



Termination fees revisited[☆]

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ABSTRACT

We reconsider the question of the optimal level of termination fees between communication networks in the context of heterogeneous usage and elastic participation. The interaction between these two features yields new insights; in our model: i) The profit maximizing reciprocal termination fee is above marginal cost; ii) the welfare maximizing termination fee is also above cost; iii) the welfare-maximizing termination fee is below the profit-maximizing one in the absence of termination-based price discrimination, but can be above it otherwise.

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1. Introduction

In most communication networks, users expect to be able to interact regardless of which network they subscribe to. To achieve this, operators enter into interconnection agreements, which not only cover technical aspects, but also stipulate access fees compensating the terminating network for the cost of communications originated from another network. These so-called termination fees have been the center of many investigations, and the question of the privately and socially optimal levels of those fees is still hotly debated in many communication industries (fixed and mobile telephony, Internet ...). In this paper we revisit this question by considering the impact of heterogeneous demands for both calls and subscriptions. We show that, when the consumers who call less have also a more elastic demand for subscription¹:

- i) The profit-maximizing reciprocal termination fee is above the marginal cost of termination;
- ii) The welfare-maximizing reciprocal termination fee is also above cost, but below the profit-maximizing level;
- iii) The welfare-maximizing termination fee is below the profit-maximizing one in the absence of termination-based price discrimination, but can be above it otherwise.

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¹ In France, the arrival of a fourth operator, targeting small users, triggered within a quarter a net expansion of more than 1.8 million users.

A key element of our analysis is the negative correlation between the traffic originated and the elasticity of participation, a feature that is present in many networks. A good illustration is mobile telephony, which exhibits a considerable heterogeneity in usage patterns. This heterogeneity is reflected to some extent in the large variety of post-paid contracts targeting different customer categories, as well as in the differences between pre-paid and post-paid users. It is a source of traffic imbalance at the customer level, since some customers call more than they receive while others receive more than they call. Genakos and Valletti (2011b) note for example that "anecdotal evidence seems to suggest [...] that pre-paid consumers predominantly use their phone for incoming calls". Another illustration of the difference between pre-paid and post-paid clients is given by a change in the collection of data on mobile traffic by the French regulator that occurred during the year 2005.² During the first semester (Q1 and Q2 in Table 1 below), volumes included the minutes of calls emitted, along with fixed-to-mobile termination and roaming. Afterwards, the volumes also included the number of minutes of off-net mobile-to-mobile calls received. Using these data, for each quarter of 2005 we computed average volumes for pre-paid and post-paid customers.

The data from the first two quarters confirm that pre-paid customers call much less than post-paid ones. But the difference between the third and second quarters,³ representing the volume of calls received from other mobile networks, also shows that the ratio of calls received from

² France moved away from bill-and-keep for mobile-to-mobile termination fees in January 1, 2005. The regulatory regime was thus stable throughout 2005, but the change in the statistics published by the *Observatoire des mobiles* was only introduced in the third quarter.

³ Using the first two quarters to account for dynamic trends does not affect the 5% and 30% figures for post-pay and pre-pay.

Table 1
Mobile traffic (France 2005).

Volume per subscriber 2005 (min)	Q1	Q2	Q3	Q4	Q3/Q2
Post-pay	786	798	837	867	+5%
Pre-pay	156	159	205	201	+30%

other mobile networks, to calls emitted (along with fixed termination and roaming), is 6 times higher for pre-paid customers. Hence, unless receiving patterns are highly asymmetric,⁴ pre-paid customers receive relatively more calls than they emit, compared with post-pay customers.

Other examples include the Internet, since most of the traffic originates from websites but the extensive margin of the market includes many content users, and the convergence between fixed and mobile services, as fixed line customers still call more mobile customers than the reverse.

Our paper is concerned with termination fees between networks that are active on all segments of the market, a situation that is often referred to as a two-way access problem. When callers and receivers do not belong to the same network, a network terminating a communication enjoys market power as it can hardly be bypassed and the receiving customer is not necessarily sensitive to the price paid by those who call him. One of the main conclusions of the existing literature on termination fees is that network operators should collectively favor low fees, which is somewhat at odds with the observation that, in practice, network operators often resist reducing those fees. We aim at reconciling theory and practice and show why firms may favor above cost termination fees. We show that the socially optimal fee is also above cost.

Formally, we use the framework of Laffont et al. (1998a) – hereafter LRT – in which we introduce user heterogeneity – and also account for the utility of receiving calls. Our model is based on the above observation that the willingness to pay for a subscription is related to the volume of calls. Customers with very large volumes of calls are infra-marginal customers, who may switch between operators when prices increase but always subscribe to an operator; marginal customers are instead those who also call less. We thus distinguish two types of customers: heavy and light users; the latter not only call less often, but their demand for subscription is also more elastic.

To keep things simple, we assume the following:

- Light users only receive calls⁵; we moreover first consider a benchmark model where their utility from receiving calls is fixed; later on, we account for endogenous reception utility;
- Network operators can offer different two-part tariffs, each including a subscription fee and a unit price for calls, to heavy and light users; later on, we also allow the operators to charge different prices for on-net and off-net calls (termination-based price discrimination).

In each situation, we analyze the impact of reciprocal termination fees on subscription and usage prices, as well as on profits and welfare. In equilibrium, usage prices are equal to perceived costs and there is no profit from origination; network operators' profit is thus driven by termination profit and by subscription fees. We identify two new effects:

Raising termination profit weakens the competition for heavy users: introducing light users reduces competition for heavy users when the termination fee is above cost, since the operators then obtain more profit from terminating off-net calls than on-net calls; losing a heavy user to the competitor thus raises the termination profit on light users – without generating an equivalent cost, as light users call less than they are called.

Raising termination profit intensifies the competition for light users: since light users generate a positive termination balance, they become more profitable when the termination mark-up increases; retail competition thus becomes more intense, which results into lower equilibrium prices. In our setting this “waterbed” effect⁶ is however modified, due to the fact that losing light users to the competing network generates a termination deficit, since light users are mainly receivers; this additional cost further intensifies competition for light users.

In the case of uniform pricing, the former effect dominates for profit while the latter dominates for welfare. As a result, both profit and welfare are maximal for termination fees that are above cost. The operators prefer a positive mark-up because the extra revenue from termination by heavy users is not fully competed away through subscription fees. Adopting a positive termination mark-up also increases welfare because it generates a market expansion that benefits all customers – in contrast, in the absence of any scope for demand expansion, welfare would be maximized for cost-based termination fees. A conflict arises, however, since network operators favor excessively high termination fees.

When on-net pricing is allowed, the market exhibits tariff-mediated network effects: with a positive termination mark-up, the off-net price is above the on-net price so a customer is better off joining a larger network; these network effects in turn intensify competition, as pointed out by Laffont et al. (1998b) and Gans and King (2001). In our setting, while network effects mostly concern heavy users, the operators compete more fiercely for both heavy and light users, and we show that welfare is still maximized for a termination rate that lies above cost; the operators also prefer an above-cost termination fee when the size of the demand from light users is not too small.

Finally, we extend the analysis by allowing users' utility to vary with the volume of calls received. We first show that the usage price is distorted downward, so as to generate more calls, more utility and thus higher revenues for the firms. We then calibrate the model on French data and show, by way of numerical simulations, that the main insights – profit-maximizing and welfare-maximizing termination fees are above cost – remain valid.

Starting with the work of Armstrong (1998) and Laffont et al. (1998a,b), a body of literature has analyzed the role of termination fees in industries with two-way access.⁷ In particular, LRT found that the termination fee had no effect on equilibrium profits when networks compete in two-part tariffs and subscription demand is inelastic, a result extended to heterogeneous calling patterns by Dessein (2003) and Hahn (2004). Subsequent work suggests that network operators should favor *below-cost* termination fees: see e.g. Gans and King (2001) for competition in two-part tariffs with termination-based price discrimination, Berger (2004, 2005) taking into account call externalities,⁸ or Dessein (2003, 2004) for, respectively, elastic but homogeneous demand and heterogeneous but inelastic demand. This paper shows that allowing instead for both heterogeneity and elastic demand drastically changes the previous conclusion, leading to above-cost private and social optimal termination fees.

DeGraba (2004) and Hermalin and Katz (2010) compare different interconnection pricing schemes when operators can charge both callers and receivers⁹; they focus on the role of cost sharing in achieving optimal usage while we focus on participation. Atkinson and Barnekov (2000) consider instead the allocation of investment costs in a setting where usage demand is fixed.

⁴ The conclusion holds as long as the proportion of off-net calls, within all incoming calls, is less than 6 times higher for pre-pay than for post-pay customers (holding constant the weight of fixed to mobile calls and roaming).

⁵ In our 2010 working paper (Jullien et al. (2010)), we show that our results extend to the case where light users have a small demand for calls.

⁶ The term was coined by Paul Geroski. See Schiff (2008) for a formal analysis.

⁷ See Armstrong (2002) for an overview of this literature.

⁸ Note that adding constraints on two-part tariffs, such as participation constraints as in Poletti and Wright (2004), may lead to non-neutrality.

⁹ Bolt and Tieman (2006) discuss the conflict between social efficiency and cost recovery in this context.

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