonably efficient entrant as having the same downstream cost as the incumbent, so $c^* = C_1$. The second definition then coincides with the first definition. In the Netherlands, OPTA/NMa have explicitly adopted this approach, i.e. they use the second definition but interpret c^* such that it coincides with the first definition.

Second, one might define a reasonably efficient entrant such that the Commission's second definition coincides with the economists' preferred price floor (6). Specifically, this is achieved by interpreting a reasonably efficient entrant as a hypothetical firm with a cost equal to the incumbent's downstream retail cost net of its extra costs for providing interconnection to an entrant, i.e. $c^* = C_1 - C_2$.

In what follows below we therefore use either (1) or (6) as definitions for the price squeeze test. For convenience, we will sometimes refer to (1) as the (European) "practitioners' test", and to (6) as the "economists' test".

4 Full regulation and regulatory squeezes

Under full regulation, the regulator determines both the incumbent's access and retail prices, so that the incumbent has no freedom to choose its prices. It is useful to start with this situation as a benchmark case, to identify some key policy problems. To illustrate the analysis we consider two examples.

4.1 Cost-oriented regulation of access and retail prices

A cost-oriented *retail* price simply means that $P = C_0 + C_1$. A cost-oriented *access* price may or may not include an allowance for the extra costs C_2 the incumbent needs to incur for providing interconnection to the entrant. Assuming the regulator accepts an allowance rate α ($0 \leq \alpha \leq 1$) for the extra interconnection costs C_2 , the cost-oriented access charge is $A = C_0 + \alpha C_2$. The regulator may decide to set the allowance rate α less than 1 for several reasons. First, a low α may reflect the regulator's desire to create competition via access. This may for example be justified

if there are asymmetries for which the entrants need compensation to be able to compete on a more equal level in the initial stages. Second, a low α may reduce the incumbent's incentives to choose artificially high interconnection costs to raise rivals' costs ("gold plating").¹⁴ For example, in its consultation document of 26 November 2001 the Dutch regulator OPTA (2001) proposes only a partial allowance for the extra costs C_2 (referred to as wholesale-specific costs), based on the argument that the incumbent operator KPN otherwise:

"has no internal stimulus for bringing these costs to an efficient level or for keeping them at an efficient level. Or, even more pertinent: there is a risk that KPN can use the wholesale specific costs as a means of raising the costs of its competitors which would strengthen its own competitive position." (paragraph 48)

Under the cost-oriented prices $P = C_0 + C_1$ and $A = C_0 + \alpha C_2$, the relationship between P and A is as follows:

$$P - A = C_1 - \alpha C_2. \quad (7)$$

One can now verify whether a price squeeze occurs using the two possible versions of the price squeeze test, i.e. the practitioners' test (1) or the economists' test (6). Begin with the price squeeze test (1). Since $P - A = C_1 - \alpha C_2 < C_1$ unless $\alpha = 0$, the price squeeze test would necessarily be violated, unless the regulatory system provides no allowance for the extra interconnection costs C_2 . Hence, the cost-based regulatory system and the practitioners' price squeeze test (1) are internally inconsistent. The policy maker would almost always identify a price squeeze, and this would solely be an artifact of the cost-based regulatory system. We refer to such a price squeeze as a "regulatory price squeeze".

Now consider the economists' squeeze test (6). In this case, the condition of the price squeeze test would never be violated, since $P - A = C_1 - \alpha C_2 \geq C_1 - C_2$. The system

¹⁴ Note that the incentives to claim excessive interconnection costs may not only be reduced by setting a low allowance rate α , but also by capping the level of the allowable extra interconnection costs, and adjusting this over time by factors exogenous to the firm, e.g. the retail price index less a specified number X% (RPI-X%), industry-wide productivity growth, etc.

would therefore be internally consistent, although the squeeze test would have no real impact.

4.2 Unbalanced tariffs

Now suppose access price regulation is still cost-oriented according to $A = C_0 + \alpha C_2$, but retail price regulation is not. In particular, suppose the regulator opts for a system of unbalanced tariffs, where some of the retail services need to be provided below cost, so that $P < C_0 + C_1$. One example is given by the regulatory requirement to offer uniform tariffs throughout the country. This requirement often implies a subsidy from less costly urban regions to the expensive rural areas. The incumbent then effectively operates below cost in the rural areas. Social tariffs are another instance of unbalanced tariffs. To ensure service to low users, the incumbent operator is often required to set the price of line rental below cost (subsidized by above-cost usage prices).

Under cost-based access prices and below-cost retail prices due to unbalanced tariffs, we have $P - A < C_1 - \alpha C_2$. Hence, the practitioners' price squeeze test (1) would now always be violated (even if the regulated access charge provides no allowance for the extra interconnection costs C_2). Furthermore, one can easily verify that even the economists' price squeeze test (6) may now be violated (namely if the allowance rate α is sufficiently high).

The presence of a regulatory price squeeze, here as an artifact of an unbalanced tariff regulation, seems to correspond to the situation to which Oftel is referring, see the citation in section 3.2. To resolve the problem, Oftel proposes to enlarge the market definition to a level at which tariffs are not unbalanced. While such a procedure would indeed avoid the identification of price squeezes as an artifact of the regulatory system, no economic justification is provided. We will come back to this issue in section 7 where we discuss the aggregation level at which price squeeze tests should be applied. At this point, we simply observe that an internally consistent procedure would be not to impose a price squeeze test as an ex post instrument for competition policy, when they arise as artifacts of the regulatory system. This does not necessarily mean, however, that the regulator should not be concerned with price squeezes. Given the close connection between price squeezes and regulatory principles, the regulator

may consider using *ex ante* price squeeze tests (such as the margin rule or ECPR) as a way to test whether the regulatory system does not create competitive distortions.¹⁵

We can now summarize our discussion in section 4.1 and 4.2 on how policymakers should treat price squeezes under full regulation, i.e. when both the access and the retail prices are regulated. Our conclusion holds for both the practitioners' and the economists' price squeeze tests.

Conclusion 1: *Under full regulation, the incumbent has no price instruments (access or retail), so that it is not appropriate to impose a price squeeze test as an ex post instrument. When access prices are cost-oriented, and retail prices are either cost-oriented or below-cost (unbalanced tariffs) regulatory price squeezes may occur as an artifact of the regulatory system.*

4.3 Exclusion with non-price instruments

The above analysis emphasizes that an incumbent has no retail or access prices to influence market structure in a fully regulated environment. It provided two examples to show under which conditions the regulatory system by construction creates price squeezes. Nevertheless, the regulatory system may also be such that price squeezes do not arise automatically, for example when the regulator sets retail prices above cost and access prices at cost. In this event, the incumbent foregoes profits from selling access to its competitors and may use *non-price* instruments as a way to squeeze competitors. For example, the incumbent may invest resources to deliberately raise its competitors' costs. Such strategies are referred to as "exclusion". Economides (1998) shows that the incumbent operator may have an incentive to raise its rivals' costs, for example by intentionally degrading the quality of interconnection, increase processing times of orders, etc... However, Mandy (2000) shows that when access charges

¹⁵ In fact, there is increasing awareness that regulatory policy should be compatible with competitive neutrality. This is for example explicitly stated in the proposed new German Telecommunication Law. We thank a referee for pointing this out to us.

exceed costs and there is imperfect competition in the downstream market, an input monopolist may refrain from sabotaging rivals' downstream activities. This happens when the double marginalization problem is not too important and the cost disadvantage of the incumbent's downstream activity is sufficiently high.¹⁶

If exclusion with non-price instruments is a source of concern, the regulator can intervene in several ways, e.g. by imposing minimum levels of delivery of service. However, this quickly amounts to a situation of heavy-handed regulation; problems of verification of imposed minimum quality levels remain present such that the first-best will be difficult to achieve. As an alternative solution, the regulator could decide to no longer regulate both the access and retail prices, and instead apply the ECPR. Although the ECPR indeed addresses the issues of price squeeze and non-price discrimination, many telecommunications regulators have argued against it. As an example, the FCC opposes ECPR because it is not cost based and does not necessarily result in downstream competitive prices. The regulator's preference for a cost-based approach may therefore reveal that the regulator is not so much concerned about the risk of exclusion strategies, and more about competitive retail prices.¹⁷

5 Partial regulation and predatory squeezes

Under partial regulation, the regulator determines the incumbent's access price, while the incumbent has the freedom to choose its retail price. Under this scenario the incumbent therefore has the possibility to use its retail price to influence market structure and induce exit, so it is appropriate to analyze the price squeeze as a potentially predatory practice. Since the incumbent cannot influence the access price under partial regulation, we do not treat the issue of the price squeeze as a foreclosure instrument here.¹⁸ This issue arises when the incumbent can influence both its access

¹⁶ See also Sibley and Weisman (1998).

¹⁷ See also Laffont and Tirole (1996 and 2000) who discuss the risk of exclusion strategies in a regulated environment and the drawbacks of ECPR in detail.

¹⁸ Although the incumbent cannot foreclose its competitors through a price squeeze since it cannot influence the access price under partial regulation, it can still foreclose its competitors through non-

and its retail prices and will be addressed subsequently in our scenario of no regulation in section 6.

5.1 Identification

Predatory pricing is defined as “a price reduction that is profitable only because of the added market power the predator gains from eliminating, disciplining, or otherwise inhibiting the competitive conduct of a rival or a potential rival” (see Bolton, Brodley, and Riordan (2000)). The incumbent thus intentionally sacrifices short-run profits, anticipating future gains from increased market power. Predation works if the incumbent faces a competitor with sufficient financial hurdles relative to the incumbent. Financial hurdles may be important if the manager of the competing firm needs to obtain internal or external financing, and the financier has limited information about the long-term profit opportunities in the market. In this case, the incumbent can charge a sufficiently low retail price, such that the manager does not meet its profit target.

There has been a long debate on how to identify predatory behavior. It is generally accepted that the test should not be based on the competitors’ margins, since competitors may simply be inefficient. Predation tests are therefore based on the margin earned by the incumbent. Current European practice is based on the AKZO case, and closely conforms to the Areeda-Turner rule, which has been influential in the U.S.¹⁹ Roughly speaking, a necessary condition for predatory pricing to occur is that a dominant firm sets its price below average variable cost for a sustained period of time. The Court of Justice provides the following reasoning:

A dominant undertaking has no interest in applying such prices except that of eliminating competitors so as to enable it subsequently to raise its prices by taking advantage of its monopolistic position, since each sale generates a loss, namely the total amount of the fixed costs [...] and, at least, part of the variables costs. (Source: Notice on the application of the competition rules to access agreements in the telecommunications sector, 98/C 0265/02, §111.)

price instruments. Hence, our earlier discussion of exclusion with non-price instruments in section 4.3 remains relevant here.

¹⁹ See *AKZO v. Commission*, Case C-62/86 [1991] ECR I-3359.

How would one then identify predatory pricing behavior in the context of partial regulation? A direct application of current practice would amount to a test whether

$$P \geq C_0 + C_1. \quad (8)$$

This is a direct test for predatory behavior, and it can of course be applied as such by the competition authority. However, under partial regulation it is also possible to reinterpret this as a predatory price squeeze test. This can be done by being more explicit about how the regulator actually determines the access price. Suppose as in section 4 that the access price is regulated based on cost-oriented principles, with a partial allowance for the extra network costs C_2 , i.e. $A = C_0 + \alpha C_2$. Under such a system, one can immediately verify that the direct test for predatory pricing (8) is equivalent with the following predatory price squeeze test only:

$$P - A \geq C_1 - \alpha C_2. \quad (9)$$

In words, under cost-oriented access price regulation the appropriate predatory price squeeze test would generally lie in between the two possible definitions (1) and (6). Only if the regulatory system does not give any allowance for the extra interconnection costs C_2 (i.e. $\alpha = 0$), the predatory squeeze test (9) reduces to the practitioners' price squeeze test (1). But conversely, only if the regulatory system gives a full allowance for the extra interconnection cost C_2 (i.e. $\alpha = 1$), the predatory squeeze test (9) coincides with the economists' rule (6). In general, when the regulatory system gives a partial allowance for the extra interconnection cost C_2 , the predatory price squeeze test (9) falls in between the two extremes, reflecting the fact that it respects previously made regulatory choices.

Since both predation tests (8) and (9) are equivalent, why would the competition authority ever want to switch from its familiar direct predation test (8) to the predatory price squeeze test (9)? There are two valid and related reasons. First, an important and well-known practical problem in predation cases is the computation of the average variable costs. By using (9), the competition authority avoids this job, and instead makes use of the work that the regulator has done *ex ante*. Second, by using (9) the competition authority ensures that there is no inconsistency between its own *ex post* competition policy and the regulator's *ex ante* policy since the same cost definitions are implicitly used.

We can now summarize our discussion on whether price squeeze tests are desirable under partial regulation, and under which form they should come.

Conclusion 2: *Under partial regulation, it is possible to use a predatory price squeeze test as an alternative to the competition authority's direct predation test. This avoids recollecting cost information and ensures consistency between regulation and competition policy. Furthermore, under cost-oriented access price regulation with a partial allowance for the extra interconnection cost C_2 , the appropriate predatory price squeeze test falls in between the previously proposed tests (1) and (6).*

We emphasize that, since the price squeeze test in a partially deregulated context is of a predatory type, it is necessary to conduct a complete analysis of all factors that help to show the presence of predation. It is thus not sufficient to show that the incumbent operates at a loss for a certain service. Bolton, Brodley, and Riordan (2000), propose a rule that would require proof of five elements:²⁰ (1) price below cost; (2) facilitating market structure, i.e. market power to raise prices; (3) scheme of predation and supporting evidence; (4) probable recoupment of losses incurred during predation phase; (5) efficiencies or business justification defense. It is therefore clear that the price squeeze test is only one element to assess in a predation case (namely a test whether price is below cost). Evidence on the remaining four elements should also be collected, and this should either be fully delegated to the competition authority, or at a minimum investigated in close collaboration between the sector-specific regulator and the competition authority.

The importance of the second element, that the firm should possess market power, is particularly noteworthy in the context of the new European Union Directives for Telecommunications (see European Commission, 2002). These state that retail prices should be deregulated if and only if the incumbent cannot exercise market power downstream. Hence, if these deregulation principles will be strictly applied, there is only a risk of a predatory price squeeze if the incumbent has no market power: the

²⁰ See also Canoy, de Bijl and Kemp (2002) for a more detailed summary of Bolton et al. (2000).

first and second element cannot be both satisfied so that the predatory price squeeze test would be irrelevant. In practice, the European regulators may not strictly adopt the new directives and sometimes deregulate if the incumbent has market power, so that the predatory squeeze tests would retain some of their relevance.

The fourth element, that the incumbent should be able to recoup its losses incurred during the predation phase, is also of importance. In network industries a high proportion of costs are fixed and sunk. Hence, while it may be possible to drive out an entrant from the market, this does not drive out its network capacity, so that reentry in the “post-predation” phase may be relatively easy.

Given the many conditions that need to be satisfied to be able to speak of predation, it is not surprising that several authors have described the possibility of predation as a “rare bird”. In particular, Baumol (1996) and Weisman (2002) argue that the introduction of predation tests in the regulatory process may in fact serve the purpose of pegging prices at artificially high levels to protect competitors rather than to prevent genuine predation.

Finally, it is instructive to relate our analysis, which stresses the role of the existing regulatory environment, to the European Commission’s recent decision of May 2003 (O.J. L 263/9). Deutsche Telekom received a fine of €12.6 million for abusing its dominant position by squeezing entrants. Deutsche Telekom defended its case by arguing that they could not be held responsible for a squeeze since wholesale prices were regulated and retail prices were approved by the regulator. The Commission replied that Deutsche Telekom was still able to set its retail prices freely (since the beginning of 1998). Phrased in our terminology, the Commission argued that the regulatory environment was one of “partial regulation”, and not one of “full regulation”. However, our analysis implies that the price squeeze should then have been treated as a predatory squeeze, requiring a complete analysis of all factors to show the presence of predation. It is not clear that the Commission has actually done this.

5.2 Prevention

The above discussion pointed out that the incentives for predatory pricing behavior depend on the financial hurdles faced by the competitors. How does the regulatory system influence the incentives not to engage in a predatory price squeeze? Biglaiser and DeGraba (2001) address this issue in an environment where the incumbent takes the access charge as fixed, similar to what we are addressing here. They ask whether the regulator can prevent predation by raising the access price *ex ante*.²¹ They show that an increase in the access price has two effects. First, an increase in the access price increases the incumbent's profits earned on its competitors, and therefore reduces the incumbent's incentives to drive its competitors out of the market. Second, an increase in the access price makes predation less costly in the sense that the incumbent may set a higher predatory price to induce exit. Biglaiser and DeGraba (2001) find that the first effect is stronger than the second effect, so that the overall effect of an increase in the access price is to reduce the incentives for predatory price squeezing. These findings may be summarized as follows:

Conclusion 3: *Suppose the regulator wants to prevent predatory price squeezes ex ante, rather than intervene ex post. It can reduce the risk of a predatory price squeeze by raising the access price above cost.*

The increase in access price to prevent predation leads, however, to a loss in allocative efficiency. Regulators therefore face a trade off between the gains from preventing predation and the losses from an allocative inefficiency. Since regulators are currently more focused on reducing access prices rather than on increasing them, this suggests that regulators do currently not consider the risk of predation a major issue, and are instead preoccupied with allocative or other regulatory issues.

²¹ The regulator may also prevent predation by regulating the retail prices. For example, the incumbent may be restrained from raising its price after having lowered it. See, however, Baumol (1979) for a critical discussion. Such a policy would bring us close to our scenario of full regulation, in which both access and retail prices are regulated.

6 No regulation: predation and foreclosure

No regulation refers to a situation where the incumbent can freely determine both its retail and its access price. Under this scenario there is again the risk of predation. In addition, since access prices are free, foreclosure now also becomes a potential source of concern. We begin with a discussion on how to treat predation under no regulation; this is done in section 6.1. In the next section 6.2, we then discuss the issue of foreclosure.

6.1 Predation

Under no regulation, the incumbent operator may again have an incentive to engage in predatory pricing behavior, just as in the partially deregulated case. However, the incumbent's deregulated access price now no longer has a simple relationship with cost. There is therefore little gain in rewriting the traditional AKZO/Areeda-Turner predation test (8) as a price squeeze test, as we did earlier in (9) for the case of a cost-oriented access charge.²² It is therefore recommended not to treat possible predatory behavior in a deregulated environment with a reference to price squeeze tests, but rather based on standard predation tests.

Conclusion 4: *Under no regulation a price squeeze may be of a predatory nature, as under partial regulation. However, because predation tests and price squeeze tests no longer show a clear relationship, it is preferable to use standard predation tests.*

²² Suppose the equilibrium access price is a monotone increasing function f of cost, i.e. $A = f(C_0 + \alpha C_2)$. Inverting this function and substituting the solution for C_0 in the direct predation test (8), we obtain the condition $P - f^{-1}(A) \geq C_1 - \alpha C_2$. Only under special circumstances can this be written as a price squeeze test. This was the case under partial regulation, in which the access price is cost-based and given by $A = f(C_0 + \alpha C_2) = C_0 + \alpha C_2$. Under no regulation, the function f is more complicated, so that the condition $P - f^{-1}(A) \geq C_1 - \alpha C_2$ seems more difficult to implement than the direct predation test (8).

6.2 Foreclosure

No regulation also offers the incumbent operator an additional instrument to influence its profits. In addition to its retail prices, it may now also freely choose its access prices. The relevant (and long-debated) question is whether the incumbent, as a monopolist over an essential input in the upstream market, has an incentive to distort competition in the downstream retail market. Absent any regulation, the incumbent firm can “exercise its market power by setting a high price for the final good and, at the same time, set a high access charge to prevent other firms in the competitive segment from becoming effective competitors.” (See European Economy, 1999, p.151.) The foreclosure doctrine states that the upstream monopolist indeed has an incentive to exclude some of the downstream users from its essential input, either to extend its upstream monopoly power to the downstream market or to restore its upstream monopoly market power.²³

In our context, the incumbent operator is a vertically integrated firm owning both the upstream essential input and a downstream retail business. The issue is whether the incumbent will charge access prices too high compared to its retail prices, thereby “squeezing” its competitors from the retail market, and possibly distorting competition in the downstream market. In an important case, the European Commission dealt with this question in the 1980s, when British Sugar, the only UK company involved in the production of sugar from beet origin, reduced

“its prices for retail sugar to the extent that an insufficient margin existed between its prices for retail and industrial sugar.... In a case such as this, where an undertaking is alleged to be dominant in the markets for the supply of both a raw material and a downstream product, and it is further alleged that the dominant undertaking maintains an artificially low margin between the price of the raw material (industrial sugar) and the price of the downstream product (retail sugar), the analysis of pricing must be centered upon the difference between the selling price of the dominant companies' raw material and its downstream product prices, in the present case on the margin between BS's price for industrial and that for its retail sugar (the repackaging margin).” (Case No IV/30.178 Napier Brown - British Sugar (88/518/EEC))

²³ For a review of the more recent theory of foreclosure as a strategy to restore market power rather than extend it, see Rey and Tirole (1997).

To address the incentives for foreclosure, reconsider our framework of a vertically integrated incumbent firm, owning an essential input.²⁴ The incumbent is now able to influence both its access price A and its retail price P . It has two possible options. First, it can choose to serve consumers directly, by setting a sufficiently high access price A so that $P - A < c$, i.e. the competitors are “squeezed” (or foreclosed). The incumbent may then be viewed as a monopoly on the downstream market, subject to a marginal cost $C_0 + C_1$.

Second, the incumbent can decide to sell its vital input to its downstream competitors, by choosing a sufficiently high retail price P so that $P - A \geq c$. Assuming that the downstream competitors have no market power, their retail price p will be equal to $A + c$. The incumbent firm’s problem of setting a profit-maximizing access price A , subject to a marginal cost for providing access $C_0 + C_2$, is then equivalent to choosing a retail price $p = A + c$ subject to a marginal cost $C_0 + C_2 + c$. In sum, the incumbent firm may again be viewed as a monopoly on the downstream market, who now effectively outsources its business and is subject to a marginal cost $C_0 + C_2 + c$.

In sum, under both options the incumbent effectively acts as a monopoly on the downstream market. If the incumbent chooses to squeeze or foreclose, then it charges the monopoly retail price based on its cost level of $C_0 + C_1$. In contrast, if the incumbent chooses to outsource or open access, then it acts as if it charges a monopoly retail price based on a cost level of $C_0 + C_2 + c$. Since a monopolist’s profits are typically a decreasing function of its marginal cost level, it immediately follows that the incumbent chooses to outsource if and only if $C_0 + C_2 + c \leq C_0 + C_1$ (assuming outsourcing would be chosen in case of indifference). This implies that outsourcing occurs if and only if the productive efficiency condition $c \leq C_1 - C_2$ given in (1) is satisfied. At the same time, however, consumers pay the monopoly retail

²⁴ For a discussion of foreclosure by a vertically integrated firm, see also Rey and Tirole (1997, section 5) and Armstrong (2002, section 2.1). They differ in focus as follows. Rey and Tirole start with the problem of a non-integrated upstream firm, who is unable to capture its monopoly rents on the essential input. They then focus on demonstrating that vertical integration is a solution to restore upstream market power. In contrast, Armstrong immediately starts from an already vertically integrated firm. He assumes a perfectly inelastic retail demand, so that too high prices do not imply allocative

price in both cases. In the first case, the incumbent forecloses and sets high retail prices. In the second case, the incumbent outsources, but the access price is such that consumers end up paying a monopoly price again.²⁵ Therefore, the vertically integrated incumbent firm, as the owner of an essential input, is indeed responsible for monopoly retail prices. However, this monopoly distortion does not stem from the practice of foreclosure *per se*. The distortion is simply the consequence of the fact that the vertically integrated firm is a monopolist over the vital input; it would foreclose if and only if this is productively efficient.

The previous reasoning assumes that the incumbent has an upstream monopoly over an essential input. In practice, the incumbent's upstream market power may not be that strong. While the incumbent operator typically owns the copper line, substitute networks in the form of cable, wireless etc... are available. In other words, the incumbent's essential facility is not absolute. The downstream competitors may therefore bypass the incumbent's network and consider purchasing access from alternative providers, or investing in an own network. Nevertheless, when bypass is possible, one can apply the same reasoning as before to show that the incumbent will outsource if and only if it is less efficient than its competitors (i.e. $c \leq C_1 - C_2$). The only difference is that the retail prices will be lower than the previous monopoly price, reflecting the incumbent's reduced upstream market power.

Conclusion 5. *Under no regulation an incumbent squeezes/forecloses if and only if entry entails a productive inefficiency. At the same time, the downstream retail price reflects the extent of upstream market power over the vital input.*

inefficiencies *per se*. He instead focuses in greater detail on the question whether the incumbent has incentives to create productive inefficiencies by foreclosing competitors.

²⁵ Since the downstream competitors have no market power, double marginalization issues do not arise. When the downstream competitors would have market power, such issues could be avoided through two-part tariffs.

The first part of Conclusion 5 summarizes the Chicago view that foreclosure may be seen as a sign of the incumbent's relative efficiency, thus casting doubt on the validity of its rivals' frequent arguments. The conclusion does however depend on several assumptions: the incumbents' rivals have no market power, there is no entry cost, and the incumbent and the rivals produce homogeneous products. If these assumptions are violated, then foreclosure of efficient rivals may occur. See for example Whinston's (1990) leveraging theory of market power. In the context of telecommunications, Armstrong, Doyle and Vickers (1996), DeGraba (2003) and Armstrong (2002) relax the assumption that the incumbent and the entrants produce homogeneous products. They allow for a displacement ratio between the incumbent's and the entrants' products that is not equal to one. With imperfect substitutes, productive efficiency is no longer guaranteed, so foreclosure may be a valid source of concern.

6.3 Price squeeze tests

How do these results relate to the price squeeze tests considered above? We provide a brief overview here; more detail on the arguments appears in the Appendix. Suppose first that the regulator requires that the incumbent satisfy the economists' version of the squeeze test (6), while keeping the actual level of the access and retail prices deregulated. One can verify that this test does not alter the outcome, i.e. the incumbent will still foreclose if and only if it is more efficient than the competitors, and the final retail prices would still reflect the extent of the incumbent's market power over its vital input. The economists' squeeze test (6) therefore simply has no bite.²⁶

Alternatively, suppose the regulator requires that the incumbent satisfy the practitioners' version of the squeeze test (1). This test effectively imposes a higher floor on the margin between the incumbent's retail and access price, since it does not allow including the extra costs in providing interconnection C_2 . One can verify that in most cases the practitioners' squeeze test (1) still has no bite, i.e. the incumbent can continue its unregulated behavior without violating the squeeze test. There is however

²⁶ Rey and Tirole (1997, section 5.2.2) obtain this conclusion for the special case where the incumbent and the entrant have the same efficiency level (so that in fact $c = C_1 - C_2$).

one important exception, namely when the competitors have a moderate degree of efficiency relative to the entrant, i.e. $C_1 > c > C_1 - C_2$: the entrant provides the downstream retail services more efficiently than the incumbent, but not sufficiently more to compensate for the extra interconnection costs it causes. In this case the incumbent has an incentive to efficiently foreclose (since $c > C_1 - C_2$). However, because the squeeze test (1) imposes $P - A \geq C_1$, the incumbent is not allowed to foreclose by setting a sufficiently high access price to obtain $P - A < c$ (since $C_1 > c$). The incumbent is therefore forced to open access, while foreclosure would have been productively more efficient. At the same time the incumbent's market power is not constrained: the incumbent sets its access price such that the retail price equals the monopoly price, now based on an inefficient cost level $C_0 + C_2 + c$. We conclude:

Conclusion 6. *Under no regulation, the economists' squeeze test (6) has no bite, i.e. it does not affect entry nor influence retail prices. Furthermore, the practitioners' squeeze test (1) has no bite, except if $C_1 > c > C_1 - C_2$. In this case, entry will be productively inefficient and result in higher consumer prices.*

The previous analysis has shown the risks involved in applying squeeze tests under no regulation. They either have no bite, or, if they do, may create additional distortions. As discussed after Conclusion 5, this analysis in part depends on the assumptions that make foreclosure efficient. If these assumptions are violated, then foreclosure may be a valid source of concern, and price squeeze tests such as (1) or (6) to detect and sanction foreclosure may be more warranted. A complete analysis on the effects of price squeeze tests when these assumptions are relaxed is beyond the scope of this paper.

In the European context, one may however note that the issue of foreclosure in telecommunications markets may be of little relevance for another reason. As noted earlier in the context of partial regulation and predatory squeezes, the European Directives (if strictly applied) imply that a situation of no regulation would only occur if the incumbent possesses no market power. Consequently, the issue of foreclosure

may be largely irrelevant in the telecommunications sector, since the regulator would not have deregulated the markets if the incumbent possessed market power.

6.4 *Alternative solutions*

The previous discussion showed that price squeeze tests may have no beneficial and sometimes even detrimental effects on efficiency in a deregulated environment. This does not, of course, imply that nothing can be done to constrain an incumbent with a dominant position over a vital input. To put our previous analysis in perspective, we briefly discuss some alternative policies. A first solution is to re-regulate access or retail prices, so as to make them closer to competitive prices. While such an approach may sometimes be unavoidable, it would go against the spirit of the deregulatory movements in most countries; it may be desirable to consider more creative policies.

One alternative solution is immediately suggested by the above discussion that competition is encouraged, when there are bypass opportunities on the upstream segment. A structural policy would therefore be to encourage investment in competing networks, i.e. facilities-based competition. Such a policy is related to issues of dynamic efficiency and would have to be based on a careful cost-benefit analysis. The allocative efficiencies from reduced market power would have to be traded off against possibly higher investment costs, e.g. the costly duplication of networks.

Another, more drastic solution would be to separate the upstream and downstream divisions of the incumbent operator. As the analysis by Rey and Tirole (1997) implies, such a separation would reduce market power at the upstream level. Once a disintegrated upstream firm has made a contract with a downstream retailer, it has an incentive to secretly negotiate another contract with another retailer, thereby leading to lower prices. An integrated firm would not have such an incentive since it would internalize the externality it causes on its own downstream business. The benefits from a break-up would of course have to be traded off against any inefficiencies arising from vertical separation.

7 The aggregation level of the price squeeze test

The previous analysis has assumed that the incumbent and its competitors provide a single retail service to consumers. In practice, operators of course offer a very wide range of retail services, with a correspondingly wide range of prices. For example, incumbent operators offer both line rental (at a monthly fee) and call services (at a price per minute). They offer a variety of these call services, such as local, regional, long-distance and international calls. In this context, the question arises at what level of detail the policy maker should intervene: should a price squeeze test be applied at the level of every individual service, or only at the aggregate level? This section extends the previous analysis to address this question.²⁷ Our analysis starts from our previously obtained conclusion that the relevance and the scope of the price squeeze test should be limited to predatory price squeeze tests.

The aggregation question has been much debated in policy documents about the price squeeze test. We refer to section 3.3 where we cited Oftel's point of view in this matter. Most of the policy debate has focused around the cost principles that should be taken into account when considering the aggregation level. A general conclusion from this debate is that, whatever aggregation level is considered, it is necessary to only account for the appropriate incremental costs at that aggregation level; see Grout (2000) for a detailed survey of the issues involved. While the discussion on the cost principles is informative on how to implement price squeeze test once the aggregation level is chosen, it provides little guidance on which level should in fact be chosen. An extreme approach would be to adopt a combinatorial testing approach, in which one applies a price squeeze test for each possible combination of individual services. Under this approach the aggregation question essentially remains an open question: one simply considers all aggregation levels, using the appropriate incremental costs

²⁷ To focus on the aggregation issues in the simplest form, we abstract from complications that may arise when the incumbent offers a pure bundle of retail services. A complete analysis of these issues is beyond the scope of this paper, as the intense debate regarding the Microsoft case illustrates.

for each considered combination of services. In practice, such an approach may be rather cumbersome.²⁸

In the discussion below, we argue that it is actually not necessary to consider all possible aggregation levels and combinations. The reason is that price squeezes may not be of a predatory nature at each considered aggregation level. First, the regulatory environment may not be one of partial regulation at each considered aggregation level (section 7.1). Second, firms may not have market power at the lowest levels of aggregation, so that there would be no predatory risk at these levels (section 7.2).

7.1 The regulatory environment

We begin by asking whether a price squeeze is indeed of a potentially predatory nature at each aggregation level. This depends on the regulatory environment: full, partial or no regulation. We start from the observation that the degree of regulation may be different at each aggregation level, so that a price squeeze may not be of a predatory nature at each aggregation level.

Consider an example of only two services X and Y , and two corresponding aggregation levels: the individual service levels and the aggregate level (sum of both services). For both access and retail prices the regulator faces three options: regulate the price at the individual service level; regulate the price at the aggregate level, i.e. regulate only the sum of both prices; do not regulate the prices. Assume that the regulator regulates the access prices at a level at least as detailed as the retail prices. Table 1 provides the various regulatory regimes corresponding to the various cases. The cells below the diagonal are empty because we assumed that the access prices are regulated at a level at least as detailed as the retail prices. Note that in the bottom right cell (“no access price regulation” and “no retail price regulation”) we have also included Laffont and Tirole’s (2000) “global price cap”. This is a system in which the regulator only regulates the (weighted) sum of all four prices (the two access and the

²⁸ If there are two services, A and B , the combinatorial approach requires applying three squeeze tests: one for product A , one for product B , and one for the sum of product A and B (with the appropriate costs for each combination). With three services, the number of combinations already raises to 7.

two retail prices); hence there is no separate regulation for the access prices and the retail prices.²⁹

The Table shows that there may be a different regulatory regime at each aggregation level. For example, it is possible that there is full regulation at the aggregate level while there is only partial regulation at the individual level. This would happen when there is individual access price regulation and aggregate retail price regulation (upper middle cell).

Table 1. Regulatory environment at alternative aggregation levels

	<i>Individual retail price regulation</i>	<i>Aggregate retail price regulation</i>	<i>No retail price regulation</i>
<i>Individual access price regulation</i>	Individual Level: FR Aggregate Level: FR	(e.g. “partial price cap”) Individual Level: PR Aggregate Level: FR	Individual Level: PR Aggregate Level: PR
<i>Aggregate access price regulation</i>		Individual Level: NR Aggregate Level: FR	Individual Level: NR Aggregate Level: PR
<i>No access price regulation</i>			(e.g. “global price cap”) Individual Level: NR Aggregate Level: NR

Notes: FR refers to full regulation; PR to partial regulation and NR to no regulation.

More generally, Table 1 shows the following. On the diagonal cells there is either full regulation or no regulation. From our previous analysis, we conclude that price squeeze tests are an inadequate policy in these cases: price squeezes would either be

²⁹ Laffont and Tirole advocate this system, since it corresponds to Ramsey pricing of all products, provided the appropriate weights are chosen.

“regulatory price squeezes” (i.e. arise as artifacts from the regulatory system) or they would be an indication of foreclosure so that alternative instruments are better suited.

For example, under the global price cap (the bottom-right cell) price squeezes would be an indication of foreclosure at both aggregation levels. This would not warrant a price squeeze test in contrast to what Laffont and Tirole’s (2000, p. 174) preliminary discussion suggests.

On the remaining cells of Table 1, there may be partial regulation on at least one of the aggregation levels (as indicated in bold), so that there may be scope for a predatory price squeeze test. Consider these cases:

1. Individual access price regulation, aggregate retail price regulation

The regulator restricts the operator’s access prices, but allows relative freedom in the retail market. Laffont and Tirole’s (2000) “partial price caps” would fall under this case. At the individual service level, there is partial regulation, and a predatory price squeeze test can potentially be applied. At the aggregate level, however, there is still full regulation. Therefore, at the aggregate level, there may only be regulatory price squeezes, arising as an artifact of the regulatory system so that a price squeeze test can still not be sensibly applied at the aggregate level.

2. Individual access price regulation, no retail price regulation

The regulator still restricts the operator’s access prices, but now allows full freedom in the retail market. There is therefore partial regulation at both aggregation levels, so that a predatory price squeeze test can be potentially applied at both levels.

3. Aggregate access price regulation, no retail price regulation

The regulator now offers the operator a relatively high degree of freedom concerning its access prices. There is full freedom in the retail market. Consequently, there is no regulation at the individual service levels, so that squeeze tests are not a sensible policy instrument. At the aggregate level, however, there is partial regulation, so that a predatory price squeeze test may be applied at the aggregate level.

These observations allow us to draw the following conclusion regarding the aggregation level at which predatory price squeeze tests ought to be carried out.

Conclusion 7. *A price squeeze may not be of a predatory nature at each aggregation level. Depending on the regulatory system, it may be appropriate to apply the predatory price squeeze test only at the individual level, only at the aggregate level, or at both levels of aggregation.*

7.2 The relevant antitrust market

There is a second reason why a predatory price squeeze test should not necessarily be carried out at each aggregation level. We discussed before that predatory price squeeze tests should be supplemented with other pieces of evidence commonly used in predation investigations. One of these elements is the presence of a facilitating market structure: the firm accused of predation must have market power to raise prices. Otherwise the firm would not have an incentive to drive out its rivals through predation in the first place. An essential question is therefore whether the considered aggregation level constitutes a relevant market in the antitrust sense: would a hypothetical monopolist be able to raise its price by a small but significant amount without losing too much consumers to make the price increase unprofitable.³⁰

Consider for example the segment of five-minute calls, and assume that this segment falls under partial regulation, i.e. the operator is subject to a regulated access price but has some freedom to choose its retail price. Does this imply a price squeeze test can be carried out at this level? This depends on whether the market for five-minute calls constitutes a separate relevant market, i.e. would a hypothetical monopolist over five-minute calls have sufficient market power to profitably raise its price by a small but significant amount. In this specific example it may be difficult to argue that this would be the case, since consumers may easily substitute to four or six-minute calls

³⁰ This description refers to the SSNIP-test: a small but significant and non-transitory increase in price (typically in the 5-10% range). This part of the market definition measures the role of demand substitution, though in practice supply substitution and entry are also considered at various stages.

when the price of five-minute calls increases. Consequently, even if an operator would be able to drive out its competitors from the five-minute calls segment through a predatory price squeeze, this would not give rise to a substantial increase in market power because of the competition from the four-minute calls and six-minute calls segments. Hence, the finding of a price squeeze at this detailed level of aggregation would not be sufficient evidence of predation. Since the five-minute calls segment is presumably not a relevant market, one cannot apply a predatory price squeeze test at this highly detailed level of disaggregation.

We therefore obtain the following conclusion:

Conclusion 8. *A price squeeze can only be predatory if the predating firm has sufficient market power after inducing exit. This implies the aggregation level at which a predatory price squeeze test should be carried out must be sufficiently high so that the services constitute a relevant antitrust market, i.e. a market at which the firm would have sufficient market power to raise prices.*

8 Conclusions

The paper has considered the relevance and the scope of price squeeze tests as proposed by (European) regulators, competition authorities and economists. In contrast to previous work, we take the existing regulatory environment as fixed, i.e. as the result of previously made regulatory choices. We instead ask whether and how price squeeze tests can serve as useful *ex post* instruments to monitor compliance with competition laws. We distinguish between three degrees of regulation: full regulation, partial regulation and no regulation. Under full regulation, price squeezes are typically regulatory price squeezes, i.e. they arise as an artifact of previously made regulatory choice. Under no regulation, price squeezes may arise as foreclosure and do not cause inefficiencies *per se*. Hence, price squeeze tests would either have no bite (not constrain the incumbent), or, if they do, would lead to additional efficiency losses.

Under partial regulation, price squeezes may be of a predatory nature, so that there may be something to say for applying predatory price squeeze tests. We propose a predatory price squeeze test that respects previously made regulatory choices, in

contrast with earlier proposed tests by European practitioners and economists. Furthermore, it is desirable to apply the predatory price squeeze test in combination with other pieces of evidence as collected by competition policy authorities in standard predation cases.

We next extend the basic framework to situations where the incumbent offers multiple retail services. This extension allows us to address the question at which aggregation level predatory price squeeze tests ought to be applied. In telecommunications there has been an intense debate whether a price squeeze test should be applied at the highest level of detail (i.e. at the level of each individual service), or rather at the aggregate portfolio level (i.e. at the level of a group of services). Apart from stressing that only incremental costs should be included at each considered aggregation level, we contribute to this debate in two ways. First, to determine the aggregation level(s) at which the predatory price squeeze test applies, it is necessary to be more precise about the specific regulatory environment. Depending on this environment, a price squeeze may be predatory only at the individual service level, only at the aggregate portfolio level, or at all aggregation levels. Second, the problem of deciding upon the aggregation level of the predatory price squeeze test is related to the problem of defining the relevant antitrust market in standard predation cases. The aggregation level should be sufficiently high to constitute a relevant antitrust market; at a too low aggregation level a firm would not have sufficient market power to actually engage in predatory price squeezes.

We have made some simplifying assumptions. For example, we have not considered in detail dynamic aspects of efficiency, e.g. investment incentives and how price squeeze tests may affect these. As another example, we have assumed that the incumbent firm, owner of the essential input, and its competitors produce homogeneous products or perfect substitutes. Much of the analysis would generalize to situations of imperfect substitutes. However, the conclusion that under no regulation foreclosure occurs if and only if it is productively efficient may need modification, as suggested by Armstrong (2002). Consequently, it may become possible that price squeeze tests efficiently constrain the incumbent's foreclosure behavior under no regulation.

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Appendix: Price squeeze tests under no regulation.

This Appendix shows in more detail the results from section 6.3, i.e. the economists' price squeeze test (6) does not form an effective constraint, while the practitioners' price squeeze test (1) only forms a constraint when this would be socially undesirable.

The economists' test (6): $P - A \geq C_1 - C_2$.

Case 1: $C_1 - C_2 \leq c$.

As shown in section 6.2, when $C_1 - C_2 \leq c$ the incumbent chooses to efficiently foreclose by setting a sufficiently high access price A such that $P - A \leq c$. Specifically, the incumbent could set its A such that it also passes (6), i.e. such that $C_1 - C_2 \leq P - A \leq c$. Hence, (6) does not constrain the incumbent.

Case 2: $c < C_1 - C_2$.

As shown in section 6.2, when $c < C_1 - C_2$ the incumbent chooses to efficiently outsource by setting a sufficiently high retail price P such that $P - A > c$. Specifically, the incumbent could do this by setting P so high that (6) is also satisfied, i.e. such that $P - A \geq C_1 - C_2 > c$. Hence (6) does not constrain the incumbent.

The practitioners' test (1): $P - A \geq C_1$.

Case 1: $C_1 < c$.

As shown in section 6.2, since in this case $C_1 - C_2 \leq C_1 < c$ the incumbent chooses to efficiently foreclose by setting a sufficiently high access price A such that $P - A \leq c$. Specifically, the incumbent could set A such that it also passes (1), i.e. such that $C_1 \leq P - A \leq c$. Hence (1) does not constrain the incumbent.

Case 2: $C_1 - C_2 < c < C_1$.

As shown in section 6.2, since also in this case $C_1 - C_2 < c$ the incumbent would also prefer to efficiently foreclose by setting a sufficiently high access price A such that $P - A \leq c$. However, since it is also true that $c < C_1$, this implies it would need to ensure that $P - A < C_1$, which would violate the squeeze test (1). Hence, (1) would constrain the incumbent to carry out efficient foreclosure.

Case 3: $c < C_1 - C_2$.

As shown in section 6.2, when $c < C_1 - C_2$ the incumbent prefers to outsource the downstream activity by setting a sufficiently high retail price P such that $P - A > c$. Specifically, the incumbent could do this by setting P so high that (1) is also satisfied, i.e. such that $P - A \geq C_1 \geq C_1 - C_2 > c$. Hence (1) does not constrain the incumbent.