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Ex-ante Margin Squeeze Tests in the Telecommunications Industry: What is a Reasonably Efficient Operator?*

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Abstract

We study the implementation of ‘reasonably efficient operator’ margin squeeze tests by National Regulatory Authorities in European telecommunications markets. We provide a theoretical framework in which we show how regulatory authorities deal with the asymmetries between the entrants and the incumbent by adjusting the ‘equally efficient operator’ margin squeeze test used in competition policy. Using this framework, we build a benchmark of implementation choices by inspecting authorities’ guidelines, market analyses and decisions. We find that some implementation choices are very similar across the authorities’ decisions, whereas some others are dealt with quite heterogeneously.

Keywords: Margin squeeze; Imputation test; Regulation; Telecommunications.

JEL codes: L51; L96.

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1 Introduction

In recent years, Competition Authorities (CAs) have dealt with high-profile margin squeeze cases in the telecommunications industry. For instance, the European Commission intervened in price squeeze cases such as *Deutsche Telekom* in 2003, or *Telefónica* in 2007.¹ These cases have established the nature of a margin squeeze and have characterized it as a stand-alone anticompetitive conduct: a margin squeeze occurs when a vertically integrated firm, providing an essential input to downstream competitors, sets retail and input prices that do not leave an economic space for efficient downstream firms to make positive profits.

Margin squeeze analyses are also popular among European National Regulatory Authorities (NRAs) of the telecommunications industry. According to a 2009 survey by the European Regulators Group (ERG),² twelve NRAs declared having a procedure to conduct ex-ante margin squeeze analysis in at least one retail market. As stated by the ERG, their purpose is different than in competition policy, because “while competition law is intended to prevent margin squeeze as an exclusionary abuse, ex-ante regulation seeks the more ambitious goal of promoting competition [...]” Accordingly, some NRAs conduct ex-ante margin squeeze tests as a regulatory tool to set downstream price floors whenever the vertically integrated incumbent is dominant in both the downstream and upstream markets.³ Alternatively, some NRAs use margin squeeze tests in a competitive downstream market as a regulatory tool for the wholesale market as in a retail-minus mechanism. Finally, the tests are in some cases implemented to analyze the replicability of the unregulated retail offers of the incumbent on top of another access price control remedy.

Ex-ante margin squeeze tests will be a key tool in the regulation of next generation access (NGA) networks. Indeed, the 2010 Commission’s Recommendation on regulated access to NGA networks highlights that margin squeeze tests are appropriate when mandated access is not cost-oriented. Furthermore, Neelie Kroes, the Vice President of the European Commission responsible for the Digital Agenda for Europe, announced in July 2012 a forthcoming recommendation on non-discrimination that will ensure equivalence of access between telecommunications operators. She stated that NRAs will have to analyze the economic replicability of dominant firms’ offers through “a properly-specified ex-ante ‘margin squeeze’ test.”⁴

Whereas CAs base the implementation of their margin squeeze tests on case law, NRAs rely on general guidelines rather than on an explicit methodology. In particular, the Commission’s NGA Recommendation defines a margin squeeze test based on a ‘reasonably efficient operator’

¹Case COMP/C-1/37.451, 37.578, 37.579 - *Deutsche Telekom AG*, later confirmed by Case T-271/03 before the European Court of First Instance and Case C-280/08 P before the European Court of Justice; and Case COMP/38.784 - *Wanadoo España vs. Telefónica*, confirmed by Case T-398/07 before the General Court.

²See ERG (2009). The European Regulators Group, has been replaced by the Body of European Regulators for Electronic Communications (BEREC) in 2009.

³When the test is implemented between two wholesale markets, a margin squeeze test is also called a ‘non-eviction’ test.

⁴“Enhancing the broadband investment environment,” policy statement by Vice-President Kroes, Brussels, 12 July 2012.

(REO), which is an alternative to the ‘equally efficient operator’ (EEO) test established by competition case law. The Commission states that in order to maintain effective competition, NRAs may consider margin squeeze tests according to costs and characteristics of an operator that does not exhibit the same economic conditions than the incumbent operator, but that is *reasonably* efficient. The Commission however does not define what “reasonably efficient” means; it only states that NRAs should properly specify in advance the methodology they will follow to implement such a test. Therefore, NRAs’ appreciation in conducting ex-ante REO margin squeeze tests is large.

In practice, such tests have been implemented by European NRAs according to different methodologies. NRAs can build a bottom-up hypothetical efficient operator using parameters tuned from quantitative measures; they can use alternative operators’ actual costs and data; they can adjust the costs and economic conditions of the incumbent to account for new entrants’ disadvantages;⁵ or they can combine these three approaches.

This paper analyzes the third approach, whereby NRAs make adjustments to margin squeeze tests based on the incumbents’ data in order to model a reasonably efficient operator. In other words, we inspect the ex-ante specific issues related to market asymmetries that entrants may encounter, and how NRAs take them into account to convert an EEO margin squeeze test into a REO test. Then, we provide a theoretical framework that allows us to translate these specific issues into practical test adjustments.

The specific issues for adjusting REO margin squeeze tests can be classified into three categories. The first category is explicitly mentioned by the European Commission and it is usually considered as the main difference between REO and EEO tests; it relates to downstream cost disadvantages. Per unit costs could be modified to take into account possible economies of scale, economies of scope as well as other specific costs for the entrant. The other two categories are not formally associated to REO tests but we estimate that they also follow to the same rationale. The second category deals with access charge adjustments. When several wholesale products are available to entrants, several margin squeeze tests may be conducted. These tests can be implemented on each of the wholesale products, or considering a wholesale product mix. Finally, the third category explores possible price adjustments. Specifically, it covers adjustments related to the increasing practice of bundling in the telecommunications industry.

Using our theoretical framework, we review the implementation of margin squeeze tests by European NRAs. Our aim is to build a benchmark by analyzing NRAs’ decisions as well as European and country-specific guidelines. Along with documents from the European Commission (EC) and the European Regulators Group (ERG), we also review decisions and guidelines from the following NRAs: BIPT (Belgium), ARCEP (France), BNetzA (Germany), ComReg (Ireland), AGCOM (Italy), UKE (Poland), CMT (Spain) and Ofcom (United Kingdom).

⁵This last approach has the practical benefit that NRAs can use incumbent’s data provided in the framework of accounting separation and cost accounting remedies. Some NRAs call this approach an ‘adjusted equally efficient operator’ test or ‘similarly efficient operator’ test.

Our analysis does not seek to study an exhaustive list of margin squeeze tests implemented by European NRAs in the telecommunications industry. However, we think our list is large enough to explore the main issues related to REO ex-ante margin squeeze tests.

Whereas we compare NRAs' choices regarding ex-ante margin squeeze tests, we do not aim at advocating EEO or REO tests, nor to endorse NRAs' implementation of margin squeeze tests, and whether or not these tests should be conducted regarding any particular regulatory context. Besides, we do not study the impact of ex-ante margin squeeze tests on investment or innovation, and do not define what "reasonably efficient" means. Our focus is rather to analyze the possible asymmetries between entrants and incumbents currently considered by European NRAs and the resulting range of implemented adjustments.

The rest of the paper is organized as follows. In Section 2 we review the literature on the interplay between margin squeeze and regulation. In Section 3 we explain in which regard NRAs adjust their margin squeeze tests when implementing them ex-ante. We develop a list of issues specific to ex-ante implementation of margin squeeze tests in Section 4, and review the NRAs' conduct regarding these issues in Section 5. Section 6 concludes.

2 Literature on margin squeeze and regulation

The economic literature on margin squeeze is scarce and most of it deals with margin squeeze from a competition law perspective. Some papers study margin squeeze tests taking into account other regulatory obligations of the vertically integrated firm, but only a few discuss margin squeeze tests as an ex-ante regulatory tool per se.

Bouckaert and Verboven (2004) consider the relevance and the scope of ex-post price squeeze tests in different regulatory environments. The authors study three different environments: full regulation (the incumbent's retail and upstream prices are fixed by the regulator), partial regulation (only the incumbent's upstream price is fixed by the regulator), and no regulation. They show that price squeezes could be observed because of the regulator's choices in a fully regulated environment, because of a predatory strategy from the incumbent in a partially regulated environment, or because of a foreclosure strategy in a unregulated environment. However, they only study the relevance of ex-post price squeeze tests to monitor compliance with competition laws in a regulated environment, and not price squeeze tests as a regulatory tool. They also discuss the appropriate aggregation level of price squeeze tests for multi-product firms in their partially regulated environment.

Biglaiser and DeGraba (2001) study an incumbent's incentive to engage in a price squeeze in order to foreclose a downstream rival. More precisely, they analyze the impact of the access charge level on the incentive to prey. In their model, the incentive to entail a price squeeze always decreases in the access charge.

Spector (2008) discusses how economic theory can provide some guidance for the implementation of margin squeeze tests when it is analyzed in terms of other well-known abuses of

a dominant position (predatory pricing, excessive upstream pricing, etc.). He further points out three major concerns to be taken into account at the retail level: product differentiation, the scope of squeeze tests when considering multi-product firms (product-by-product vs global tests), and the case of new products. We also find some of these sources of concern in our benchmark analysis, and review how NRAs deal with these issues.

Ergas et al. (2010) describe the difficulties associated with margin squeeze tests for NGA services. The authors consider some critical issues for margin squeeze tests at the retail level. They express their concern about bundling, retail discounts related to offers with long-term commitments, low prices for new offers, nonlinear pricing and economies of scale. In addition, concerning implementation in practice, they stress the major difficulties that arise from retail product differentiation, wholesale product differentiation and bypass, and the possible ‘two-sidedness’ of markets. They argue that the number of false-positive test results can be high when these margin squeeze tests are implemented ex-ante, and that the cost associated with these errors is likely to be large. They conclude that margin squeeze tests should only be applied ex-post, in the context of competition law.

Briglaue et al. (2010) also study margin squeeze in a regulatory environment; they argue that a margin squeeze could be an indicator for market deregulation. They develop a theoretical model that demonstrates that a margin squeeze can result from regulation in combination with inter-modal competitive pressure, and not from an anti-competitive foreclosure strategy from the incumbent. In this regard, they advocate that NRAs should deregulate markets where inter-modal competition is strong enough, in order to avoid margin squeeze of intra-modal new competitors.

Despite the limited economics literature on the interplay between margin squeeze tests and regulation, the importance of margin squeeze tests in ex-ante regulation is highlighted in some policy analysis. For example, Briglaue and Vogelsang (2011) emphasize the relevance of considering an alternative wholesale access charge pricing formula to cost-orientation using forward-looking long run incremental costs. They justify the use of a new regulatory wholesale price formula because the margin squeeze issue becomes particularly predominant in contracting markets in the telecommunications industry. Their analysis proves that margin squeeze tests conducted ex-ante by NRAs are notably relevant and, hence, need to be carefully conducted.

We can see from this literature review that a few papers consider the interplay between regulation and competition law for margin squeeze tests. Yet none of them study REO margin squeeze tests, which are widely used by European NRAs to define some of their regulation policies. We build a theoretical framework that reflects NRAs’ practices in the implementation of REO margin squeeze tests, and hence, our work could constitute a basis for further economic analysis on the impact of REO margin squeeze tests as a regulatory tool.

3 Margin squeeze: from theory to practice

In this section, we present the two different margin squeeze tests defined by the European Commission, and we briefly review some implementation issues that are common to both tests.

3.1 Two different tests to demonstrate a margin squeeze

The European Commission's Recommendation 2010/572/EU on regulated access to Next Generation Access networks provides two alternative definitions of ex-ante margin squeeze test: the Equally Efficient Operator (EEO) test, and the Reasonably Efficient Operator (REO) test.

The EEO test. The first definition of a margin squeeze test in the NGA Recommendation is given as follows:

“Margin squeeze can be demonstrated by showing that the SMP [Significant Market Power] operator's own downstream operations could not trade profitably on the basis of the upstream price charged to its competitors by the upstream operating arm of the SMP operator (‘equally efficient competitor’ test) [...]”

Whereas this definition is to be used in ex-ante margin squeeze tests, it is to be noted that the EEO test has been formally designated as the adequate test to apply by ex-post competition law.⁶ It provides legal certainty for dominant firms as they have knowledge of their own costs and access charges in order to assess the lawfulness of their own conduct. The EEO test is also consistent with the objectives of competition policy, as it guarantees that downstream competitors with lower costs would make a positive profit by buying the wholesale product and competing against the incumbent in the retail market. Accordingly, more efficient downstream competitors are not excluded from the market.

With ex-ante regulation, the adoption of the EEO test depends on the objectives of regulation at a certain state of development of competition in a given market. As formulated in 2009 by the European Regulators Group, “where there are concerns about the incentives to invest and innovate, it is possible that a regulator would more likely use the equally efficient operator test. Under this test [...] a dominant firm is not required to price its products artificially high in order to encourage (inefficient) entry into its market to increase the competitiveness of that market in the long run.”⁷

The REO test. The NGA Recommendation also proposes an alternative to the EEO, the REO test:⁸

⁶See the cases *Deutsche Telekom* and *Telefónica*.

⁷ERG (2009), §55.

⁸Although the EEO and REO tests were first mentioned in the 1998 Notice on the application of competition rules to access agreements in the telecommunications sector, the 2010 NGA Recommendation provides for the

“[...] Alternatively, a margin squeeze can also be demonstrated by showing that the margin between the price charged to competitors on the upstream market for access and the price which the downstream arm of the SMP operator charges in the downstream market is insufficient to allow a reasonably efficient service provider in the downstream market to obtain a normal profit (reasonably efficient competitor test). In the specific context of ex-ante price controls aiming to maintain effective competition between operators not benefiting from the same economies of scale and scope and having different unit network costs, a ‘reasonably efficient competitor test’ will normally be more appropriate.”

As presented by the Commission, the REO test might be used ex-ante when there are asymmetries between the SMP and other operators.⁹ This is typically the case of a new entrant in the downstream market which faces an already installed incumbent with significant market power in the downstream market. The adjustments of the REO margin squeeze test allow to create a level playing field, which would promote competition in the downstream market.

However, it is not clear whether the Commission recommends adjusting for asymmetries in the downstream market whenever this market is considered competitive and exempted from regulation. In particular, in situations where the upstream market power of the vertically integrated operator is already addressed through other regulatory obligations, should a margin squeeze test be conducted?¹⁰ The Commission has nevertheless indicated that margin squeeze tests should not in any case be used to regulate competitive downstream markets.¹¹ Clearer guidelines and economic analysis are necessary to better frame and understand the pertinence of REO adjustments, and more generally, the precise use of margin squeeze tests.

3.2 A simple theoretical margin squeeze test

A direct transcription of the EEO test, as previously described, compares the retail price p set by the incumbent with the sum of the wholesale access charge a and the incumbent’s downstream cost c . There is no margin squeeze if the downstream branch of the incumbent covers its perceived upstream and downstream unit costs:

$$p \geq a + c. \tag{1}$$

first time a clear difference between the two and an explicit preference for the REO test in the context of ex-ante regulation.

⁹See also the Commission’s comments pursuant to Article 7(3) of Directive 2002/21/EC in decisions EL/2010/1113 and IT/2010/1103.

¹⁰Indeed, the REO definition is ambiguous, it refers to *maintaining* effective competition between operators, opening the possibility for asymmetric adjustments in downstream competitive markets.

¹¹See the Commission’s comments pursuant to Article 7(3) of Directive 2002/21/EC in decisions IT/2010/1103 and PL/2010/1098.

The EEO test guarantees that more efficient competitors are not excluded from the market. An entrant with downstream cost $c_E \leq c$ would make positive profits buying the wholesale product and competing against the incumbent.

By contrast, when conducting a REO test, NRAs have to adjust the imputation test defined by inequality (1) to take into account competitors' asymmetric conditions, that are for instance due to the presence of economies of scale and scope. Therefore, a REO test can hardly be defined by a simple formula, as the one expressed in inequality (1) for the EEO test. In Section 4, we study the various adjustments NRAs do to the EEO test in order to model a REO, and we build a theoretical framework which translates these adjustments into practical margin squeeze tests. Before inspecting these adjustments, we briefly discuss an important question in the implementation of margin squeeze tests.

3.3 The not-so-simple implementation of margin squeeze tests

The telecommunications industry is dynamic and marketing practices can be complex as services evolve according to innovation and technological progress. As Ergas et al. (2010) point out, there are several difficulties associated with the implementation of a simple margin squeeze test, as described by inequality (1). To name a few, these include retail discounts with long-term commitments offers, introductory low prices, learning-by-doing economics, nonlinear pricing, two-sided markets.

In particular, a common issue to the implementation of EEO and REO tests concerns the appropriate time frame for evaluating the profitability of a downstream operator. There are two possible approaches: a period-by-period approach, and a dynamic approach.

The period-by-period approach assesses periodically the profitability of an activity within a given period of time, usually one year. With this approach, a margin squeeze test is conducted for each of these periods.

Alternatively, the dynamic approach evaluates the profitability of an activity over several years. Revenues and costs can be evaluated with the discounted cash flow (DCF) method, generally used to test if the net present value of cash flows is positive. Contrary to the period-by-period approach, the dynamic approach does not specify how costs should be recovered in each period; it allows for initial losses that are compensated by future high profits.¹²

As dynamic pricing (when price varies over time) is commonly observed in the telecommunications industry when new products or services are introduced in the market, imputation tests using the dynamic approach seem to be preferable. Indeed, a failure to pass the period-by-period imputation test might not indicate a margin squeeze conduct, but rather a penetration pricing strategy (when price increases over time). This is especially so when the product in

¹²In practice, when the squeeze test takes place ex-post, the period-by-period approach generally compares the revenues and costs of the activity based on historical information extracted from the operator's accounts. By contrast, ex-ante tests use the best currently available information, based sometimes on short term forecasts. Note also that the test given by inequality (1) should be modified when using a dynamic approach, in order to take into account the evolution of costs, demand, and prices.

question is characterized by network externalities and consumers find greater value in the product when the penetration rate is higher. Similarly, discounts and promotions or learning-by-doing effects related to new services favor imputation tests using the dynamic approach. As Spector (2008) puts it, “[l]ow introductory downstream prices may have innocent motives because both producers and consumers in new markets need to gain experience, and costs can usually be expected to decrease.”

However, there are shortcomings in the dynamic approach. For instance, an imputation test may rely on unreasonable cost and demand forecasts. Or, a positive net present value for the incumbent could be the result of a successful foreclosure strategy, as the dynamic approach would allow for the recoupment of the initial losses induced by a predatory strategy.¹³ Even so, all things considered, the European Commission and NRAs acknowledge the relevance of the dynamic approach in the telecommunications industry for EEO or REO tests, but they claim caution and suggest using the period-by-period and the dynamic approaches simultaneously whenever required.

The rest of the paper focuses on margin squeeze tests as conducted ex-ante by European NRAs, and on the adjustments that these NRAs make to the EEO margin squeeze test described by inequality (1) to model a REO. The next section builds a theoretical framework to take account of possible market asymmetries between the entrants and the incumbents.

4 Specific issues for building a REO margin squeeze test

In this section, we review each issue specific to REO margin squeeze tests in detail. For each of these issues, we first explain what would be the nature of the asymmetry between the incumbent and a new entrant. Then, we propose an adjustment to the simple imputation test described by inequality (1).

The margin squeeze test is composed of three parameters: costs, access charge and retail price. We analyze the possible adjustments that can be made for these three parameters.

4.1 Cost adjustments

In this subsection, we analyze three different cost adjustments made by NRAs when conducting their imputation tests: economies of scale, economies of scope, and entrants’ specific costs.

4.1.1 Economies of scale

Firms in the telecommunications industry usually have to bear important fixed costs in order to enter the market, namely to build their own networks or their information systems. Because of these fixed costs, an increase in demand leads to a decrease in the average cost of production. With identical cost functions, firms with a higher demand will have a lower average cost than

¹³As pointed out in the European Commission in its response to CMT (2007) guidelines, SG-Greffe (2007) D/202782, or in its *Telefónica* decision.

firms with a lower demand. Therefore, a potential entrant might find unprofitable to enter the market when the incumbent already serves a high demand, and hence, benefits from lower average costs.

Suppose that the average cost of production decreases with the firm's demand D , that is $c = c(D)$ and $\partial c(D)/\partial D < 0$. In markets recently opened to competition, the incumbent's demand D_I is higher than the entrants' one, so the NRAs usually have to scale back the incumbent's market share to take into account economies of scale. To adjust the simple imputation test for economies of scale, an NRA may consider the average cost of the incumbent c , evaluated at \tilde{D} , the expected demand served by an efficient entrant. \tilde{D} is evaluated by the regulator and $c(\tilde{D}) > c(D_I)$, as $\tilde{D} < D_I$. The imputation test hence becomes:

$$p \geq a + c(\tilde{D}). \quad (2)$$

We immediately see how the test (2) differs from the test (1): the incumbent's cost is evaluated at a lower demand than the one it is actually serving.

4.1.2 Multiproduct incumbent: Economies of scope

When the incumbent is active in several markets, whereas the entrant is active in only one, the incumbent can benefit from a strategic cost advantage over the entrant if there are economies of scope. This is the case when there are potential cost-savings because of common costs that can be spread between two (or more) incumbent's products.¹⁴

Suppose that the incumbent sells two different retail products, product 1 and product 2. Suppose further that for some reason the entrant can only produce product 1. For instance, one could argue that as a new entrant it is not possible to offer all of the incumbent's product range that has experience in the market. The NRA may consider that it is *reasonably* efficient that at the time of entry only one product is offered but that an efficient entrant will eventually produce other products if there are economies of scope. Let the total cost function of the incumbent be $C(q_1, q_2)$, where the incumbent sells q_1 units of product 1 and q_2 units of product 2. There are some economies of scope between products 1 and 2 if:¹⁵

$$C(q_1, 0) + C(0, q_2) > C(q_1, q_2).$$

We denote by $c = c(q_1|q_2)$ the incumbent's average cost of selling q_1 units of product 1, when it already sells q_2 units of product 2. The average cost of an entrant that is as efficient as the incumbent in the first downstream market is $c(q_1|0)$; the entrant produces at the same average costs in market 1 when producing zero units of product 2.

¹⁴When analyzing economies of scope, we consider a multi-product incumbent and entrants that cannot produce all of the incumbent's products. If entrants can compete on all of the incumbent's portfolio, the relevant modifications to the simple imputation test are described in the "Price adjustments" category.

¹⁵For example, see Panzar and Willig (1981).

We denote by F the common fixed costs of producing products 1 and 2.¹⁶ We assume no product-specific fixed costs and no difference in marginal costs of producing one product according to the number of other products that are sold.¹⁷ When $q_2 = 0$, the incumbent's downstream average cost equals:

$$c(q_1|0) = c(q_1|q_2) + F/q_1.$$

The economies of scope advantage of the incumbent is therefore represented by the common (fixed) costs, F .

The entrant could be squeezed due to the incumbent's economies of scope advantage. An adjusted version of the imputation test (1) would be for the NRA to take this cost difference into account in its price squeeze test, by choosing a downstream cost in the interval $[c(q_1|q_2), c(q_1|0)]$.

This is represented in the following test, where α is chosen by the regulatory authority, with $\alpha \in [0, 1]$:

$$p \geq a + c + \alpha F/q_1. \quad (3)$$

First, consider the extreme case where $\alpha = 1$: inequality (3) becomes $p \geq a + c + \frac{F}{q_1}$. The test favors entry of competitors which are as efficient as the incumbent in the first market, taken in isolation. It requires that the incumbent recoups its common costs on product 1 sales only, and loses the advantage of its economies of scope. Second, consider the other extreme case, where $\alpha = 0$. It favors the incumbent as it allows it to take advantage of its economies of scope.

4.1.3 Entrants' specific costs

Entrants may have to bear specific costs relative to market entry or to interconnection to the incumbent's essential facilities, such as equipment collocation costs. When this is the case, the imputation test may be adjusted. Indeed, if the test is not adjusted, it offers the incumbent a competitive advantage due to cost asymmetries.

Suppose there is a per unit entrant's specific cost, c_S . If the NRA includes this entrant specific cost into the margin squeeze analysis, the imputation test becomes:

$$p \geq a + c + c_S. \quad (4)$$

¹⁶For instance, a fixed cost common to both products may be the billing information system or rent paid by for the retail distribution infrastructures. Also, note that when there is a fixed cost in producing product 1, an NRA could also adjust the squeeze test for economies of scale.

¹⁷Our analysis extends to including economies of scope at the marginal cost level, but we want to keep the analysis as simple as possible, and common fixed costs are particularly relevant in the industry. For example, difference in marginal costs may illustrate the ability of a vendor to sell both products to one consumer more rapidly than each product to two different consumers.

4.2 Access charge adjustment: Wholesale product mix

The access charges that entrants have to pay to the incumbent in order to connect to its infrastructure can also be adjusted when conducting an imputation test. When several wholesale products are available to entrants, several imputation tests can be conducted to detect a margin squeeze.¹⁸ These tests can be implemented either on each of the wholesale products, or considering a wholesale product mix.

Suppose n types of wholesale access products are available to entrants, with wholesale charges a_i , $i = \{1, \dots, n\}$. The adjusted margin squeeze test that encompasses a wholesale product mix is:

$$p \geq \sum_{i=1}^n \gamma_i (c_i + a_i), \quad (5)$$

where $\gamma = (\gamma_1, \dots, \gamma_n)$ is a weighting vector, with $\sum_{i=1}^n \gamma_i = 1$ and $\gamma_i \geq 0, \forall i = \{1, \dots, n\}$, and c_i corresponds to the unit cost of the incumbent's downstream component associated with the access product of access charge a_i .

The regulator can choose to conduct several imputation tests simultaneously, using different weighting vectors, or to conduct an aggregated test, taking into account a wholesale product mix, as described by inequality (5).

The adjustment that favors entry the most would be the one that states that any wholesale product has to allow for economic space, with respect to the retail price. This would correspond to conducting n tests, with, for test number i , a weighting vector composed of $\gamma_i = 1$ and $\gamma_k = 0$ if $k \neq i$.

4.3 Price adjustment: Multiproduct incumbent and bundling

When the incumbent is dominant in one retail market along with the upstream market, it can leverage its retail market power in other retail markets through a bundling strategy. The adoption of such a strategy may lead to market foreclosure.¹⁹ Therefore, modifying margin squeeze tests in order to take such bundling strategies into account might be necessary.

When the incumbent is a multiproduct firm, the previous adjustments concerning economies of scope may be relevant. Another adjustment may be necessary when the multiproduct incumbent engages in bundling. As explained by Ergas et al. (2010), an imputation test conducted on one product (for example, fixed telephony) might demonstrate a margin squeeze, whereas a test conducted on a bundle (for example, a fixed telephony-broadband internet dual-play bundle) might lead to a regular competitive strategy.

Suppose that the incumbent produces several retail products, and offers these products to

¹⁸Several wholesale access products might be available because the NRA implemented the ladder of investment, for instance. In this case, a reasonably efficient operator would be expected to climb the ladder, step by step. However, it might simultaneously use different wholesale accesses in different geographical areas, investing more in its own network in high-density areas.

¹⁹See, e.g., Carlton and Waldman (2002).

final consumers in a bundle, of price \bar{p} . We denote by c_i product's i 's cost.²⁰

The REO imputation test an NRA might set up is also determined by the entrant's ability to replicate the incumbent's bundle offer. We analyze below the two different cases.

Multiproduct entrant. When the entrant competes directly with the incumbent by selling a bundle of products, the regulator can decide to conduct an aggregated test on the incumbent's price:

$$\bar{p} \geq a + \sum_{i=1}^n c_i. \quad (6)$$

This imputation test is just a multiproduct version of the basic test given by inequality (1).

Single-product entrant and price separability. By contrast, when the entrant is active in one retail market only, the NRA might want to ensure that the bundle sold by the multiproduct incumbent does not squeeze the entrant. As the incumbent's bundle price aggregates prices of more than one product, it is difficult for the NRA to conduct a margin squeeze test for one product only (i.e., the product sold by the entrant). The question is then: how to allocate a price to this product from the bundle price?²¹

Suppose that the incumbent uses a mixed bundling strategy and sets 3 prices: p_1 and p_2 for products 1 and 2, respectively, and \bar{p} for the bundle.²² Assume that the entrant is only active in the market for product 1, that there are no economies of scale or scope, and that the price p_1 is not squeezing *per se* (i.e., $p_1 \geq a + c_1$). We would normally expect to have $p_1 + p_2 \geq \bar{p} \geq \max[p_1, p_2]$. Indeed, if the first inequality does not hold, consumers would never buy the bundle.²³ Whereas if the second inequality does not hold, consumers would never buy any of the single products.

The NRA has to determine whether or not the bundle price squeezes the entrant and prevents him from competing in the market for product 1. That is, the NRA needs to allocate a price \hat{p}_1 to product 1 from the bundle price \bar{p} . The upper bound of \hat{p}_1 is $\bar{p} - c_2$, which corresponds to the price of product 1 in the bundle when the incumbent sets a margin equal to zero for product 2. The lower bound of \hat{p}_1 is $\bar{p} - p_2$, which is the remainder of the bundle price less the price of the single-product 2, assuming that the allocated price is above cost.

²⁰In order to simplify our argument, we assume that there are no economies of scope associated to bundling. However, using the previous adjustments, it is straightforward to include economies of scope in the analysis.

²¹Note that one should also refer to previous issues regarding the allocation of costs and access charges when the incumbent is a multiproduct firm.

²²There are two bundling strategies: pure bundling, and mixed bundling. Pure bundling occurs when the consumers can only buy the bundle. By contrast, mixed bundling occurs when consumers can buy each of the products separately, or together in the bundle.

²³We assume that the consumers do not save any cost (e.g., shopping cost) when they buy the bundle, as compared to the case where they buy one product (or both) separately.

Therefore, with mixed bundling,²⁴ the NRA chooses $\hat{p}_1 \in [\bar{p} - p_2, \bar{p} - c_2]$ in the test:

$$\hat{p}_1 \geq a + c_1.$$

Written differently, it chooses $\beta \in [0, 1]$ and conducts the following test:

$$\bar{p} - c_2 - \beta(p_2 - c_2) \geq a + c_1. \quad (7)$$

Let's have a look at the two extreme cases. When $\beta = 0$, then $\hat{p}_1 = \bar{p} - c_2$, \hat{p}_1 is high, and the imputation test is more easily satisfied. This favors the incumbent, as the margin it earns on the sale of a bundle is completely allocated to the first product (the one the NRA does the imputation test on).

By contrast, when $\beta = 1$, then $\hat{p}_1 = \bar{p} - p_2$, \hat{p}_1 is low, and the imputation test is more difficult to pass. This latter test is the one preferred by entrants, as the price allocation is such that the incumbent extracts the same margin from product 2 in the bundle than from an independent sale at price p_2 .

Whereas aggregated-product tests favor multi-product competition, product-by-product tests can be useful if the NRA wants to develop competition for a specific product, or if entry in one market can be considered as a stepping-stone for multi-product entry, as in Carlton and Waldman (2002).

4.4 Summary of ex-ante REO specific issues

In Table 1, we summarize the REO specific issues that can arise in ex-ante margin squeeze tests, classified in three categories.

Parameter	Specific Issues
Costs	Economies of scale
	Economies of scope
	Entrants' specific costs
Access charge	Wholesale product mix
Price	Bundling

Table 1: Ex-ante specific issues for margin squeeze tests

Note that issues related to access charges and prices may not be seen as specific to ex-ante margin squeeze tests and have also been considered in competition policy cases. However, these issues are particularly relevant in tests conducted by NRAs, as they often reflect transitory asymmetries between incumbents and entrants. Indeed, there might be several wholesale products because the NRA implemented a specific regulatory approach (the ladder of invest-

²⁴When the incumbent engages in pure bundling instead of mixed bundling, there is no price p_2 set by the incumbent. Nevertheless, we can define the allocated price to product 2 in the bundle by $\hat{p}_2 = \bar{p} - \hat{p}_1$, and we have $\hat{p}_1 \in [\bar{p} - \hat{p}_2, \bar{p} - c_2]$ and $\hat{p}_2 \in [\bar{p} - \hat{p}_1, \bar{p} - (u + c_1)]$, where u is the upstream marginal cost of the incumbent. As $\hat{p}_1 \geq u + c_1$, we obtain $\hat{p}_1 \in [u + c_1, \bar{p} - c_2]$.

ment, for example), whereas, in the long run, only one wholesale product remains. Similarly, an entrant might be unable to reproduce the incumbent's bundle because it needs some time to do so.

5 Benchmark analysis of economic issues

We now review NRAs' choices regarding the specific issues we have considered. This benchmark analysis does not aim at being exhaustive, but rather at giving a taste of how the ex-ante regulators in Europe adapt, in practice, their imputation tests to different specific economic issues. All NRAs' guidelines and cases we reviewed in this benchmark analysis are provided in the Appendix.²⁵

5.1 Cost adjustments

As explained above, we have identified three different adjustments to be made to EEO imputation tests on the cost parameter.

5.1.1 Economies of scale

As the European Commission advocates in its Recommendation 2010/572/EU on regulated access to NGA networks, the BIPT and Ofcom clearly adjust their modeled efficient operator to take into account the retail market share differences between the incumbent and entrants.²⁶ In its 2007 guidelines, the BIPT states that the incumbent's retail market share can be reduced to 25% for cost calculation if important scale effects are observed. In its 2009 guidelines, it also explains that its REO has a 20-25% market share, following ERG (2003). In the BT IPStream case, Ofcom "has chosen to scale back BT's volumes and has considered a range of volumes over which to model the costs of a similarly efficient entrant", because "[g]iven [BT's] scale, its costs are considerably lower than those faced by smaller scale operators." Ofcom then details the size it gives to an efficient entrant: "[t]he range of volumes is approximately 1.7m-2.5m subscribers by the end of the studied period, i.e. in 5 years' time."

ComReg (2012) takes a dynamic approach for the adjustment for economies of scale.²⁷ The Irish NRA sets the price floors for bitstream rentals by reference to a REO that would increase its market share over time as it "considers that it is logical to use an REO as the hypothetical entrant, with a lower market share and therefore lower economies of scale, to set the minimum price floors for bitstream."²⁸ The cost model is computed on an assumed level

²⁵For some countries (e.g., U.K.), the NRA can also intervene as a Competition Authority in the telecommunications industry. In the present paper, we only analyze its ex-ante decisions of such cases.

²⁶ARCEP also states it would take market share into account when economies of scale exist: "market share" is listed as a parameter of an hypothetical model presented in Brussels, June 19th, 2008. Presentation available at <http://www.cullen-international.com/ressource/138/0/helene-boi.pdf>

²⁷Note that ComReg, the Irish NRA, mixes both bottom-up and adjusted top-down approaches in its imputation tests. See, e.g., ComReg (2012), B33, p. 55.

²⁸ComReg §3.37.

of LLU take-up, which increases over a three year period, corresponding to the market review period. The average subscriber base using LLU for the REO is 51,000, 88,000, and 99,000, respectively.

ComReg (2012) also tests for margin squeeze between the regulated bitstream service and an end-to-end wholesale access product lower in the chain. For this second test, ComReg assumes that the hypothetical entrant would achieve a 25% market share.

On the contrary, BNetzA (2007) does not adjust its tests for economies of scale, at it aims toward a long-term analysis, where such cost asymmetries are overcome: “[a]s such, it can generally be assumed that specific competitor costs such as the realization of (temporary) lower economies of scale and scope than the dominant company, collocation costs and any differences in the customer structure have to be compensated in another way. [...] It can therefore be assumed that (additional) competitor-specific costs are generally of a temporary nature. Therefore, the (long-term) costs of the efficient competitor should generally not be higher than those of the dominant undertaking.” This view is close to that of Competition Authorities.

5.1.2 Multiproduct incumbent: Economies of scope

As for economies of scale, the European Commission, in its Recommendation 2010/572/EU on regulated access to NGAN, gives its preference to REO tests, which take into account the differences between incumbents and entrants regarding economies of scope. In practice, NRAs use different cost models to adjust their imputation tests for economies of scope.

NRAs generally conduct their imputation tests using one of the following cost models: Short Run Average Variable Costs (SRAVC), Long Run (Average) Incremental Costs (LRIC), or Fully Allocated Costs (FAC).²⁹ Average Variable Cost allocation only takes into account short term variable cost, whereas a Long Run Incremental Cost model also includes fixed costs (considered as variable costs in the long run). In Fully Allocated Costs, variable costs are included as well as fixed costs and a share of common costs. There is also a cost model, which takes into account a share of common costs, called LRIC+, i.e., Long Run Incremental Costs plus a mark-up for the recovery of common fixed costs. In some circumstances, LRIC+ models are equivalent to FAC models. Finally, a cost model that is less common is the Stand Alone Costs (SAC) model, which includes all variable, fixed and common costs.

When looking at the test defined by inequality (3), a LRIC model would correspond to $\alpha = 0$, whereas a FAC model (or a LRIC+ model) would incorporate a share of common costs, that is, $\alpha \in (0, 1)$, and a SAC model would correspond to $\alpha = 1$. There are several practices to allocate common costs between products for the FAC model. They can be proportional to products’ revenues, margins, or, for example, to the number of products sold in each market (in this case, we would have $\alpha = q_1/(q_1 + q_2)$).

In its BT IPStream decision, Ofcom clearly details its cost allocation decision and justifies

²⁹ITU’s 2009 ‘Guide de la comptabilité réglementaire’ resumes regulatory cost standards.

it by the need to adjust for economies of scope. First, Ofcom states that only long-run costs are relevant in their margin squeeze test, as “[a] cost floor based on short-run measure of costs [...] would set a cost floor which a firm could price down to in the short-term but which would not be sustainable over a number of years where there are fixed costs to recover.”³⁰ Second, Ofcom reviews all available long-run cost models: LRIC, FAC or LRIC+.³¹ Third, the NRA states that “the appropriate cost floor would be one that incorporates an element for the recovery of common costs: e.g. FAC or LRIC+,” because “Ofcom’s benchmark of a similarly efficient entrant involves the same underlying cost function as BT’s, but smaller economies of scope.”³² Finally, Ofcom conducted its test using Fully Allocated Costs, because this was the cost model used by BT in the information it provided to Ofcom.^{33,34}

BIPT (2007) has a different approach from the one developed by Ofcom, as it prefers to conduct its tests using a LRIC model (or on a FAC model if LRIC information is not available).³⁵ The BIPT advocates the use of this cost model because it already adjusts its test for scale effects at the retail level (see above). It states that if the economies of scale adjustment is too difficult to conduct, the BIPT could use FAC or LRIC+ as a cost model, in order to adjust for common costs.³⁶ However, the BIPT does not justify its cost model choices as an adjustment for economies of scope differences. Lastly, the BIPT can conduct some ‘combinatory tests’ on several retail markets, in order to ensure that joint costs are recovered.³⁷

ComReg (2011) also decided to employ LRAIC+, as this cost model “allows the promotion of sustainable competition by [alternative operators] to the benefit of consumers as ‘LRAIC plus’ includes appropriate amounts of variable, fixed and common costs, which is the calculus faced by any [alternative operator] when deciding to enter or expand.”

Finally, BNetZA (2007) does not adjust its tests for economies of scope, as it aims toward a long-term analysis, for which such cost asymmetries are overcome (see above).

5.1.3 Entrants’ specific costs

BIPT (2007) clearly includes entrants’ specific costs in its imputation tests.³⁸ ARCEP (2006) also includes specific costs in its margin squeeze bottom-up model for the fixed telephony market, taking into account, for instance, collocation costs.

³⁰Ofcom (2004), §2.27.

³¹Ofcom (2004), §2.28.

³²Ofcom (2004), §2.32.

³³Ofcom (2004), §2.35.

³⁴CMT also states it uses “Fully Distributed Costs” (similar to Fully Allocated Costs), and ARCEP states it uses Fully Distributed Costs or LRAIC for margin squeeze tests in the broadband sector, in presentations showed in Brussels, June 19th, 2008. CMT presentation available at <http://www.cullen-international.com/ressource/145/0/jordi-canadell.pdf>

³⁵BIPT (2007), §56 and 58.

³⁶BIPT (2007), §65.

³⁷BIPT (2007) also states that OPTA, the Netherlands NRA, had introduced such combinatory tests in 2005.

³⁸BIPT (2007), §60 and 61.

As for previous cost parameters, BNetzA (2007) does not adjust its imputation tests for entrants' specific costs, as it states that in the long-run there should be no cost difference between an efficient entrant and the incumbent.

All cost adjustments defined in this subsection are summarized in Table 2.

Document	Economies of scale	Economies of scope	Entrants' specific costs
EC (2010)	Yes.	Yes.	
ERG (2003)	Incumbent's market share reduced to 20-25%.	One approach is to calculate the incumbent's cost when disallowing economies of scope ($\alpha = 0$).	
ARCEP (2006)			Yes (bottom-up model).
ComReg (2011)		Use of LRAIC+.	
ComReg (2012)	Incumbent's market share reduced to 25% (for second test). Incumbent's market share reduced to a weighted average (51k, 88k and 91k LLU line share).		
BIPT (2007)	Incumbent's market share reduced to 25%.	Use of LRIC (or FAC) and combinatory tests.	Yes.
BIPT (2009)	Incumbent's market share reduced to 20-25%.		
BNetzA (2007)	No (long-term analysis).	No (long-term analysis).	No (long-term analysis).
Ofcom (2004)	Incumbent's demand reduced to 1.7-2.5 million subscribers (time period: 5 years).	Use of FAC.	

Table 2: Cost adjustments for ex-ante margin squeeze tests

5.2 Access charge adjustments: Wholesale product mix

Most NRAs conduct imputation tests using wholesale product mix (see, e.g., ERG (2009)). When they use a mix of upstream input prices, they have to set the share of each upstream product (i.e., to determine the weighting vector γ).

In the fixed calls telephony market, ARCEP's (2006) squeeze test takes into account a mix composed of two different wholesale products: handover at the local exchange (80%), and handover at the tandem exchange level. Furthermore, the wholesale mix is constructed as a mean of different rates which apply for peak and off-peak interconnections, based on consumer call profiles. ComReg (2011) also uses a weighted average of interconnection rates at local

(66%), tandem (24%), and double tandem (10%) levels. According to ComReg this weighted average is appropriate to protect alternative operators' investments, and it will be updated if competitive conditions justify it.³⁹

Regarding broadband markets, AGCOM (2010) and CMT (2007, 2008a) use wholesale product mixes in their imputation tests. The Italian and the Spanish NRAs describe their wholesale mixes based on the current mix of wholesale products used by new entrants.⁴⁰

Setting the weighting vector introduces an endogeneity problem, as it aims at reproducing the already existing usage pattern of the wholesale products. In this regard, two CMT members developed an interesting point of view stressing some possible drawbacks to the upstream product mix in CMT (2008b). In this document, the authors explain their disagreement with the wholesale product mix established by CMT (2008a). They state that this input mix does not require each wholesale product to be profitable. Conducting imputation tests for each of the three upstream products, they show that potential competitors which would like to use a different basket of wholesale products than the one taken into account in CMT's (2008a) imputation test might be squeezed out of the market.

All access charge adjustments analyzed in this subsection are summarized in Table 3.

Document	Wholesale product mix
AGCOM (2010)	Yes: balance based on historical data at a national level and updated periodically.
ARCEP (2006)	Yes: local exchange 80%, tandem exchange 20% (bottom-up model).
ComReg (2011)	Yes: weighted average level of interconnection at local, single tandem, and double tandem levels (respectively 66%, 24%, and 10%).
CMT (2007)	Yes.
CMT (2008a)	Yes: balance based on historical data and updated every six months (LLU 73.8%, GigADSL 8.7%, ADSL-IP 17.5%).

Table 3: Access charge adjustments for ex-ante margin squeeze tests

5.3 Price adjustments: Multiproduct incumbent and bundling

As explained in ERG (2009), bundling is a key issue in implementing margin squeeze tests. Regarding the price adjustments that can be made in order to take bundles into account, AGCOM (2010) guidelines explain that margin squeeze tests on bundles will be conducted using an aggregated test, thus replicating the incumbent's retail offer. These tests consider the whole bundle as a single product *per se*.⁴¹

³⁹ComReg (2011), §4.48.

⁴⁰CMT (2008a), p. 9, and AGCOM (2010). See also the European Commission response to the 2010 AGCOM draft measure: European Commission, SG-Greffe (2010) D/12083.

⁴¹See, AGCOM (2010), Annex 1, p. 63.

BNetzA (2007) states that, since bundle replicability is the central issue, a case-by-case analysis is necessary to decide whether a per product or a per basket/bundle margin squeeze test should be conducted. More precisely, the German NRA states that margin squeeze tests could be conducted at an aggregate level only if “the practicability of a margin squeeze test is not called into question” and if “the bundles to be taken as a reference can also be offered by all efficient competitors in that particular combination.”⁴²

CMT (2007) does not exactly adjust its margin squeeze tests in order to take into account bundling; it conducts separated replicability tests for bundles (either joint or individual replicability tests, using implicit pricing calculations to determine product/service prices within the bundle). Indeed, for CMT’s margin squeeze imputation tests, “unit of reference is a specific offer/service- not the whole market.”⁴³

Bundles are also adjusted by the UKE in the ex-ante margin squeeze tests within the framework of the 2009 agreement concluded between the Polish NRA and the incumbent operator. The price of the bundle offer is tested by excluding other unregulated elements of the bundle at incremental cost level. This corresponds to $\beta = 0$ in inequality (7).

All price adjustments studied in this subsection are summarized in Table 4.

Document	Bundling
AGCOM (2010)	One aggregated test.
BNetzA (2007)	Case-by-case basis.
CMT (2007)	Not directly taken into account in imputation test: additional replicability test.
UKE (2009)	Per product, implicit price net of incremental costs ($\beta = 0$).

Table 4: Price adjustments for ex-ante margin squeeze tests

6 Conclusion

In this paper, we identified the main economic issues that are specific to the implementation of REO ex-ante margin squeeze tests by European National Regulatory Authorities. We found that the margin squeeze tests might be adjusted to correct for market disadvantages, and that the adjustments can be found on all the test parameters, namely the downstream price, the access charge, and the downstream costs. We were able to transpose these issues into practical test adjustments, so as to define precisely how NRAs could build a Reasonably Efficient Operator based on the incumbent’s parameters.

We also provided a review of current practices implemented by National Regulatory Authorities in European telecommunications markets. We conducted this review in the light of

⁴²See BNetzA presentation on margin squeeze tests, Brussels, June 19th, 2008. Presentation available at <http://www.cullen-international.com/ressource/149/0/michael-schi.pdf>.

⁴³See CMT presentation on margin squeeze tests, Brussels, June 19th, 2008.

the test adjustments we had defined. We found that some adjustments are very similar across the authorities' decisions, whereas others are dealt with quite heterogeneously.

As an extension of this work, it could be relevant to analyze the impact of REO ex-ante margin squeeze tests on investment and innovation, both theoretically and empirically.

Also, our work could be complemented by a benchmark analysis of NRAs' implementation choices in building a Reasonably Efficient Operator based on existing entrants' parameters, or from a bottom-up hypothetical operator. Indeed, some NRAs prefer to model a bottom-up hypothetical entrant to define a REO. In this case, the hypothetical operator might be required to be structurally more efficient than the incumbent (because it is expected to benefit from a more recent technology to provide its services, whereas the incumbent uses an older network, for instance), but still is less efficient than the established firm, because of temporary market asymmetries and disadvantages.

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Appendix

Authority	Year	Documents	Market
European Commission (EC)	2010	European Recommendation 2010/572/EU on regulated access to NGAN	<i>Guidelines</i>
European Regulators Group (ERG)	2003	ERG Common Position on the approach to Appropriate remedies in the new regulatory framework	<i>Guidelines</i>
	2009	Report on the Discussion on the application of margin squeeze tests to bundles	<i>Report</i>
BIPT (Belgium)	2007	Décision établissant des lignes directrices relatives à l'évaluation des effets de ciseaux tarifaires	<i>Guidelines</i>
	2009	Décision concernant le test de ciseaux tarifaires des lignes louées Ethernet	Leased lines
ARCEP (France)	2006	Notice du test d'effet de ciseaux tarifaires téléphonique fixe	Fixed telephony
BNetzA (Germany)	2007	Notes on margin squeezes as defined by section 28(2) para 2 TKG	<i>Guidelines</i>
ComReg (Ireland)	2011	Response to Consultation Document No. 10/76 and decisions amending price control obligations and withdrawing and further specifying transparency obligations	Call origination and termination
	2012	Further specification to the price control obligation and an amendment to the transparency obligation, D06/12	Wholesale broadband access
AGCOM (Italy)	2010	Delibera 499/10/CONS and Appendix	<i>Guidelines (Fixed networks)</i>
UKE (Poland)	2010	Commission decision concerning Case PL/2010/1098 and 2009 UKE and TP Agreement (Annex 11)	Wholesale broadband access
CMT (Spain)	2007 2008a 2008b	Resolución MTZ 2006/1486 Resolución AEM 2008/215 Voto Particular de Marcel Coderch e Inmaculada López en su condición de Consejeros de la CMT en relación a la Resolución AEM 2008/215	<i>Guidelines</i> <i>Guidelines</i>
Ofcom (United Kingdom)	2004	Direction Setting the Margin between IPStream and ATM interconnection Prices (BT IPStream)	Broadband Internet

Table 5: Reviewed Decisions and Guidelines