PREDATORY PRICING ON LIBERALISED TELECOMMUNICATIONS MARKETS*

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Abstract

One of the popular arguments against retail price deregulation in recently liberalised network industries is the risk of predatory pricing by former monopoly suppliers. In general, predatory pricing will not be profitable though, as the cost of predation cannot be recovered through additional profits later. But some game theoretic models show that predation *can* be part of a rational, profit maximizing business strategy, if there are either information asymmetries on the horizontal level between incumbents and entrants or in the vertical relationship between firms and investors/banks. However, prices below average cost and even below marginal cost can also be part of a profit maximizing business strategy without any predatory intent. As a result, it is often difficult to distinguish between predatory, anti-competitive price cuts and normal, competitive pricing policies. The question then is: What regulatory policy should best be adopted to deal with the risk of predatory behaviour?

As we argue in this paper, a regulatory policy which requires incumbents to obtain regulatory authorisation for all price cuts is not adequate. This ex-ante regulation of retail prices through a Government agency, as currently practised on many telecommunications markets in Germany, is the least satisfying approach. Similarly, the price squeeze tests that have been recently suggested by various European regulators have their limitations, as they tend to be over-inclusive.

An efficient approach should minimise the damages from both regulatory type-I- and type-II-errors, i.e. not punish competitive behaviour as anti-competitive (type-I-error) *and* not mistakenly regard anti-competitive behaviour as being competitive (type-II-error).

Since both theoretical considerations and empirical evidence lead us to conclude that the risk of predatory pricing is low on telecommunications markets, we argue for a price ratchet rule according to which an artificial price ratchet is used to lock in price cuts for some period of time if these price cuts have driven competitors off the market. This rule needs to be augmented by an efficiency defense in case the incumbent only wants to cut prices temporarily, so that efficient price cuts are not unduely prevented. However, the burden of proof for the efficiency defense for temporary price cuts should be shifted to the incumbent.

This augmented rule is adequate to deal with predatory pricing also on telecommunications marktes, the risk of which is low in any case. The experience in Germany to date supports this conclusion. Therefore, a rule that focuses on type-I-errors and does not classify competitive behaviour as anti-competitive is adequate, as predatory pricing will be rather rare on telecommunications marktes (and thereby also the risk of type-II-errors).

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1 Introduction

One of the main reasons for liberalising network industries has been the (well founded) suspicion that traditional monopoly providers were producing low quality services at high costs and accordingly high prices, which resulted in all productive, allocative and dynamic inefficiencies. The liberalisation of telecommunications markets was, therefore, not only intended to lead to more competition, but primarily to increase efficiency.

The path from monopoly to competition can be characterised by two simultaneous developments: Firstly, former state-owned monopoly providers have largely been privatised or at least been put under more corporate governance structures. And secondly, the regulatory framework has been reformed substantially. While the introduction of competition requires regulation of certain bottlenecks (or essential facilities), former monopoly providers have also been given more freedom in pricing their services (see, e.g., Laffont and Tirole, 1999, p. 37).

Some economists and, above all, new entrants are now concerned that the former monopolists could abuse this new freedom and engage in predatory pricing in order to maintain or regain their monopoly position (see, e.g., Miller, 1997). In fact, this concern is the main argument of the German Monopoly Commission for maintaining retail price regulation on German telecommunications markets. The Monopoly Commission argues that preemptive retail price regulation mainly aims at „preventing cross-subsidisation and predatory pricing“, as the „risk of predation is not *completely* eliminated as long as the economic stability of firms is not secured“ (Monopoly Commission, 2002, pp. 133/134, our translation). Hence, while the traditional concern has been that prices were too high, now the concern rather is that prices may not be high enough.

Many economists, however, do not share this point of view. One of the most sceptic observers is Lott (1999) who argues that predation strategies are used extremely rarely, if at all. And even authors, who may not think that predation strategies are that rare, at least maintain that certain conditions have to be fulfilled for predation to become a plausible and successful strategy.

The aim of this paper is twofold. First, we want to discuss the conditions under which predatory pricing may realistically be expected and examine whether these conditions are met on liberalised telecommunications markets. And secondly, we will analyse the adequacy of potential policy responses to deal with the risk of predatory pricing.

The rest of this article is now organised as follows: In section 2 we will briefly define predatory pricing before we discuss its rationale in section 3 and the underlying theory in more detail in section 4. Section 5 will then analyze the risk of predatory pricing on liberalised telecommunications markets and also examine the experience in Germany. The topic of section 6 is the question how predatory pricing can be identified. As we will see it is not sufficient to show that prices are below average or even marginal cost to classify them as predatory. In contrast, even prices below marginal cost can serve legitimate business purposes and be part of naive profit-maximising behaviour without any strategic or predatory intent. In section 7 we will analyse potential policies to deal with predatory pricing more generally, while section 8 summarises our findings and concludes.

2 What is Predatory Pricing?

Prices are defined as predatory if (a) they are intented to induce a rival firm to exit the market or, at least, to discipline that rival in its behaviour, *and* (b) if that pricing policy was not profit maximising would it not lead to increased market power. Hence, it is not the price level alone that is decisive for a pricing policy being predatory, but also the firm’s intention to make a rival leave the market in order to defend or to gain market power (also see Cabral and Riordan, 1997, p. 160 and Bolton, Brodley and Riordan, 2000, pp. 2242 sq.).

Hence, the decisive element for pricing to be predatory is the strategic intention to increase one's own market power. In contrast, if some pricing policy is in accordance with „naive" short-term profit maximisation behaviour, this pricing should not considered to be predatory.

3 The Rationale Behind Predatory Pricing

It is sometimes suspected that it is a profitable strategy for large firms to aggressively price smaller rivals off the market. However, this strategy is only profitable for an aggressor if the temporary losses incurred through a price war are at least compensated through additional profit later. Hence, to determine whether predatory pricing is a profitable business strategy one has to consider its costs in terms of losses incurred and its benefits in terms of additional profit gained later.

The opportunity cost of a predation strategy mainly consists in the loss of profits incurred during the predation period. In addition, there may be some other costs such as advertising which may be necessary to inform potential customers about the price cut. In general, the total cost of predation is the higher the larger the predating firm's market share. A high market share usually implies that prices have to be reduced for many consumers which would otherwise buy the product at a higher price. This is especially relevant for the former monopoly firms in the telecommunications industry, as these firms tend to have some loyal customer basis and large market shares on most markets. However, the cost of predation can be reduced if the firm manages to selectively reduce prices only for those consumers that are most likely to switch to a competitor. In this potential case, the cost of predation can be small even with a large market share.

In addition, predation costs also depend on the rivals' response to a price war. The key question for the predating firm is how long a price cut has to be sustained for the rival to exit the market. Or to put the question differently: How long is the rival willing to sustain the losses associated with a price war? What is decisive here is the rival's exit decision and, hence, its barriers to exit.

The second decisive factor for predatory pricing to be profitable is the predation profit. Only if the predating firm can increase its prices to a level that exceeds the competitive price level after the predation period, predatory pricing can be profitable at all. This may be the case if the resulting market structure is a monopoly or a tight oligopoly. If there are many firms to start with, however, or if entry barriers are not high enough, this is rather unlikely to occur.

4 Economic Theories of Predatory Pricing

4.1 The Chicago View

Even though predatory pricing appears to be a plausible business strategy to limit competitive pressures, at least at first sight, the so-called Chicago School has cast serious doubts on its rationality for three reasons (also see van den Bergh and Camesasca, 2001, 287 ff.):

Firstly, proponents of the Chicago view argue that on most markets it is difficult to earn super-normal profits even if a rival exits the market because the barriers to entry (or re-entry) are low (see Bork, 1978; Easterbrook, 1981). Only if there are sufficiently high barriers to entry there is a prospect to earn super-normal profits for some period of time so that the predation costs can be amortised. If, however, barriers to entry are relatively low a price increase will attract new entrants again. With sufficiently low barriers to entry, new entrants will deprive the predator of its expected fruits. In the extreme case of a perfectly contestable market, predation would never be rational, as the predator could never reap the fruits of its strategy.

Secondly, Chicago School proponents question whether predatory pricing will really lead to market exit. If there are barriers to exit (due to asset specificity and sunk costs), it is expensive and difficult for the established firm to drive rivals off the market, once they have entered. Hence, predation is rather unlikely in this case.

If, in contrast, barrieres to exit and, thereby, barriers to entry are low, re-entry after a period of predation will be profitable, should the predator raise prices later. Then, however, the Chicago School argues the prey firm should be able to obtain sufficient funds on the capital market to sustain a price war in the first place, as expected long-term profits are positive (see Bork, 1978, 147). Furthermore, potential customers should be interested in concluding long-term contracts with the potential prey firm in order to secure its survival, as the customers themselves would suffer from a successful predation strategy later (see Easterbrook, 1981, S.270). Therefore, so the argument of Chicago School, predatory pricing is unlikely to be successful.

In reality one may ask whether consumers are actually able to conclude long-term contracts, as the transaction costs may not be negligible, at least not for private households. For business customers, however, this scenario is not implausible since they often award their entire purchasing volume for a period of time to one single supplier via tender, especially in telecommunications.

Thirdly, so the reasoning of the Chicago School, is predatory pricing unlikely to be the *optimal* strategy even if it succeeds in driving the rival off the market because it will usually be cheaper to simply take over the rival firm (see McGee, 1958). As both firms' profits will be lower during the price war than after, it should be less costly to acquire the rival firm than to drive it off the market through an aggressive, loss-inducing price war.[1]

Therefore, the Chicago School argues that, everything taken together, predatory pricing is rare because (a) it is not rational for incumbent firms to engage in predatory pricing in most cases, and (b) for entrants it is often not rational either to leave the market in case of a price war.

In summary, while the logic behind the Chicago School's reasoning is intriguing, there are, at the same time, two weak spots: Firstly, the analysis totally ignores the dynamic aspects of predatory pricing strategies. And secondly, the analysis rests on the heroic assumption that all actors possess complete information about all relevant parameters. With the development of game theory, these two points have been addressed more recently in a number of models.

4.2 Game Theoretic Models

The first criticism, i.e. the lack of strategic interaction, has taken up by Selten (1978) in his seminal paper. His question was whether an incumbent monopolist that is active on many regional sub-markets would fight entry if a rival entered one sub-market so as to deter entrants from entering other sub-markets. As Selten (1978) has shown dynamic aspects are irrelevant as long as there is no information asymmetry among the parties involved. With complete information any threat to fight entry is not credible, but only "cheap talk". This result is independent of the number of regional sub-markets, on which the incumbent is active.

Selten (1978) himself has called this result a paradox because, while predatory pricing is not a rational strategy in his model, it seems to occur in reality. This rift between game theoretic logic and general intuition is mainly the result of one assumption, namely that information is perfect.

More recent models have dropped this assumption and examined games with incomplete information. As these models show, predation may well be a rational business strategy either

(a) if firms face different financial constraints, or
(b) if the incumbent firm has better information about market demand or production costs than potential entrants; or
(c) if it is known that some firms do not behave rationally.

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[1] The problem with this argument is that while it may be valid for historic cases, it is much less convincing today, as mergers and acquisitions come under close scrutinity by cartel offices or competition authorities in most jurisdictions. If, however, horizontal mergers are not allowed should they lead to substantial market power, then it may well be profitable for a firm to predate on a competitor in order to drive it off the market (see Posner, 1976). Furthermore, a merger may be permitted even though it may lead to market power if the target company would otherwise fail (failing company defense). In this case, predatory pricing may well be a rational strategy in order to obtain permission for a takeover of the then failing target company and to drive down the target company's takeover price (see Saloner, 1987; Granitz and Klein, 1996).

4.2.1 Different Financial Constraints

Already Telser (1966) has argued that predatory pricing may be successful if incumbents and entrants face different financial constraints. If the incumbent has better access to financial ressources either because it is subject to more favourable terms and conditions on capital markets or because it can finance its predation strategy through cross-subsidies from protected monopoly markets, then the incumbent can sustain a price war for a longer period of time than the entrant. While the incumbent can use its „deep pocket“ or „long purse“, the entrants' financial resources may dry up so that predation may indeed be successful in driving the entrant off the market. If, in turn, the entrants correctly judges the situation ex ante, it will not enter the market in the first place (also see Benoit, 1984 and Cabral, 2000, 270 f.).
However, the question remains *why* an incumbent firm should be subject to better financial terms and conditions than an entrant. Why would banks not make a credit available to the entrant if it can earn a profit after the price war? As Bolton and Scharfstein (1990) have argued, the principal-agent-relationship between lenders and borrowers may result in capital market imperfections. More specifically, information asymmetries between banks and their clients may lead to credit rationing: As borrowers tend to be better informed about their own situation and as they directly affect the fortunes of their business, e.g. through the riskiness of their investments, adverse selection and moral hazard problems can result. Since incumbent operators are, at the same time, well established and lenders tend to have better information on them (e.g., because of their past record), this may lead to incumbents facing better financial terms and conditions than an entrant. This disdavantage for the entrant may in turn lead potential lenders to doubt the entrant's viability and restrict lenders' willingness to make the funds available that entrants would need to sustain a price war.
If, however, there are lenders who are willing to bear some risk or if entrants have other financial resources (e.g., a monopoly on some other (home) market), a predation strategy that aims at depleting the entrants' funds will not be successful and is therefore unlikely to be used by the incumbent.

4.2.2 Signaling Strategies

Predatory pricing can also be a rational, successful business strategy if the entrant is not as well informed about the incumbent's cost or about market demand as the incumbent. If the entrant is uncertain whether the incumbent has high or low costs, the entrant may take a low price as a signal that the incumbent has low costs, which may render competition with the incumbent unprofitable for the entrant. This in turn may induce the entrant to leave the market (see Milgrom and Roberts, 1982; Roberts, 1986).
Similarly, price cuts may induce the entrant to exit the market if the entrant has only poor information about market demand (see Riordan, 1985; Fudenberg and Tirole, 1986). If the incumbent reduces its price in the entrant's market testing period, the entrant may obtain false signals about demand for its product. Such a signal jamming strategy can also drive the entrant off the market if the entrant is lead to miscalculate market demand and, therefore, decides against market entry.

4.2.3 Reputation Models

Reputation models are based on the idea that incumbents engage in predatory pricing in order to build a reputation for them aggressively fighting rivals' entry (see Kreps and Wilson, 1982). This reputation for tough behaviour acts as a barrier to entry for rivals which prevents them from entering markets where the incumbent is active, as the entrants believe that the incumbent will respond to entry with aggressive price cuts. These models basically follow Selten’s (1978) idea that

an incumbent may engage in predatory pricing on one market in order to send a signal to potential entrants on other markets. Such a strategy may indeed be successful and rational to apply either if (a) there are infinitely many subgames or (b) if there is at least a small probability that the incumbent does not behave rationally.
If there are infinitely many potential rivals or infinitely many regional sub-markets and, therefore, infinitely many subgames, Selten's paradox can be solved and predatory pricing may be part of a (perfect) equilibrium (see Milgrom and Roberts, 1982). However, this result is relatively discontenting, as (a) games with infinitely many sugames tend to have multiple equilibria and (b) the entrants have to hold rather implausible beliefs about the incumbent's behaviour to make predatory pricing part of a (perfect) equilibrium (see Ordover and Saloner, 1988, 553).
The incumbent's reputation can also act as a barrier to entry if there is at least some small probability that the incumbent does not behave rationally. In this case, price cuts on one market may convince potential entrants that an incumbent will also fight entry on other markets even if this is not its profit maximising strategy. The mere possibility that the incumbent behaves in this way allows him to build up a reputation to fight entry.
The problem with reputation models of predatory pricing is that it is still not rational for the incumbent to engage in predatory pricing unless (a) the entrant is poorly informed about the payoffs of market entry or (b) there is some chance that the incumbent does not behave rationally (see Kreps and Wilson, 1982). To solve Selten's paradox by deviating from the rationality assumption is not very satisfying though, as irrational behaviour could „explain" all sort of phenomena without there being a chance of empirical falsification. If, however, entrants have poor information about the payoffs of market entry, models based on reputation are really nothing else but signalling models. Or to put it differently, signalling models and reputation theories of predatory pricing are nothing but different sides of the same medal. The incumbent sends a signal about its cost which in turn provides him with a reputation to aggressively fight entry (because he has low costs of doing so).

4.3 Summary

In summary, we can conclude that predatory pricing can only be explained as rational behaviour if asymmetric information plays a significant role. These information asymmetries may either be important in the vertical relationship between entrants and financial markets or on the horizontal level between entrants and incumbents. How important are these models to inform economic policy?
It can hardly be denied that financial markets are often characterised by information asymmetries. However, this does not mean that predatory pricing is a successful business strategy, let alone the best one available to the firm. A necessary condition for predatory pricing is that the entrant faces tighter financial constraints than the incumbent. However, this is not sufficient to make predation an optimal strategy. For predation to be profit maximizing, the expected costs of a price war must be outweighed by the expected additional profit to be made after the rival has left the market *and* the incumbent must not have any alternative strategy that would yield a higher long-term profit. Only in this case, the sufficient condition for predatory pricing to be the incumbent's optimal strategy is fulfilled. Hence, rather than drawing a blanket conclusion across all cases one has to carefully consider how important financial constraints may be in any single case.
The second approach to explain predatory pricing as rational behaviour is to assume that there is asymmetric information between the incumbent and potential entrants. More precisely, the incumbent has to be better informed about cost or demand conditions than the entrant. As before, one has to carefully consider how relevant these information asymmetries may be in any particular case before jumping to conclusions.
Overall, it is important to note that the game theoretic models of predatory pricing are not very robust against changes in the underlying assumptions. These models rest on quite restrictive

assumptions, especially about the players' information. Hence, one cannot conclude that predatory pricing is a prevalent phenomenon on real markets only because it *can* exist in theory. On the other hand, one cannot rule out its existence on real markets either. Hence, one has to ask how real and acute the risk of predatory pricing may actually be on liberalised telecommunications markets.

5 Predatory Pricing on Telecommunications Markets

5.1 Particularities of Telecommunications Markets

Telecommunications markets are characterised by a number of particularities, which are relevant for the risk of predatory pricing. First of all, on most fixed-line telephony markets there is one vertically integrated former monopolist who has started with a fixed customer base at the beginning of the liberalisation process. In contrast, new entrants have to convince customers to switch providers. Secondly, many telecommunications services require use of a network infrastructure which involves high fixed and common costs while the variable costs are relatively low. Thirdly, prices for using the incumbent's infrastructure are usually regulated if competitors invariably need to use the infrastrcuture to compete with the incumbent provider. Usually these prices are set at long-run incremental cost (LRIC), be it services based (TSLRIC) or element based (TELRIC).

What relevance does this have for predatory pricing? Two points may, at first glance, point towards an increased risk of predation: Firstly, established providers can work from an installed customer base which may arguably result in market power. And secondly, the incentive to cut prices in the case of market entry may be high, as there are relatively high fixed and common costs and relatively small variable costs.

At second sight, however, it becomes clear that these two points do not lend support to the suspicion that liberalised telecommunications markets are especially prone to predation risks. For the first point, it is important to realise that firms will be the less inclined to cut prices the more loyal their established customer base is. The so-called fat-cat effect results (see Fudenberg and Tirole, 1984), i.e. the established operator will rather fleece its loyal customers than try to keep all customers through hefty price cuts. The opportunity cost of engaging in a price war are rather high in this case, as the established firm has to forego the opportunity to fleece the loyal customers. Only if the incumbent is (a) allowed to cut prices selectively and (b) able to differentiate between loyal customers and those who are ready to switch, he can both fleece its loyal customers through high prices *and* keep those who are willing to switch through selective price cuts. However, it is doubtful that such a pricing policy would be possible for many telecommunications services in reality.

Regarding the second point it is crucial to note that the incumbent has to reveal all its costs and that all essential inputs are available to competitors at regulated prices. This in turn has far reaching consequences for the potential use of predation strategies. Firstly, information asymmetries about the incumbent's costs are not likely to play a major role, which means that cost signalling predation is rather implausible. Secondly, as access to the incumbent's production facilities is regulated, entrants hardly have to undertake any specific investments if any at all in order to enter telecommunications markets. Hence, these markets where all firms have access to the same facilities at the same costs almost resembles the ideal of a perfectly contestable market.[2]

What about the game-theoretic arguments discussed in section 4 though? Do incumbents know so much more about cost and demand conditions than entrants or do they have so much better access to capital that a predation strategy becomes plausible?

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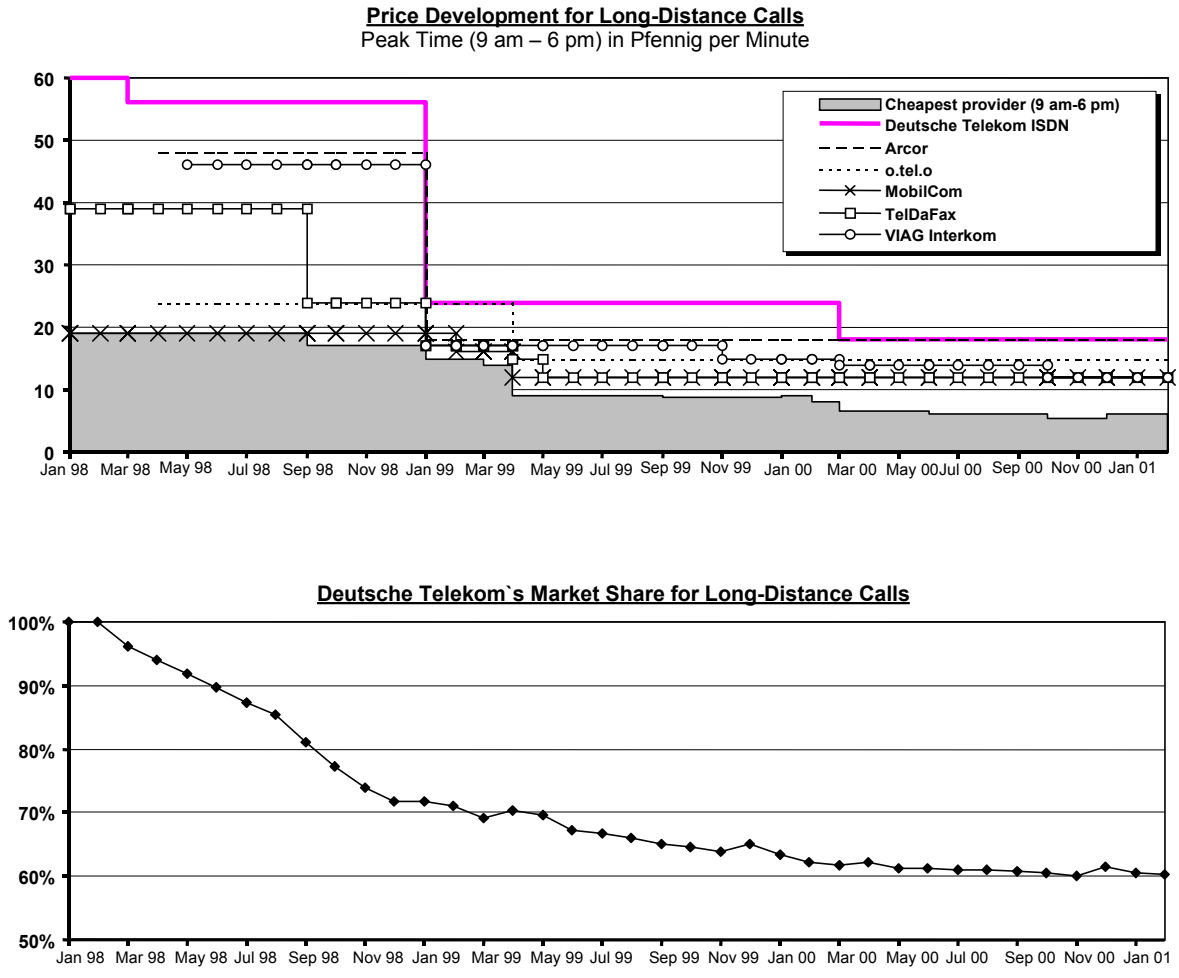
[2] Even if the incumbent has lower marginal cost than entrants (which is a necessary condition for the cost signalling model of predation) a price cut below the entrant's marginal cost is desirable form a welfare economic perspective as it comes closer to the first-best solution of efficient marginal cost pricing.

There are two reasons why it is rather unlikely that incumbents have an informational avantage regarding cost and demand conditions. Firstly, more than in any other industry, incumbent operators have to disclose their cost of providing services. Apart from regulatory accounts and specific information disclosure rules, there are also several competing cost models that are also available to any entrant. Secondly, many entrants have been active on other (home) telecommunications markets before, i.e. they are not new to the industry, but rather experienced in estimating cost and demand. Moreover, many of them used to be monopolists in their home countries, so it also appears unlikely that they face much different financial terms and conditions than the incumbent on the market under consideration.
Hence, we can conclude that the risk of predatory pricing is not higher on telecommunications markets than on any other market. However, are these theoretical considerations supported by empirical facts?

5.2 The German Experience

For this purpose, let us consider the development of the German market for long distance calls as illustrated in Figure 1. When deregulation took off in 1998, the incumbent, *Deutsche Telekom (DT)*, could have dropped its prices and announce price cuts in advance so as to deter competitors from entering the market. However, with an initial market share of 100% this would have been a rather



costly strategy.

Figure 1: Prices and DT's Market Share on the Market for Long Distance Calls

The fact that a large number of competitors have actually entered the market shows that the risk of prices being cut substantially has not prevented firms from entering the market. The several small new entrants had to fear substantial price cuts not so much from DT, whose retail prices are regulated, but from the larger entrants who built their own infrastructure and who had to rapidly gain market share in order to achieve the necessary economies of scale.
However, in fact it was an entrant without much infrastructure at all, *Mobilcom*, who took the price leadership and entered the market in 1998 with a then revolutionary low call-by-call offer of 0.19 DM (per minute peak time). This price was taken by other competitors as an orientation mark. Even infrastructure-based entrants soon lowered their initial prices.
In contrast, DT initially stuck to its high price of 0.55 DM in order to "exploit" and profit from its customer base. As a consequence, DT's market share declined rapidly (see Figure 1b). If DT had instead followed a predation strategy, it should have at least followed the price cuts in order to send strategic signals to the new entrants. No such thing happened though.
In the following, DT's market share on the market for long-distance calls rapidly shrunk to 70%, and by the end of 2000 it was only 60% (and even less for international calls). Because of the rapid decline of its market share, DT dropped its long-distance charge to 0.24 DM in January 1999.
If we now ask whether DT's behaviour resembles predatory pricing, we have to note that while prices were dropped to stop the decline of its market share the new prices were still 60% higher than the cheapest rival who charged a price of 0.15 DM at that time (see Figure 1a). To close the gap between one's prices and rivals' charges (without undercutting them) can hardly be viewed as predatory pricing
Furthermore, an important element of any predation strategy must be to reduce rivals' sales. However, even after its price cuts DT continued to lose market share. Consumers got used to the new competitive market so that demand has been becoming increasingly price elastic. The price cuts did not stop the decrease of DT's market share, they only slowed it down.
Hence, DT's behaviour can hardly be described as predatory. As Figure 1 shows, all price cuts were initiated by entrants who took the price leadership while DT acted as a follower, if at all.

6 Identifying Predatory Pricing and Explaining Below-Cost-Pricing

6.1 Identifying Predatory Pricing

In practice it often proves extremely difficult to identify predatory pricing. Decisive for predatory pricing is a price cut's purpose. Only if a price cut is intended to drive other firms off the market or to deter them from entering, a price can be classified as predatory.
The problem is that market entry will usually lead to price cuts even in the absence of any strategic purpose. As we know from standard economic theory, monopoly prices are higher than duopoly or competitive equilibrium prices. In the extreme case of Bertrand competition with homogeneous goods the resulting duopoly price will equal marginal cost. Hence, the question arises how one can distinguish between predatory pricing and a price cut which results from the transition from monopoly to duopoly prices.
Since it is difficult to establish the strategic character of some particular behaviour in practice, rules of thumb are often used. In general, a behaviour is considered predatory if it has the effect of driving rivals off the market and there is no legitimate business reason which could explain that behaviour. In turn, a price cut is usually not considered predatory if it is consistent with short-run profit-maximising behaviour.
The probably best known rule of the thumb is the so-called Areeda-Turner-rule, according to which a price cut is considered predatory if the resulting price is below (short-run) marginal cost or - to economise on information costs - average variable cost (see Areeda and Turner, 1975). The idea is

that prices below marginal costs may only be profitable in the long run if the strategy leads to sufficient market power to increase prices and recover the temporary losses later.
The Areeda-Turner-rule is not without problems, however: On the one side, it does not reveal predation where prices are above average variable costs, while, on the other side, it may lead to prices being considered predatory where they are not. This is because prices below average or even below marginal costs can well reflect rational, profit-maximising behaviour without any predatory intention if:

(a) an operator has high fixed and common costs and is faced with shrinking demand, e.g., because of the business cycle or if new competitors add capacity to a market (see 6.2), or if
(b) a new product is introduced to a market (see 6.3), or if
(c) a firm is selling products that are complements (see 6.4).

In all of these cases, a price below cost does not have to be predatory, but can well be the result of normal profit maximisation without any strategic purpose.

6.2 Excess Capacities with an Inelastic Supply Curve

Many markets are characterised by an inelastic supply curve in the short run due to sunk costs. If entrants add capacity to such a market or if demand decreases for macroeconomic reasons, prices below long-run average costs may well be profit-maximising. This is because sunk costs are not relevant for the firm's pricing decision in the short run. As long as the short-run (or avoidable) average costs are covered, which will be lower than long-run average costs, it is rational for the firm to continue production. Hence, prices below long-run average costs may well result from short-run profit maximisation.
Firms are especially hit by short-run demand fluctuations if fixed, unavoidable costs are high so that the short-run supply curve is inelastic and even more if the demand curve is inelastic as well, both of which is charateristic for many telecommuncations markets. Therefore, prices below long-run average costs may well result from demand fluctuations and/or excess capacity rather than predatory pricing.

6.3 New Product Introductions, Network Effects and Learning-by-Doing

Another typical case for below-cost-pricing is the introduction of a new product. If either consumers are uncertain about the product's quality or the utility it provides or if there are learning effects on the production side, below-cost-pricing is often a rational business strategy. With consumer uncertainty about product quality, firms may induce consumers to try the product through introductory offers. Once consumers have acknowledged the product's quality, the firm will raise the price to an above-cost level so that the firm can recover the losses from the product introduction phase (see Shapiro, 1983).
If a production process exhibits learning effects firms may also initially set a low price in order to boost demand for their product so that they can quickly realise learning effects and production efficiency (see Cabral and Riordan, 1997).
Furthermore, firms may also set prices below costs if there are network effects on the user side and if it is important to quickly reach a critical mass of consumers (see Bolton, Brodley and Riordan, 2000, 2281 f.). If consumers' willingness to pay is positively related to a product's number of users, it may well be rational for providers to offer the product even to some (or all) of those consumers whose willingness-to-pay is below the marginal cost of production.
In each of the above cases, prices may not only be below short-run average costs, but even below marginal cost without there being any predatory intention. The pricing policy simply results from the profit maximisation objective to reach a criticical threshold. However, it is also important to note that in these cases prices should only be below cost covering levels for a certain period of time

at the early stages of the product life cycle, i.e. in the product's introductory phase. These examples cannot explain price cuts for well-established products in response to market entry. On telecommunications markets such a penetration strategy, as used by some operators to push DSL-products, may result from naive profit maximisation without any predatory intent (also see Kurth, 2002).

6.4 Products that are Complements

A price below marginal cost can also result if a firm sells complementary products. In this case the provider may decide to offer one product at a price below marginal cost if this boosts demand for the complement. The classic example are wet razors and shaving blades: While the blades are sole profitably, the razor's price is below its production cost (see Allen, 1938, or Davis and Murphy, 2000).
In the telecommunications industry this sort of behaviour is present on mobile telephony markets. While handsets are heavily subsidised and sold at prices below their acquisition costs, mobile phone calls, mobile data services etc. are highly profitable. This means that handsets are cross-subsidised from calls and other mobile services without any predatory intention. Similarly, fixed-line connections and services are complementary products so that cross-subsidies do not necessarily have to reflect anti-competitive behaviour (also see Kruse and Haucap, 2002).

6.5 Alternative Tests of Predatory Pricing

Since below-cost prices do not necessarily result from predatory pricing, it is problematic to use the Areeda-Turner rule to establish predatory pricing. Apart from the issue that prices below costs do not have to be anti-competitive, it is also not clear whether price cuts are necessarily welfare reducing - even if they would serve a predatory purpose.
This criticism has been taken up by a number of economists who have suggested alternative tests. Williamson (1977), for example, has suggested to consider a price cut predatory if there is a significant quantity expansion by the incumbent within the 12 to 18 months following a rival's market entry. This rule would allow for price cuts as long as the established operator does not increase it quantity at the same time. Short-term price cuts to deal with excess capacity or demand fluctuations, for example, would not pose a problem under Williamson's rule, as the established operator would not increase the quantity sold. In contrast, Baumol (1979) has suggested to regard a price cut as predatory only if the entrant is driven off the market *and* the established operator then reverts to the pre-entry price.
All of the three tests discussed so far have the advantage of being relatively simple and, therefore, relatively easy to apply. This, however, is at the same time their weakness. Simple indicators may often be useful to identify predatory pricing, but they are usually not sufficient. The problem, however, is that a detailed analysis of some firm's pricing policy may lead to more accurate results concerning economic efficiency, but only at the cost of taking away the certainty that simple rules of thumb provide for firms and lawyers.
Simple rules run the risk of either punishing competitive behaviour as anti-competitive (type-I-error) or of not preventing anti-competitive behaviour as it is mistakenly regarded as being competitive (type-II-error). The German Monopoly Commission, for example, implicitly assumes that only type-II-errors are to be minimised (see Monopolkommission, 2002, 134). From an institutional economics point of view, however, the expected damages from both type-I- and type-II-errors should be minimised.
A proposal, which incorporates this insight, has been brought forward by Joskow and Klevorick (1979). They argue for a multistage test where it first must be shown that the firm under suspicion has a dominant position on the relevant market. Secondly, it has to be shown that the price charged

is below average cost, before, thirdly, the firm is prevented from rasing that price again for a period of two years.
Even more advanced procedures have been developed by Posner (1976), Scherer (1976), Ordover and Willig (1981)[3] and more recently by Bolton, Brodley and Riordan (2000). While the first three proposals are effectively little else but a rule-of-reason approach, Bolton, Brodley and Riordan (2000) offer a fairly detailed, structured test, which explicitly contains an efficiency defense for below-cost pricing. Thereby, the test takes welfare implications into account, bearing in mind that below-cost prices are not necessarily inefficient in a second-best world.
The approach proposed by Bolton, Brodley and Riordan (2000) consists of five separate points which have to be checked in order to identify a predation strategy: (1) whether predation is possible at all, given market structure and barriers to entry and exit, (2) whether price cuts or other actions that may potentially be predatory have been observed, (3) whether recovery of predation costs is likely, (4) whether the price is lower than the long-run incremental cost for the quantity additionally supplied, and (5), if the first four criteria are met, whether there is a legitimate business reason or efficiency defense for the observed behaviour. While the burden of proof for the first four points should rest with the plaintiff, the accused party has to provide any efficiency defense (point 5).

7 Regulatory and Competition Policy Measures

7.1 General Considerations: Ex-ante vs. Ex-post Control

Given our discussion above, what policy measures are adequate to deal with predatory pricing? As economic theory tells us, there is only a realistic risk of predatory pricing if certain, rather restrictive conditions are met. On telecommunications markets that risk is low, especially since the prices for access to essential inputs are regulated so that market entry is easy and not very costly. Moreover, as it is difficult to identify predatory pricing, there is a risk either that competitive behaviour will be banned (type-I-error) or that predatory pricing is not prevented (type-II-error) if simple rules are applied. A complex approach, however, may lead to uncertainty and lengthy processes with high transactions costs, even though there may be fewer errors. Hence, the question remains how policy should address predatory pricing.
In most jurisdictions predatory pricing is prohibited, even though some proponents of the Chicago School argue that, due to the imperfectness of the legal system, a ban on predatory pricing leads to competition being choked and efficiency losses being created rather than the competitive process being protected (see Lott, 1999).
In most industries and jurisdictions, competition authorities supervise the competitive process (and potential predatory behaviour). In the end, authority is with the courts which decide ex post whether certain behaviour is anti-competitive or not. However, courts do not positively instruct firms what to do and what not to; they only prohibit certain behaviour without automatically prescribing another one. The problem with this type of ex-post control is, apart from the identification problem discussed above, possibly also the delay that is induced by an ex-post control system through competition authorities and the courts.
In contrast, a rather drastic policy to prevent predatory pricing is the current practice to require the incumbent operator to obtain ex-ante approval for any price change. This is current practice on many telecommunications markets. Instead of an ex-post supervision through competition

[3] Posner (1976) suggests to check for three things: (a) whether the price is below long-run average cost, (b) whether the market is highly concentrated, and (c) whether there is a predatory intention. In contrast, Scherer (1976) suggests a rule-of-reason approach that encompasses all relevant economic factors. Ordover and Willig (1981), finally, define a price cut as predatory if the firm under consideration increases its market power. The problem that all of these tests have is the information asymmetry between the accused firm and the courts. The tests reduce the problem's complexity only to a very limited extent and mainly focus on reducing type-I-errors.

authorities, there is ex-ante regulation through a sector specfic regulatory agency for all opeators with a dominant position in a market.
With ex-ante regulation, dominant firms are required to obtain regulatory approval for all price changes. In contrast, with ex-post supervision competition authorities only get involved after the fact. The advantage of ex-ante regulation is that potential anti-competitive behaviour may be prevented before it occurs so that there is no damage to the competitive process. There is no risk that specific investments will be devalued. The disadvantage, however, is that the regulatory agency has to second-guess how competitors might have reacted. The agency cannot observe their market behaviour, but has to assess it before the fact (also see Laffont and Tirole, 1999, 276 ff.). This disadvantage does not apply to ex-post control, as competition authorities can use more market information in this case.
While ex-ante regulation could minimise the number of type-II-errors, it is also over-inclusive and leads to regulatory intervention when none is needed (type-I-error). Hence, ex-ante regulation may stifle competition and cause costs and inefficiencies, which would not exist without regulation.
According to Laffont and Tirole (1999, 276 f.), however, regulation has the advantage of being more timely than supervision through competition authorities. The risk that authorities only react after the threatened firm has left the market and the market has been re-monopolised does not exist with ex-ante regulation, while this risk exists with ex-post supervision. On the other hand, competition is much less spontaneous with ex-ante regulation so that market forces are prevented from unfolding freely. There is a risk that not the most efficient firms will survive, but the best protected ones. In addition, consumers have to wait much longer for price cuts to occur.
Furthermore, if we compare the German cartel office's most recent decision in the predation case *Lufthansa* vs. *Germania*[4] and critical decisisons to be taken by the German telecommunications regulator (RegTP), such as business customers in Berlin or international calls to Turkey and the US, it becomes obvious that the German regulator needs far more time for its decisison than the German competition authority.[5] While this effectively reduces any risk of predation, this comes at the cost of increased prices and stifled competition where one firm is only allowed to respond to other operators' actions and market developments with substantial delay.
Nevertheless one may argue that such an approach may lead to better results if an industry is especially prone to predation. While we have argued that this is unlikely to be true for telecommunications markets, it is useful to analyse whether we can expect to observe predatory pricing once DT is freed from ex-ante regulation of its retail prices.

7.2 Predatory Pricing on Telecommunications Markets in the Future

First of all, its should be noted that predation is a costly strategy for two reasons: Firstly, a price reduction would lead to a large decrease in sales (in monetary terms) because of DT's large call volume (in minutes). And secondly, the reasons lie in consumers' inertia. On the one hand, inertia means that DT's chances to rapidly re-gain market share are small. As price differences tend to be quite small on many telecommunications markets today, a significant consumer reaction can only be expected if DT's price cuts were quite substantial. On the other hand, DT would canibalise itself, as it would sacrifice the profits of its (loyal) customer base, even though these customers would not switch with higher prices. Hence, consumers' inertia increases the cost of predation.
Another question concerns the market structure that may be achieved through predatory pricing (in order to be able to increase prices later). In contrast to many theoretical models and practical

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[4] See the decision made by the German Cartel Office (Bundeskartellamt) on 18 February 2002 (online at: http://www.bundeskartellamt.de/B9-144-01.pdf).
[5] The reason may be that RegTP is not subject to time pressures, as nothing will happen as long as RegTP has not made a decision. In contrast, the Cartel Office has to come to a conclusion while the market developments are unfolding that are potentially to be stopped.

antitrust cases, most telecommunications markets see many operators with different business models and different financial constraints. Hence, it does not suffice to drive one rival off the market. Sporadic market exit of a few operators or mergers would hardly change the overall competitive situation.
Hence, if DT followed an aggressive pricing policy some rivals may actually be driven off the market, but many others would not be. Since some operators are relatively well funded when compared to DT and there appear to be prospects for future profits on many telecommunications markets, it is unlikely that *all* competing operators would leave the market.[6] The chances to achieve a stable collusive oligopoly or even a monopoly appear to be rather low.
The crucial point, however, is that barriers to entry will also be low in the future. Most decisive are not current entry rates or price levels, but prices and profits that firms expect to earn in the future. Only if firms failed to enter even though prices significantly exceeded costs, this would point towards the existence of barriers to entry.
Suppose prices would significantly raise as a consequence of market consolidation or successful predatory pricing. At some price level, firms would find market entry (or re-entry) profitable again. This can be predicted because the cost of market entry is clear and calculable for entrants, as all bottleneck facilities are regulated. Little specific investment is necessary for entry, as capacities can easily be leased and access and interconnection prices are given by regulation. While switching facilities require investment that is specific to the industry, the equipment can easily be sold to other players in the same or other telecommunications markets. Hence, there are little sunk costs associated with market entry.
Some sunk cost may be associated with advertising campaigns. However, advertising is often not even necessary, as several price comparisons are conducted and published in various media and on web pages. The fact that there may be some sunk costs does not prevent firms from entry. This is especially true on the markets for national and international calls.
Hence, the decisive argument against predatory pricing being a rational strategy for DT is that DT would either not be able to increase prices later or the price increase would induce new market entry, as barriers to entry are low.
Finally, it also has to be noted that ex-monopolists such as DT would run the serious risk of being re-regulated should they unexpectedly succeed in re-monoplising the market. The threat of drastic re-regulation may suffice to deter incumbents from using predation strategies (see Miller, 1997).

7.3 Price Squeeze Tests

In order to still deal with the risk of predatory pricing anyhow, a number of regulatory authorities have most recently developed so-called price-squeeze tests. These tests are especially designed for regulated firms who possess an essential facility (see OPTA, 2001; BIPT, 2001; de Ghellinck, 2001).
Price-squeeze tests are used to check whether the difference between the regulated access charge and the final retail price is sufficiently large to allow an *efficient* competitor to earn non-negative profits. As charges for access to essential facilities (such as origination and termination charges) are usually set at long-run incremental cost and it is known what elements need to be used to provide a certain service (e.g., a long distance call), the regulatory authority can calculate whether a certain retail price is below or above the cost covering level.
This method is relatively simple and provides some certainty for all relevant parties such as firms and courts. At the same time long administrative procedures to obtain approval for a price change become redundant. Price-squeeze tests can be used to obtain an *indicator* whether a retail price is above or below cost without necessitating ex-ante control.

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6 Moreover, a firm's capacity is unlikely to disappear, as it will most likely be acquired by some other firm.

However, price-squeeze tests also have their limitations, as they are rather mechanistic. Since these tests are not much else but a standardised version of the Areeda-Turner rule, they will also include low prices that are not predatory. In order to avoid capturing efficient below-cost prices, e.g. because of excess capacity or product introductions, the concerned firm should be given the right to provide an efficiency defense for below-cost pricing as, for example, envisaged by Oftel (2000). Such an approach should be preferable to long ex-ante regulation procedures.

7.4 Baumol's Proposal

An elegant solution to manage predatory pricing risks consists in the approach proposed by Baumol (1979). According to his proposal, a dominant firm may not increase its price again for some time if a previous price cut has driven a rival off the market.[7] The rival's market exit triggers a price ratchet for the incumbent.

The rationale behind this rule is as follows: If a firm, which intends to use predatory pricing in order to drive a competitor off the market, is only allowed to increase its price again much later, a predation strategy becomes more costly and, thereby, less attractive. If, however, a low price is justified by product complementarity or as a normal response to competition, a price ratchet will do little harm, as the new price will not be inefficient if the competitor leaves the market.

However, Baumol's proposal also has its problems, as it may prevent firms from cutting prices even when they are not motivated by predation. This is especially relevant if there is excess capacity (due to additional entry or demand fluctuations). In this case, it can be efficient to set a price below long-run average cost as long as excess capacity exists. Once any excess capacity has vanished, however, prices should be allowed to increase. This in turn would be prevented through a price ratchet under Baumol's proposal.

A similar problem may arise with new product introductions. If a new product is so successful that other products are driven off the market, a problem may arise if the innovative firm is not allowed to increase its price after the introductory period to recover its costs. Dynamic inefficiency can result if the price ratchet effectively prevents firms from introducing new products. Hence, for both excess capacity and new product introductions an efficiency defense would be desirable. However, the accused firm should carry the burden of proof for the efficiency defense in order to economise on information costs.

Baumol's proposal is also attractive because its transactions costs are low, as quantitative information is only required for an efficiency defense. In all other cases, market exit would automatically trigger the price ratchet. Since such a ratchet rule will usually not lead to allocative inefficiencies, it will not only minimise transactions costs, but also minimise welfare losses resulting from type-I- and type-II-errors. What still has to be explored and analysed in more detail though, is the rule's practicality on markets with many firms.

8 Summary and Conclusions

In general we can conclude that predatory pricing is not profitable for firms, as the cost of predation cannot be recovered through additional profits. There are, however, exceptional circumstances under which predatory pricing *can* be a rational strategy. More specifically, for predatory pricing to be rational information asymmetries either on the horizontal level between the firms concerned or in the vertical relationship between firms and capital markets must play an important role. Without information asymmetries, predatory pricing can only be explained in unsatisfatory ways (e.g., by assuming that there are irrational players).

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[7] In principle, other thresholds may serve as trigger as well. The threshold does not necessarily have to be one firm's market exit. On a market with many small firms it appears sensible to define a higher threshold before the price ratchet is triggered.

In contrast, below-cost prices can, in many situations, be explained without reverting to predatory pricing. For this reason it is in practice often difficult to distinguish between predatory pricing and legitimate pricing schemes. While the Areeda-Turner rule offers a simple test, it is not satisfying, as it is over-inclusive. The same is true for price-squeeze tests. The least satisfying method is the strict ex-ante regulation of retail prices through a Government agency as currently practised on many telecommunications markets in Germany.

An alternative proposal has been brought forward by Baumol (1979). According to his proposal an artificial price ratchet is used to lock in price cuts for some period of time if these price cuts have driven competitors off the market. This approach should be augmented by an efficiency defense, however, so that efficient price cuts are not unduely prevented.

This augmented rule is adequate to deal with predatory pricing also on telecommunications marktes, the risk of which is low in any case. The experience in Germany to date supports this conclusion. Therefore, a rule that focuses on type-I-errors and does not classify competitive behaviour as anti-competitive is adequate, as predatory pricing will be rather rare on telecommunications marktes (and thereby also the risk of type-II-errors).

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