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Margin squeeze in fixed-network telephony markets: competitive or anticompetitive?

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Margin Squeeze in Fixed-Network Telephony Markets – competitive or anticompetitive?

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Abstract

This paper looks at the effects of different forms of wholesale and retail regulation on retail competition in fixed network telephony markets. We explicitly model two asymmetries between the incumbent operator and the entrant: (i) While the incumbent has zero marginal costs, the entrant has the wholesale access charge as (positive) marginal costs; (ii) While the incumbent is setting a two-part tariff at the retail level (fixed fee and calls price), the entrant can only set a linear price for calls. Competition from other infrastructures such as mobile telephony or cable is modelled as an ‘outside opportunity’ for consumers. We find that a horizontally differentiated entrant with market power may be subject to a margin squeeze due to double marginalization but will never be completely foreclosed. Entrants without market power might be subject to a margin squeeze if the wholesale access price is set at average costs and competitive pressure from other infrastructures increases. We argue that a wholesale price regulation at average costs is not optimal in such a situation and discuss retail minus and deregulation as potential alternatives.

Keywords: access regulation, foreclosure, margin squeeze, telecommunications, fixed networks

JEL L12, L41, L42, L50, L96

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1 Introduction

In 2007 the European Commission published a new Recommendation on Relevant Markets which does no longer include retail fixed network voice telephony services as markets susceptible to ex-ante regulation.¹ The main argument for this is that wholesale regulation and general competition law should be sufficient to address any competition problems which may arise on these markets. This is an important (and also the most significant) change since many countries still have retail price regulation in place and it is questionable whether national regulatory authorities (NRAs) can justify this vis-à-vis the European Commission in the future.² The main questions for NRAs therefore are: (i) Is regulation for all relevant retail markets (still) necessary, (ii) will regulation on retail access markets (markets 1 and 2 only) be sufficient or (iii) can regulation be reduced even further towards wholesale access markets (origination, termination and possibly transit) to address (potential) competition problems? If NRAs cease to regulate the calls markets, (iv) which form of wholesale regulation is most appropriate?

The main goal of regulation of retail call markets is to prevent the incumbent from ‘leveraging’³ its market power either from the wholesale to the retail level or from the retail access to the calls markets. At the beginning of fixed network liberalization in the late 1990s, the main concern of regulators was to bring down retail prices from their (perceived) excessive levels. As calls prices of the incumbent fell after the introduction of wholesale access regulation, the focus of regulation shifted: Currently, a main concern of NRAs is that

¹ See European Commission (2007a): Markets 3-6, see Appendix A for details of the EU framework,.

² It is possible to deviate from the Recommendation, however, the European Commission has a veto right with regard to decisions on market definition and SMP (significant market power) designation.

³ The framework directive in Article 14 (3) explicitly characterizes leveraging as a competition problem that might lead in itself to a position of dominance.

the incumbent might – absent regulation – set the price of call services so low that an equally efficient entrant in the downstream segment could not survive given the regulated wholesale access charge. Such price setting by the incumbent operator is also called margin squeeze or price squeeze.

According to the European Commission, services offered by alternative operators buying origination and termination from the incumbent and offering carrier selection (CS) and carrier pre-selection (CPS) to consumers are still widely used today (see European Commission (2007b), Annex 2, Figure 14). The consumer subscribes to the incumbent's network and then can choose to make her calls via the incumbent or the entrant. At the same time, competitive pressure from other infrastructures, in particular mobile telephony, increased over the past years.

Our paper examines in detail the incentives and equilibrium outcomes in a scenario where the potentially regulated incumbent faces such service-based competition. Given this focus, facilities-based competition – either intra-modal from within the wireline sector or inter-modal from wireless telephony – enters our model as an important outside opportunity for consumers. This provides a feasible way to take into account developments in this segment without having to deal simultaneously with complicated strategic interactions between a large number of potential players. We use this framework to examine the meaning and importance of concepts such as 'foreclosure' and 'margin squeeze', as well as the implications and effects of various regulatory options such as access regulation at cost oriented prices or retail minus, regulation of the fixed fee, etc. Accordingly, our analysis allows for a discussion of the appropriateness of wholesale and/or retail regulation compared to the unregulated benchmark case.

Our article employs a differentiated product Bertrand oligopoly model. We allow for different specifications of the demand side as well as differences concerning number and kind of entrants in the service segment of the market. This different scenarios mainly serve to illustrate the important role double marginalization potentially plays with this type of industry structure, in particular if a single entrant has market power. Furthermore, our model differs from previous models in two respects: First, we model a potential difference in (perceived) marginal cost between the incumbent and the entrant. While the incumbent is assumed to have zero marginal costs per minute, the entrant has the wholesale access charge as (potentially) positive and substantial marginal costs. We call this asymmetry between incumbent and entrant the ‘vertical asymmetry’. Second, the incumbent can set a two-part tariff at the retail level (a fixed fee and a price per minute), while the entrant can only set a linear price per minute.⁴ We call this the ‘horizontal asymmetry’. Both of these asymmetries appear important when dealing with the service-based type of competition we focus on.

As far as we are aware, the horizontal and the vertical asymmetry have not yet been simultaneously applied in a single model. The seminal telecom-models of Armstrong (2002) and Laffont/Rey/Tirole (1998a and 1998b) (ALRT) either consider one-way access where the incumbent and the alternative operator are setting linear prices at the retail level or consider competition (and interconnection) between two operators which can both set one- or two-part tariffs at the retail level. Also in the literature on non-price discrimination (‘sabotage’, see

⁴ Although CS/CPS operators could also set two-part tariffs in principle (where the user then pays a fixed fee in addition to the incumbent’s fixed fee), empirical evidence shows that customers are reluctant to accept such an ‘extra’ fixed fee, see for instance WAR (2004). This comes along with an increase in consumers’ demand for ‘one-stop-shopping’ solutions, see for instance RTR (2008), pp. 20-21. In turn, the entrants’ pricing scheme is comparatively realistically represented by simple linear tariffs. In a few European countries, in addition to CS/CPS, a ‘wholesale line rental’ product exists which allows an alternative operator to offer access services to consumers without having own infrastructure in place. We focus on the case where only CS/CPS is available since this applies to the majority of countries.

Economides (1998), Sibley/Weisman (1998), Beard/Kaserman/Mayo (2001), Weisman (2003), Mandy/Sappington (2007)) incumbent and entrant compete in linear prices at the retail level. We show that the extent to which the incumbent is able to extract consumer surplus via a fixed fee is decisive for retail per-minute prices and for the terms at which the incumbent is willing to provide access. Biglaiser and DeGraba (2001) also consider a model where the incumbent operator has wholesale costs of zero but is selling access at a positive price. Both firms can set two-part tariffs at the retail level, however. Gans and King (2005) investigate the ‘competitive neutrality’ of access charges and model the ‘vertical asymmetry’. They find that upstream prices that differ from marginal costs are not competitively neutral in the sense of placing integrated and non-integrated firms on an equal basis. They do not allow the incumbent to set two-part tariffs, however. Davis and Murphy (2001) analyse competition between a firm offering two complementary goods and a firm offering only one of the two goods (in the context of Microsoft Windows and the Internet Explorer), which is a setting close to the ‘horizontal asymmetry’ but without two-part tariffs. Other (recent) related papers are Sarmento/Brandao (2007) and Kotakorpi (2006) which focus on effects of vertical integration and access regulation on foreclosure and investments. Both use linear pricing at the retail level.

The rest of the article is structured as follows: Section 2 presents the basic model as well as two extensions concerning the specification of demand and the number of entrants. Section 3 contrasts the benchmark case of an unregulated incumbent with various regulatory options. We examine the most commonly employed instruments of retail-minus and cost-oriented regulation. We also consider the effects of increased competition from outside opportunities. Section 4 discusses an extension of the basic model accounting for switching costs. Section 5 summarizes and discusses the main conclusions.

2 The model

In this Section we first present our standard case where an incumbent faces a horizontally differentiated entrant. This situation endows the entrant with market power and gives rise to double marginalization as well as to a scenario where the entrant charges a higher price than the incumbent. In order to examine in more details the importance of the entrant's market power, we introduce a group of two or more homogeneous entrant in our first extension. Our second extension allows for a 'kinked' demand curve for the entrant's services. If the entrant charges a higher price than the incumbent, he does not receive positive demand.

2.1 One entrant, linear-quadratic utility (the 'standard' case)

Our basic case considers a model where a vertically integrated operator (the incumbent operator I) competes with an entrant (E) who buys access at a price t from the incumbent operator. At the retail level, the incumbent operator is setting a two-part tariff with a fixed charge f and a per-minute charge of p_I . The entrant can only set a per-minute charge of p_E . Consumers subscribe to the incumbent and pay the fixed charge f and then can decide whether they use the incumbent or the entrant for their calls.

We model the products of the incumbent and the entrant as horizontally differentiated goods to allow for different prices but nevertheless positive market shares. Demand for the entrant is given by

$$(1) \quad x_E = \frac{a - p_E - as + p_I s}{1 - s^2}.$$

The incumbent faces retail demand x_I for calls with

$$(2) \quad x_I = \frac{a - p_I - as + p_E s}{1 - s^2}.$$

The differentiation parameter s is between 0 and 1 with 0 indicating independent demand and 1 indicating homogenous products.

The above demand functions can be derived from the following utility function of a representative consumer:

$$(3) \quad U = y + \max \left\{ U^O, a(x_E + x_I) - \frac{x_E^2}{2} - \frac{x_I^2}{2} - sx_E x_I \right\},$$

where y is the numeraire good and U^O is the utility consumers obtain from the outside opportunity. We assume that the number of consumers is of measure one, and that all consumers are actually identical. When introducing a fixed fee to extract consumer surplus, we will further discuss this assumption. The outside opportunity might be provided by either a facilities based fixed line service such as a cable operator, by an unbundling (ULL) operator or by mobile telecommunications operators.

As mentioned in the introduction, U^O provides a simple way to account for facilities based competition from either intra-modal or inter-modal services. Note that consumers choose either the outside good provided by the alternative suppliers or the incumbent's product (inclusive of the CS and CPS services provided by the service-based entrants). We will assume that the incumbent takes the utility provided by the outside opportunities as given. Therefore, we abstract from the potential strategic interactions between the different market segments (e.g. mobile vs. wireline). While one could and should model these interactions in a

framework building on ALRT or Biglaiser and DeGraba (2001), this task is beyond the scope of our present paper.

Consumer surplus is given by utility minus total expenses. If the outside opportunity is not chosen, consumer surplus reads

$$(4) \quad CS = U - Y = a(x_E + x_I) - \frac{x_E^2}{2} - \frac{x_I^2}{2} - sx_E x_I - p_E x_E - p_I x_I - f ,$$

where total income Y is equal to total expenditure from the budget constraint. In formal terms, this means that $Y = y + p_E x_E + p_I x_I + f$ respectively. Consumers will choose to buy access from the incumbent only if $CS > CS^O$, where CS^O is consumer surplus from the outside opportunity, which is defined analogously to CS .

The profit of the entrant is

$$(5) \quad \Pi_E = x_E (p_E - t) ,$$

while the profit of the incumbent is

$$(6) \quad \Pi_I = f + x_I p_I + tx_E$$

with t being the access charge. For simplification, all other variable costs are assumed to be equal to zero. As regards fixed costs, we assume that the service-based entry we consider does not require fixed investments. Therefore, entrants do not face fixed costs. As we will see later, this implies that foreclosure does not occur as long as demand increasing effects exist, i.e. as long as $s < 1$.

2.2 Two entrants offering homogeneous products

Here we introduce a scenario with two or more entrants which offer a homogeneous product. Since the entrants basically resell the same service (provided by the incumbent), we assume that consumers do not view their products as differentiated. Since we assume Bertrand price-competition an immediate change is that the price of the entrants will always be equal to the access charge t . Therefore, we are able to isolate the effects of entrant's market power and its absence, respectively. Like in Armstrong (2002), our entrants can be called a competitive fringe. However, we still assume that the products of the incumbent and the entrants are differentiated according to the demand functions in equations (1) and (2). As a consequence, double marginalization can no longer arise, whereas it is still possible that the incumbent's price is lower than the price of the entrants without driving the entrants out of the market completely. This scenario appears to be relevant in many telecoms markets, where competition among CS and CPS providers is particularly intense as it is for instance in Germany.

2.3 Discontinuous demand for the entrant

In the above Sections, we have assumed that the entrant(s) is(are) horizontally differentiated to the incumbent and even can survive with a higher price. However, with regard to the markets under consideration, this assumption might seem to be at odds with real market characteristics, because entrant firms have been competing against 'incumbency advantages'. At the same time this incumbency advantage, rooted in features such as switching costs, customer inertia, uncertainty about quality, product loyalty, and reputation effects, allows the incumbent to keep significant retail market shares despite higher prices. In this Section, we capture this asymmetry by making the behavioural assumption that consumers do not buy anything from an entrant if she charges a higher price than the incumbent. Nevertheless we

keep the assumption that consumers consider the products as differentiated once the entrant's price is lower.

Formally, we assume that consumers exhibit discontinuous demand with

$$(7) \quad x_E = 0 \quad \text{for } p_E > p_I \quad \text{and}$$

$$(8) \quad x_I = a - p_I \quad \text{for } p_E > p_I.$$

For $p_E \leq p_I$, the demand functions in equations (1) and (2) apply. A related kind of demand asymmetric response has been analysed in Bidwell, Wang, and Zona (1995). Note that we use the tie-breaking rule that entrants get a positive market if their price is identical to that of the incumbent for simplicity. Our assumptions prevent entrants from charging a higher price than the incumbent (which is hardly ever observed in practice), but allows the incumbent to keep a positive (retail) market share even if he is undercut by the entrant.

3 Equilibrium outcomes under various regulatory regimes

We now turn to the derivation of the equilibrium of the different variants of our model. We examine different regulatory regimes starting with the unregulated benchmark case. We then analyse regulation of the wholesale access charge and of the retail fee individually in order to show the main effects of these instruments in isolation. Finally, we consider the practically most relevant case of the combination of retail and wholesale regulation.

3.1 Benchmark case: The unregulated incumbent

We start our discussion with our basic demand and industry specification. The model extensions then put the results into perspective.

3.1.1 The standard case

As a benchmark we consider a two-stage game where the unregulated incumbent operator decides about the access charge t in the first stage and sets the retail fixed fee f and the retail per-minute price p_I in the second while the entrant sets her retail per-minute price p_E in the second stage. The game is solved recursively.

In the second stage the incumbent will set his fixed fee such to extract all consumer surplus (greater than CS^O). Substituting the consumer surplus CS from equation (4) for f in the profit function of the incumbent and taking the first derivative with respect to p_I , we obtain the reaction function of the incumbent as

$$(9) \quad p_I = st$$

The reaction function of the entrant reads

$$(10) \quad p_E = \frac{a - as + p_I s + t}{2}.$$

Interestingly, the incumbent's reaction function does not depend on the price of the entrant but only on the access charge t and on the substitution parameter s . Furthermore, it is (weakly) smaller than t , implying a price below the costs of the rival and therefore a 'margin squeeze'. Note that the optimal price p_I deviates from the solution of a monopolist charging a two-part tariff. Since the direct price effect is only a second-order effect, increasing the price p_I above

marginal costs shifts demand from an activity with no mark-up (retailing) to the one with the positive mark-up t (wholesale revenue). Therefore, p_I will be above marginal costs as long as there is a wholesale mark-up, i.e. $t > 0$, and as long as the incumbent's price has an effect on the entrant's demand and therefore on wholesale revenue (given t). This is the case as long as s is neither 0 nor 1.

It is now straightforward to derive equilibrium retail prices depending on t . We obtain

$$(11) \quad p_E = \frac{a(1-s) + t(1+s^2)}{2}$$

$$(12) \quad p_I = st$$

Note that p_E is strictly decreasing in s with the monopoly price $(a+t)/2$ for $s=0$ and p_E equal to (perceived) marginal costs t for $s=1$. Substituting the above equilibrium prices in the profit function of the incumbent, we can derive the equilibrium access charge t from the first-order condition with respect to t . It reads:

$$(13) \quad t = \frac{a(1-s)}{3+s^2}.$$

Figures 1 and 2 show how t , p_E , p_I , x_E , and x_I vary with the product differentiation parameter s (a is set equal to 1). The incumbent appropriates part of the entrant's profits by charging a non-zero interconnection fee t . The interconnection charge therefore is lower the more homogenous the products and the smaller the market power of the entrant. As we will see in more detail when considering the other demand specifications this source of inefficiency is due to the market power of the entrant leading to a double marginalization problem.

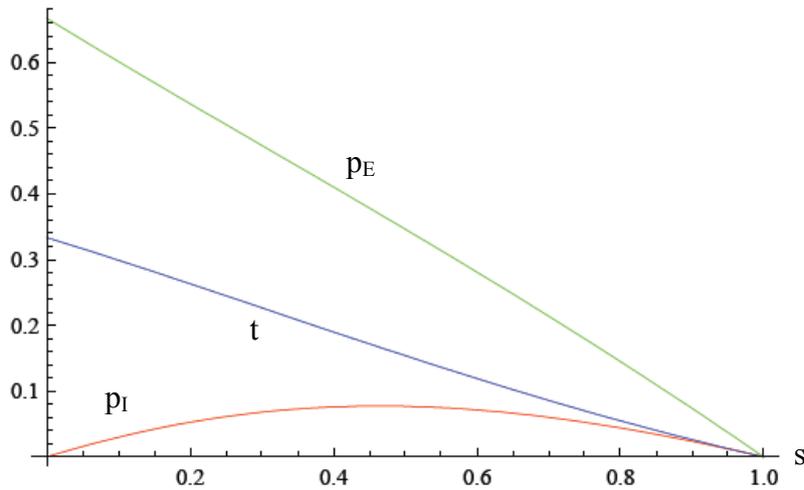


Figure 1: Equilibrium prices and access charge for the unregulated benchmark case ($a = 1$)

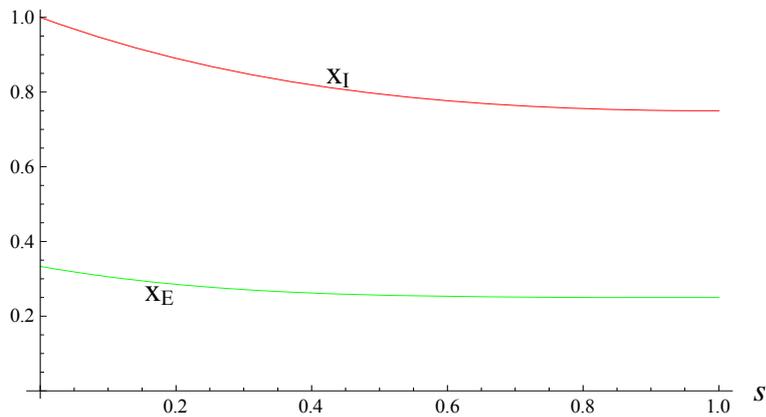


Figure 2: Equilibrium quantities for the unregulated benchmark case ($a = 1$)

As already noted above, we also find a ‘margin squeeze’ in the sense that $t > p_I$, yet this does never lead to foreclosure (given that the profit of the entrant is sufficient to cover retail fixed costs). Even though the market share of the entrant is always significantly smaller than that of the incumbent (even in the limit as s approaches 1), it is always in the interval $[24.2, 25.0]$. Note that even when access would be priced at marginal cost (i.e. $t = 0$), the entrant due to her market power would charge a higher price than the incumbent. This property, however, does not hold for the other two demand specifications introduced above as we show next.

3.1.2 Other scenarios

The results for the two alternative cases discussed above are straightforward. As noted above, introducing at least two entrants offering a homogeneous product leads to pricing at marginal costs for the entrants, i.e., for each entrant we have $p_E = t$. There is no double marginalization problem in this case, and the incumbent will simply set the access charge equal to marginal costs, i.e. $t = 0$. This maximizes the consumer surplus, which the incumbent extracts via the fixed fee.

The same reasoning holds for discontinuous demand specification introduced above in section 2.3. Note that this case implies that the incumbent's price acts as a price cap for the entrant. At the same time a margin squeeze with p_I smaller than the access charge t , would drive the entrant out of the market. Since the existence of the differentiated product increases consumer surplus, the incumbent does not have an incentive to foreclose the entrant. The incumbent sets the access charge and the retail per-minute price equal to zero. As a consequence the entrant also charges a price equal to marginal costs, i.e. $p_E = 0$.

These results are an instance of the 'Chicago Critique' of foreclosure according to which there is only one profit which the incumbent can fully skim by the fixed fee. If potential entrants are equally efficient retail outlets and if they do not have market power, the incumbent is strictly better off to provide access as long as $s < 1$, i.e. if there is a love of variety effect.⁵

⁵ In the model, the incumbent would even 'subsidize' inefficient entrants or entrants facing fixed costs if consumers value variety. However, the extent of love for variety seems to be limited in our case. Voluntary access or even subsidized access by an incumbent has, to our knowledge, never been observed in practice. We will discuss the assumption of love for variety in section 5.

The welfare properties of the equilibrium are straightforward. Since prices are equal to marginal costs, we are in a first-best solution. Total welfare is at a maximum. Consumer surplus is equal to the consumer surplus provided by the outside opportunity. It is interesting to note here that we would also obtain the first-best result, if the regulator could implement a Loeb-Magat (1979) mechanism where the incumbent receives total consumer surplus minus some fixed amount. This would also guarantee both efficiency – the incumbent is the residual claimant – and a given level of consumer welfare. While such a regulatory mechanism is typically considered as not implementable, competition of either facilities-based providers of wireline services or of mobile network providers might well be considered as achieving this.

Summarizing the discussion, we can state:

In the absence of market power of the entrants we obtain the first best result in which the level of the fixed fee is determined by the competition from the outside goods. If the entrant has market power, we find a ‘margin squeeze’, but no foreclosure. The margin squeeze is solely due to the market power of the entrant.

3.2 Wholesale regulation of the access charge t

Now we consider the case where only the access charge t is regulated, but not the retail prices f and p_I . We examine two different regulatory rules to determine the access charge, cost-oriented prices and the retail-minus rule.

The retail-minus rule says that the wholesale price t^{RM} must be equal to the retail price minus the avoided retail costs. It is a simplified form of the efficient component pricing rule (ECPR)⁶ which in practice is frequently used in its simplest forms (“retail-minus”) as an

⁶ This rule is sometimes also called Baumol-Willig rule and goes back to Willig (1979).

alternative to cost-oriented prices. As the avoided retail costs are zero in our model, the rule simplifies to

$$(14) \quad p_I = t^{RM}$$

The type of price regulation most frequently used in the EU is cost oriented prices. In practice the access charge t^{CO} is based on the *average* costs of access. In terms of our model this would be

$$(15) \quad t^{CO} = c_a + \frac{F}{x_E + x_I} ,$$

where c_a are the marginal (or, in practice, variable) costs of access and F are the fixed costs of the network infrastructure (however, in fixed network telecommunications, all costs are often assumed to be fixed in the short run, i.e., $c_a \rightarrow 0$). The regulator usually calculates average costs based on accounting data from the incumbent operator and/or engineering models, forecasts quantities for the next period based on the quantities of the previous periods and sets the access price as in (15). Rather than modelling this procedure we simply treat the access charge as exogenous and analyse the effects of an access charge below (or above) the unregulated access charge. There are two reasons for proceeding in this way. First, we cannot restrict the level of fixed costs F a priori in a meaningful way. Second, we do not want to enter a discussion about a possible strategic manipulation of the output by the incumbent to affect the access charge. This possibility is due to the problem that an endogenized t^{CO} would be determined based on realized quantities. We assume that the incumbent's profits are high enough in equilibrium so that he can cover at least that part of the fixed costs which is not sunk. When examining a 'cost-oriented' access charge, we again consider a two-stage game but now with the regulator setting the access charge t^{CO} in the first period and incumbent and entrant setting their prices (p_E, p_I, f) in the second period.

Turning to the implementation of the two rules for the regulation of the wholesale access charge t , we first need to point to the importance of whether entrants have market power or not. As shown in Subsection 3.1.2 above, absence of entrant market power leads to an unregulated access charge equal to marginal cost.

In the case of a ‘cost-oriented’, exogenous access charge t^{CO} , the second stage is the same as before and prices p_E and p_I are given by (11) and (12). As is clear from Figure 1, for any exogenous t^{CO} , there exists an $s(t^{CO})$ such that the incumbent would voluntarily set a lower access charge than t^{CO} for all $s > s(t^{CO})$. It immediately follows from the reasoning above that a regulated access charge *below* the unregulated access charge will (for all values of $0 \leq s \leq s(t^{CO})$) lead to a decrease in p_E and p_I , an increase in f , an increase in x_E and x_I , and an increase in the entrant’s market share. Of course, the entrant’s market power implies that the prices are still above the first-best level. As in the unregulated case, double marginalization will lead to a margin squeeze but not to foreclosure.

More interesting is the case of retail-minus regulation of the access charge. We look at the same two-stage game as in the benchmark case. As noted above, the incumbent’s constraint is that $p_I = t^{RM}$. Substituting this constraint and the entrant’s reaction function (10) into the profit function of the incumbent and maximizing with respect to t^{RM} yields

$$(16) \quad t^{RM} = \frac{a(1-s)}{7+s}.$$

Comparison with equation (13) shows that the access price t^{RM} is lower than in the unregulated case.

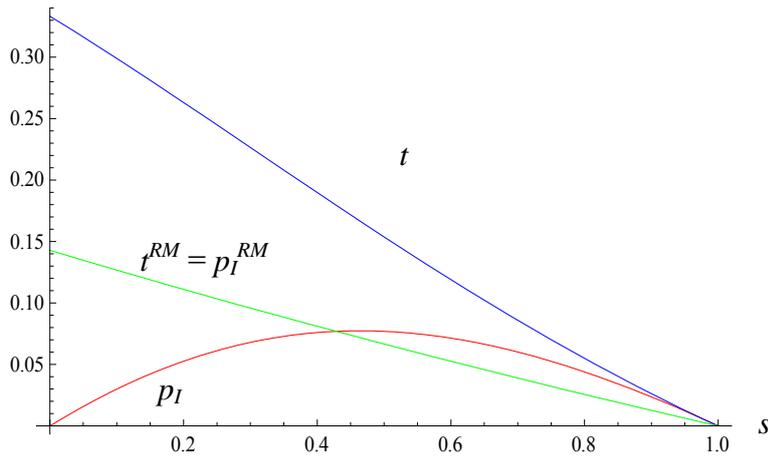


Figure 3: Equilibrium price of the incumbent and access charge in the unregulated benchmark case and with retail-minus (*RM*) regulation

Figure 3 reveals an interesting result: The retail-minus rule leads to a decrease of the incumbent's price in the most relevant range, i.e. for not too differentiated products. Contrary to what one might expect, one does not obtain a price which is between the unregulated retail price and the unregulated access charge. The reason is that a reduction of the unregulated t to the unregulated value of p_I reduces profitability of wholesale access. Therefore the incentive to deviate from marginal costs becomes weaker. There is an incentive to reduce p_I below the unregulated level.

The effect of the retail-minus rule on quantities is ambiguous. While the output of the entrant increases, the incumbent's output might either fall or grow depending on the substitution parameter s . However, since x_I increases for values of $s > .72$, i.e. in the empirically probably most relevant range of not too differentiated products (values of s close to 1), we consider an increase of the incumbent's output as the relevant case. The market share of the entrant nevertheless increases slightly. With regards to prices we observe again that the incumbent firm prices below the entrant firm throughout the whole range of s . Profits of the entrant increase, profits of the incumbent decrease and there is a net welfare gain compared to the

benchmark case due to the mitigation of the double marginalization problem. As mentioned above, consumer surplus remains unchanged at the value of the outside opportunity.

3.3 Retail regulation of the fixed fee f

So far, we considered cases where the incumbent charged retail prices rather close to marginal costs as he could extract consumer surplus directly by means of a fixed fee. In the next step, we examine the changes resulting from putting constraints on this instrument. Contrary to the outside opportunity such constraints render extraction of all consumer surplus (above CS^0) impossible. In most countries regulators set upper bounds on retail access charges, motivated by universal service considerations or market power.⁷ Second, the ability to extract all consumer surplus is limited if consumers are heterogeneous.⁸

We consider the following three-stage game:

Stage 1: The regulator and/or the heterogeneity among consumers determines f^R ,

Stage 2: The incumbent sets the access price t

Stage 3: Price competition between the firms

We have to distinguish three cases:

Case 1: f^R is so small that optimal linear prices are charged.

Case 2: f^R is in a medium range where it becomes binding with equality, such that a marginal change in the constraint has an effect on prices.

⁷ Prior to liberalisation particular retail access fees were typically cross subsidised due to distributional concerns. Introducing liberalisation by forcing access to the incumbent's network was first achieved by basic forms of wholesale (interconnection) obligations (enabling CPS and CS services). Gradually, inefficient cross subsidies among retail tariffs were eliminated ('tariff rebalancing') during the first liberalisation phase.

⁸ For an in-depth analysis cf. Tirole (1988), Chap. 3.

Case 3: f^R is large and no longer binding. This brings us back to the unregulated benchmark case (see above).

Before proceeding with a detailed discussion of cases 1 and 2, we want to highlight the nature of competition arising in the two cases. If we are in case 1, the prices of both firms are strategic complements. If p_E increases, for instance due to an increase in t , p_I will also increase. However, once we increase f^R up to the point where it becomes binding with equality, the nature of competition switches from strategic complements to strategic substitutes: The same increase in p_E now leads to a decrease in p_I , as only this allows the incumbent to extract f^R . In our setting where the incumbent sets the access charge, this implies that the incumbent is now a more aggressive rival. By increasing t , the incumbent can increase the costs of the entrant. However, the fact that he reacts to a increase in p_E with a price cut due to the strategic substitutability constrains the entrant's market power. As a consequence the mark-up of the entrant will be lower. This strategic effect implies that f^R has an effect on prices even if it is (slightly) smaller than the consumer surplus realized with optimal linear prices.⁹ In the following discussion of cases 1 and 2, we bear this twist in mind. However, as we are interested in the general pattern, we do not attempt to determine all of the borderline cases.

Case 1: Optimal linear prices

If f^R is sufficiently small, the incumbent maximizes profits by choosing the optimal linear price p_I . The first order conditions of the third stage of the game yield the standard reaction functions

⁹ For instance for $s = .8$ and $a = 1$ consumer surplus with optimal linear prices is .121. However, f^R has an effect on prices as soon as it is greater than .113. Therefore, case 2 applies if $f^R > .113$.

$$(17) \quad p_I = \frac{a(1-s) + p_E s + ts}{2}$$

$$(18) \quad p_E = \frac{a(1-s) + p_I s + t}{2}$$

From the second stage of the game, we obtain the access charge t determined by the incumbent as

$$(19) \quad t = \frac{a(8+s^3)}{2(8+s^2)}$$

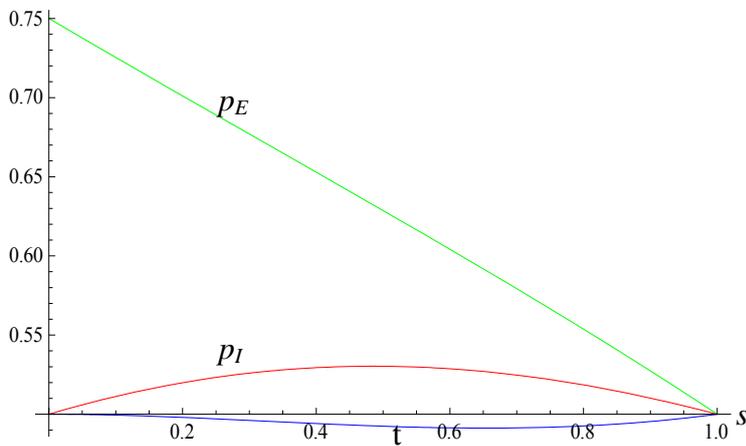


Figure 4: Equilibrium prices and access charge with optimal linear prices ($a = 1$) (Note: vertical axis origin at .5).

The case is similar to the unregulated case in that the price of the incumbent is always lower than the price of the entrant (due to lower marginal costs) and hence the market share of the entrant is lower than the market share of the incumbent. However, it differs from the unregulated case in that there is no margin squeeze (i.e., $p_I > t$ for all s)! Note that t is much higher compared to the unregulated case and that therefore call prices p_I and p_E are also much higher.

The results for the two extensions of the basic case (see Subsections 2.2 and 2.3) are simple and straightforward. Bertrand competition among two entrants leads $p_E = t$ and the incumbent sets t as well as p_I equal to the monopoly price $a/2$. The same result holds for the discontinuous demand case. Here, it is $p_I (=a/2)$ which provides the cap on the entrant's price. By setting t equal to this value, the monopolist is able to extract all profit possible with linear prices.

Note that the above reasoning applies only if either f^R or the utility from the outside good and therefore CS^O is rather low. It assumes that there is not much substitution away from fixed line telephony even if monopoly prices are charged for this service. Given that there are serious arguments for considering mobile telephony as increasingly better substitutes for wireline services, we expect that the incumbent is subject to stronger constraints. Note that the constraints from the outside good and the respective values of CS^O imply that Case 2 applies also for 'small' values of f^R . As soon as $CS^O + f^R$ is greater than the consumer surplus with optimum linear prices, f^R becomes binding with equality.¹⁰ Given the above arguments, we turn to the empirically probably more important case 2.

Case 2: f^R is binding with equality

We want to start the discussion of this case with the examination of the two extensions of the basic model. They yield the same result:

$$(20) \quad p_I = p_E = t = a - \sqrt{(CS^O + f^R)(1+s)}$$

$$\text{for } CS^O + f^R \in \left[\frac{a^2}{4(1+s)}, \frac{a^2}{(1+s)} \right]$$

¹⁰ Here we abstract from the twist implied by the strategic effect. See footnote 9 above.

Note that the incumbent sets his price and the access charge in a way such that ensuing consumer surplus is just equal to $f^R + CS^O$. The boundary cases of the domain lead to the monopoly price and to price equal marginal cost, respectively. The explanation of this result is straightforward. The incumbent sets prices sufficiently low so that he can extract as much consumer surplus by means of the fixed fee as possible and that consumers still buy the product. Given the constraint to provide sufficient consumer surplus, the incumbent sets the prices as high as possible since we are in the range below the monopoly prices.

The result in equation (20) shows that there is no margin squeeze; the incumbent offers access at retail-minus. Furthermore, prices are decreasing if utility from the outside opportunity increases. Via this channel, intermodal competition has a direct effect on call prices. This effect is also at work in the basic demand specification as can be seen from Figure 6.

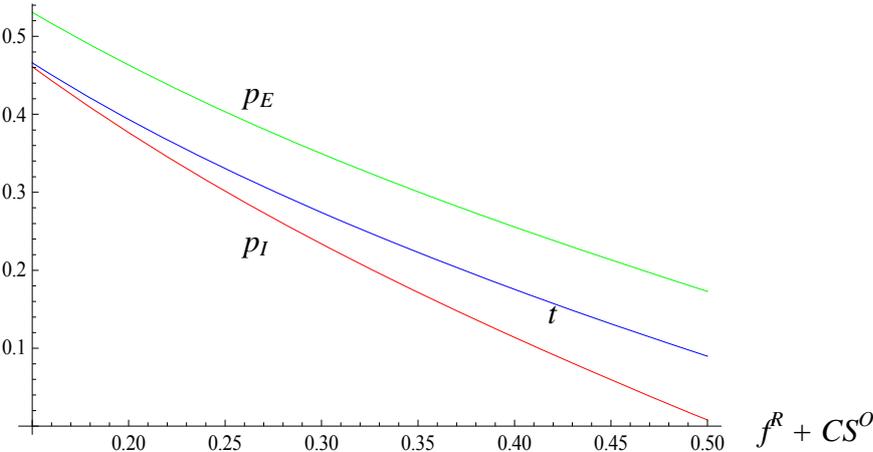


Figure 5: Equilibrium prices and access charge as a function of f^R and CS^O , resp. ($a = 1, s = .75$).

Figure 6 shows the relation between f^R and equilibrium prices and the access charge for a given value of the product differentiation parameter s . As in the two extensions the relation is an inverse one. As in the other regulatory regimes above we obtain the results that there is a margin squeeze and that the entrant’s retail price is higher than that of the incumbent. This is

again due to the double marginalization problem as can best be seen for high values of f^R for which p_I approaches marginal costs.

3.4 Regulation of the fixed fee f and the access charge t

In current EU regulatory practice regulation of both the monthly fixed fee and the access charge is common. We examine this scenario by first looking at the situation with two homogeneous entrants. Again, we need to distinguish between different, i.e. binding and non-binding levels of f^R . As far as the wholesale access charge t is concerned, we consider first the exogenously fixed (cost-oriented) case and second retail-minus regulation. Note that with an exogenous access charge t^{CO} , the entrants' price p_E is also t^{CO} in our case with two homogeneous entrants.

For a low level of f^R (Case 1 from above applies) we know that the optimum linear prices apply. The incumbent's price derives from the respective reaction function (Equation 21 applies). We obtain:

$$(21) \quad p_I = (1-s)\frac{a}{2} + st^{CO}.$$

Note that p_I is always greater than t^{CO} as it is a weighted average of the monopoly price and the access charge t^{CO} . Therefore, the incumbent's price is greater than that of the entrants and there is no margin squeeze.

Next, we examine what happens for larger values of $f^R + CS^O$, i.e. in the case where f^R becomes binding with equality. This applies when $f^R + CS^O$ is greater than consumer surplus evaluated at optimum linear prices, i.e. when

$$(22) \quad f^R + CS^O > CS \left(p_I = (1-s)\frac{a}{2} + st^{CO}, p_E = t^{CO} \right) = \frac{1}{8} \left(\frac{a^2(5+3s)}{1+s} - 8at^{CO} + 4(t^{CO})^2 \right).$$

If this condition applies, the incumbent will charge a (lower) price in order to guarantee f^R . As soon as

$$(23) \quad f^R + CS^O > CS(p_I = t^{CO}, p_E = t^{CO}) = \frac{(a - t^{CO})^2}{1+s},$$

the incumbent charges a price lower than the price of the entrants and also lower than the access charge t^{CO} .

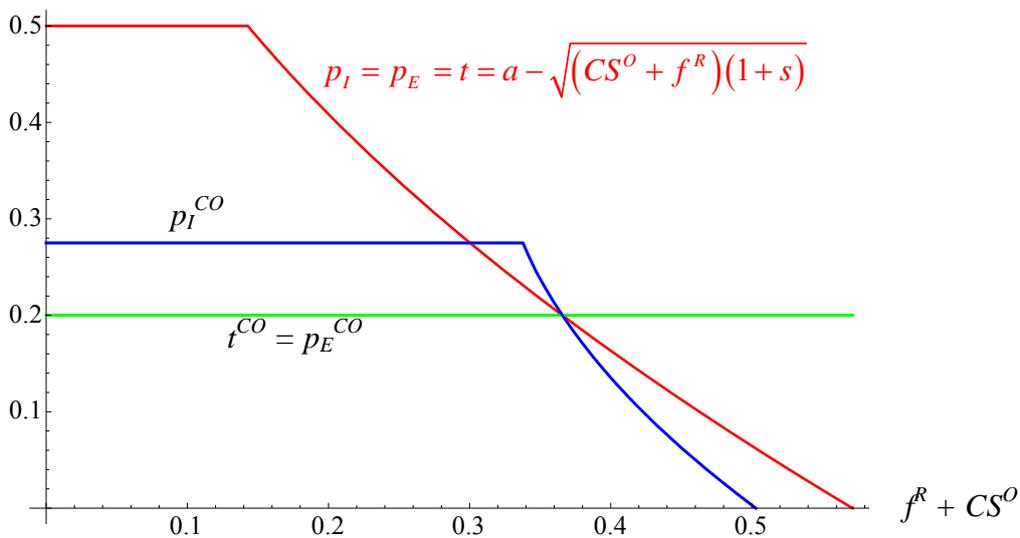


Figure 6: Equilibrium prices and access charge as a function of f^R and CS^O , including cases with and without cost-oriented regulation of wholesale access charge ($a = 1, s = .75$).

Figure 7 depicts both the case without regulation of the wholesale access charge and with a rate t^{CO} regulated at average cost. The figure allows for a ‘dynamic’ interpretation of a development with increasing intermodal competition. Just fix f^R at some small values (e.g. .1) and assume that CS^O is 0 so that optimal linear prices apply (in the case without regulation of the wholesale access charge). Without wholesale regulation the incumbent charges the (linear)

monopoly price of .5 as both the retail and the wholesale price. Increasing intermodal competition leading to larger values of CS^O eventually lead to a gradual decrease of the wholesale and retail prices to prices which can be as low as the marginal costs. We arrive at flat rates for fixed-line telephony.

If we introduce cost-oriented wholesale regulation of the access charge at $t^{CO} = .2$, prices are lower for low values of CS^O than without wholesale regulation. Furthermore, there is no margin squeeze and the incumbent charges a higher retail price than the entrant ($p_I^{CO} > p_E^{CO}$). However, as intermodal competition increases to lead to values of $f^R + CS^O$ greater than about .34, the incumbent reduces his retail price. Tougher intermodal competition eventually leads to a margin squeeze. This is an important result since it is a potential explanation for the observed shift of regulation from preventing excessive calls prices to preventing ‘too low’ calls prices which may squeeze the entrants out of the market. This shift has happened within the last years when competition from other (in particular mobile) networks also increased significantly and the fixed fee also increased.

Two results deserve further mentioning:

- First, in the region of the margin squeeze the incumbent charges a lower price than without wholesale regulation. The low p_I serves to allow full extraction of f^R .
- Second, even though the entrants charge a higher price than the incumbent, they get positive demand due to product differentiation and therefore are not foreclosed.

The basic case with a single entrant does not yield qualitatively different results. It is straightforward to calculate equilibrium profits, prices and quantities for an exogenously determined access price t^{CO} . For case 1 (f^R is so small that optimal linear prices are charged)

the reaction functions in (17) and (18) apply. They result in the following equilibrium prices, which depend on t^{CO} :

$$(24) \quad p_E = \frac{(as + as^2 - t^{CO}s^2 - 2t^{CO} - 2a)}{(-4 + s^2)}$$

$$(25) \quad p_I = \frac{(-2a + as^2 + as - 3t^{CO}s)}{(-4 + s^2)}$$

Note that $t < p_I < p_E$ in this case (see also Figure 4). Since prices are higher than in the previous case with two homogeneous entrants, f^R becomes binding (with equality) for smaller values than before. A further decrease below the respective f^R would eventually lead to a margin squeeze.

In the case with discontinuous demand we obtain basically the same pricing with wholesale regulation as in the case with two entrants and no(!) wholesale regulation (the upper line in Figure 7 applies). There are only two differences: First, the entrant earns a markup $p^I - t^{CO}$ (note that $p^I = p^E$). Second, the incumbent does not reduce the price below t^{CO} even if this would be required in order to extract f^R . This holds until the additional wholesale revenue generated by the demand for the entrant's product does no longer compensate for the loss in revenue from the fixed fee. Again, the incumbent would in this case be happy to provide wholesale access at more favourable terms than the ones prescribed by the regulator.

Turning to regulation according to the retail minus rule, the access charges are determined from the incumbent's optimization problem. In our standard scenario with one entrant, we obtain for the case of low values of f^R that the incumbent charges the (linear) monopoly price:

$$(26) \quad t = \frac{1}{2}a = p_I$$

$$(27) \quad p_E = \frac{3}{4}a - \frac{1}{4}as.$$

The entrant's price would be higher. Since the prices are rather high in this case, f^R is very likely to be binding with equality early on. The high mark-up of the entrant forces the incumbent to set a comparatively low access charge t in order to satisfy the constraint related to f^R .

In the case with two homogeneous entrants, the results can directly be derived from equation (23) which now holds with equality in the case of a sufficiently large value of $f^R + CS^O$. Increases in either f^R or CS^O lead to a reduction of the access charge t . With retail-minus regulation such increases would eventually lead to lower access charges than the values obtained under cost-oriented regulation.

4 Model extension

Above, we introduced the case with discontinuous demand in order to deal in an implicit way with incumbency advantages. In the remainder of this section we want to show that our results extend to cases in which the above characteristics are treated in more detail. For this purpose, we change our model to explicitly account for switching costs. We do this by introducing two groups of consumers, one willing to switch, while the other will stay with the incumbent irrespective of prices. This specification captures the observation that some consumers use (sometimes in addition to the incumbent's services) the entrant's calls services, while a significant share of consumers keeps using only the incumbent's services. Consequently, our model features two groups of consumers: One group (indexed 1) only uses the incumbent's services while the other group (indexed 2) considers the services offered by the incumbent and the entrant, respectively, as homogeneous. Therefore, group 2 buys from the cheaper firm. We assume that the incumbent charges the same per minute price to both consumer groups, i.e. there is uniform pricing by the incumbent.

While in a model with two firms setting a *linear* price the limited coverage of the entrant leads to a softening of competition and a higher (uniform) price of the incumbent (see Valletti et al. (2002)), this is not the case if the incumbent is unregulated and can charge two-part tariffs. Rather, the results of the model with two consumer groups resembles the result with only one group (or a ‘representative’ consumer): The incumbent charges a per-minute price equal to marginal costs and is indifferent with respect to providing cost-oriented wholesale access. The incumbent operator extracts the consumer surplus (above CS^0) by means of the fixed fee f . He is willing to provide cost-based wholesale access to equally efficient rivals.

If the fixed fee is regulated and becomes a binding constraint, the incumbent will charge a positive (possibly monopoly) retail price. In the given setup with differentiated goods, he will always be willing to provide access on retail minus terms. If wholesale access is also regulated and if f^R is binding, an equilibrium in pure strategies does not exist. Since competition for consumers of group 2 is softened due to the existence of the loyal group 1, it is clear, however, that – in an equilibrium in mixed strategies – the incumbent charges a higher price in expectation than the entrant and the entrant has a higher expected market share in group 2.

The results obtained above with a representative consumer therefore largely extend to a model with two consumer groups one of which is not willing to use the entrant’s services.

5 Conclusions and discussion

We presented a model where an entrant buys an input from a vertically integrated incumbent and competes with the incumbent in prices at the retail level. The model allowed us to

investigate if or under which conditions the entrant is subject to a margin squeeze and/or will be foreclosed by the incumbent. The entrant has the wholesale access price as positive marginal costs while the incumbent has zero marginal costs. In addition, the incumbent can set a two-part tariff while the entrant can only set a linear price. Such we were capturing the main features of CS/CPS competition in fixed network voice telephony markets. We also considered the effects from infrastructure based competition (e.g. from mobile or cable networks or from ULL operators) by introducing an ‘outside opportunity’ for the consumer.

In our basic model with a single entrant which is horizontally differentiated to the incumbent, we find that the unregulated incumbent will expose the entrant to a margin squeeze which is, however, solely due to the market power of the entrant (which leads to double marginalization). Since the entrant is differentiated and consumers have ‘love for variety’, the entrant is never completely foreclosed. These results extend to a situation where the wholesale access price is set at (exogenously determined) average costs (although retail calls prices are lower if the regulated access charge is below the unregulated access charge). The margin squeeze only disappears if the access charge is set according to the retail minus rule or if the fixed fee is also regulated and sufficiently small (so that the incumbent cannot extract consumer surplus by means of the fixed fee and has to increase calls prices).

For all the scenarios of the basic model, the incumbent prices below the entrant in equilibrium throughout all relevant levels of product differentiation. This result is clearly at odds with real market behaviour where entrants usually had to cope with switching costs or other incumbency advantages and had to undercut the incumbent in order to gain market shares. Therefore we introduced extensions of the basic model. Keeping the product differentiation assumption to allow for a positive market share of the incumbent in case he charges higher prices, we limited the market power of entrants by introducing a discontinuous, ‘kinked’

demand (where the price of the incumbent works as a price-cap for the entrant) or, alternatively, by introducing two homogenous entrants. These extensions remove the counterfactual results of an entrant's price above that of the incumbent. Since the entrants do not have market power, there is no double marginalization and no margin squeeze in the unregulated case.

A margin squeeze may still arise, however, if the access charge is regulated at (positive) average costs and the retail fixed fee is unregulated or regulated and sufficiently large. Again, there is no foreclosure as the entrants are differentiated from the incumbent. If the fixed fee is regulated and sufficiently small, the margin squeeze disappears. With the introduction of an outside opportunity, which potentially provides the consumer a certain utility level, a dynamic interpretation of the model is possible: In a situation where the access price is regulated at average costs and the fixed fee is also regulated (and sufficiently small), an increase in the utility provided by the outside opportunity or an increase in the fixed fee will lower the retail calls price of the incumbent below the access charge. Increased competition from outside opportunities may such lead to a margin squeeze. This is an important result since this might have happened in many countries over the past years. While pressure from other infrastructures – most notably mobile telephony – became stronger and stronger, the focus of regulation in fixed network markets shifted from preventing excessive calls prices to preventing a margin squeeze. Our model provides a possible explanation for this. It also suggests that in such a situation a retail-minus access price would – at least in theory – lead to lower retail prices compared to a cost-oriented access price. At the same time there would be no margin squeeze. There are, however, a number of implementation problems related to retail-minus access pricing which would have to be overcome before the current regulatory

regime (FL-LRAIC¹¹ being the cost standard for origination and termination services in most countries) can be changed.¹²

Strong pressure from outside opportunities of course puts into question the need for regulation in calls markets (including wholesale regulation and the CS/CPS business case) itself.

Regulators therefore will have to closely examine on empirical grounds whether (and for which markets) competitive pressure from mobile telephony or other networks is strong enough so that the regulation of fixed network voice telephony markets would no longer be necessary at all or could be at least partially reduced. Fixed-mobile substitution, for example, is typically much stronger for private consumers (compared to businesses) and national calls (compared to international calls and retail access markets). Even if Fixed-Mobile substitution is deemed to be non-sufficient by NRAs to define a common market, it must be considered when the regulator decides upon the remedial measures imposed on the dominant operator.

As regards a critical evaluation of our framework, we first have to discuss our demand model. We model consumers' demand as exhibiting 'love for variety'. This is the main reason why the entrant is – despite being exposed to a margin squeeze in some situations – never foreclosed. Since he brings additional demand, he is valuable for the incumbent who can appropriate some or all of the additional surplus. However, many effects extend also to the case where the entrant is not differentiated (see Briglauer/Götz/Schwarz (2008)) although the entrant is always foreclosed if there is a margin squeeze in this setting.

A potential limitation of our framework is that it does not allow for dynamic effects. A margin squeeze might also be part of dynamic foreclosure strategy where an incumbent sets a

¹¹ Forward Looking Long Run Average Incremental Costs

¹² We provide further discussions on this and related policy issues in Briglauer/Götz/Schwarz (2008).

price which does not maximise his profits in the short run but drives out the entrant of the market so that the incumbent can make higher profits in the long run. Our model does not allow for such behaviour. Also, dynamic effects of entry, such as backward integration or entry into other markets after having established a brand name and a customer base ('ladder of investment', see for example Cave (2006)) is beyond the scope of our model. It can be assumed that the incumbent's incentives are changed if there is the threat of backward integration.¹³ On the other hand it can be argued that more than ten years after fixed network liberalization, the promotion of market entry by means of resale or service competition should no longer be the focus of regulation.

Appendix: Regulatory background

The EU regulatory framework for electronic communications markets¹⁴ requires national regulatory authorities (NRAs) to periodically analyse the state of competition on a certain number of markets and impose appropriate *ex ante* remedies in case that an operator is found to have significant market power (SMP).¹⁵ To promote harmonization among Member States, the European Commission also published a list of markets which have to be considered by each NRA, the 'Recommendation on Relevant Markets' (see European Commission (2003)). This Recommendation originally included the following fixed network voice telephony markets, which are the issue of this article (the number of the market corresponds to the number in the Recommendation):

Retail level:

¹³ See for example the discussion and literature review on dynamic leveraging in Crocioni (2007).

¹⁴ See Directives 2002/19/EC, 2002/20/EC, 2002/21/EC and 2002/22/EC, OJ L108, 24.4.2002.

¹⁵ The concept of SMP is based on the concept of dominance in general competition law (see European Commission (2002)).

1. Access to the public telephone network at a fixed location for residential customers.
2. Access to the public telephone network at a fixed location for non-residential customers.
3. Publicly available local and/or national telephone services provided at a fixed location for residential customers.
4. Publicly available international telephone services provided at a fixed location for residential customers.
5. Publicly available local and/or national telephone services provided at a fixed location for non-residential customers.
6. Publicly available international telephone services provided at a fixed location for non-residential customers.

Wholesale level:

8. Call origination on the public telephone network provided at a fixed location.
9. Call termination on individual public telephone networks provided at a fixed location.
10. Transit services in the fixed public telephone network.

While all NRAs found SMP on the retail access markets (markets 1 and 2) and on the wholesale markets for origination and termination, a majority also found SMP on some or all of the ‘calls’ markets (markets 3-6). In many cases, therefore, not only the access to wholesale services, but also the prices of the incumbent’s retail services have been regulated up to now.

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