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Patching up the waterbed

PRICING AND PROFITS IN THE MOBILE TELEPHONY MARKET

In the past few years, European regulators have been grappling with the problem of constraining the excess profits they fear that mobile networks can earn from charges for connecting calls levied on fixed-line operators and other mobile companies. The vivid image of the “waterbed” illustrates the argument that pushing down one set of charges would only result in a price bulge elsewhere. To discover why and when this may be the case however requires rigorous modelling of the relationship between pricing behaviour and the intensity of competition in these markets.

Identifying the best pricing regimes in telecoms markets is an extraordinarily difficult task. Regulators are looking to maximise social welfare, while operators are seeking to generate profits and gain competitive advantage over their rivals. The regulatory task is complicated by the prevalence of multi-part tariffs; subscription charges; and many differences in call rates - between peak and off-peak, customers of different networks and mobile and fixed lines.



Then there are the extensive complications present in a market rife with externalities: both network externalities, which increase the value of the services to existing users when new users join the network; and call externalities, which mean that phone users get value from receiving calls without (in Europe at least) paying anything to do so. Furthermore, because of scarcity of spectrum and fixed costs in the provision of phone networks, the market – at least at the wholesale network level – falls short of the textbook benchmark of perfect competition.

Understanding the true effect of imperfect competition on the profits of mobile operators has however proved challenging to the regulators. The argument over the “waterbed effect” illustrates the extent to which an intuitive approach can lead to mistaken conclusions.

The term “waterbed” was introduced to the regulatory vocabulary in 2003 by the Competition Commission’s report on UK mobile access charges. This graphic term was used to refer to the relationship between the level of mobile operators’ access charges and the level of their subscription and call charges. Implicit in this concept was acceptance of the notion that you pushed access charges down, prices would push up somewhere else.

The concept of the waterbed has now been adopted by many other European regulators seeking to implement the new EU framework. But however intuitively attractive this approach, simple rules of thumb based on the waterbed concept are no substitute for formal theoretical frameworks and rigorous analysis of market dynamics. As we will show, reality turns out to be much more complex than regulators have so far acknowledged. The implications may be precisely the opposite of what regulators are currently assuming to be the way to set optimal access charges.

WHAT GOES DOWN...

When faced with the complaint that fixed-to-mobile (F2M) access charges were too high, the mobile operators argued that consumers were not harmed: even if access charges were set above the cost of access, any profits the operators made from access would be competed away in lower handset prices and subscription charges. Hence, if regulators were to reduce F2M access charges, the only consequence would be higher charges elsewhere.

However, the commission – although it bought into the concept – did not think the “waterbed effect” could be relied on to work perfectly. The mobile operators’ own arguments, the commission noted, demonstrated that the retail mobile market was not perfectly competitive because of the limited number of licensed networks and the presence of fixed costs.

If competition in the mobile retail market was imperfect, there was no reason to expect operators to return all profit from mobile termination in lower charges elsewhere. In other words, the waterbed effect would be less than 100%. Some proportion of an increase in access charges would be retained as profit. To prevent this happening, the commission argued, access charges should be set lower than would be necessary if the retail market were perfectly competitive.

The commission’s argument appeals both to common sense and to our basic understanding of the workings of imperfectly competitive markets. We all know that in such markets, firms tend to make some degree of excess profit. Where the commission went wrong was in confusing the levels of charges with changes in them. (That is like mixing up the level of the consumer price index with the rate of inflation, which would equally confuse monetary policy-making.)

Imperfect retail competition between mobile operators may generate profits above the competitive level (which incidentally may, in practice, be more or less entirely absorbed by the high fixed costs of mobile provision). However, this does not mean that a change in access charges will change the level of profits.

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Indeed, there is no intuitive reason to believe that it would. Assuming that the level of profits earned by mobile operators is inversely related to the intensity of competition between them (perfect competition eroding all profit, in the economic sense of that word), the key question is: will an increase in access charges reduce competition? If not, then profits will not depend on the level of such charges; and the waterbed may well be 100% effective.

In order to answer this key question properly, we cannot rely on mere generalisations. Instead, what is needed is a formal model of competition between mobile operators, which can be used to test the relationship between the level of access charges and the intensity of competition. Fortunately there is a well-established model, commonly used by economists to capture the dynamic effects of competition in mobile markets, which is called the “differentiated Bertrand” model, which is also described in the companion Frontier bulletin, *Call a friend?*

MODEL BEHAVIOUR

In this model it is assumed, for simplicity, that customers are distributed along a line, with the competing networks located at either end. The networks compete for customers by offering prices intended to maximise the welfare that customers would get from subscribing to their network. Customers choose the network that they believe offers them the greatest welfare - taking into account a search cost that, other things being equal, makes them favour the closest to them on the line.

In running the model, the degree of differentiation between networks can be controlled by adjusting the size of the search cost parameter. The higher the search cost, the more “differentiated” the networks, and the less the intensity of competition.

The other important concept used in such models is the “Nash equilibrium”. The key assumption here is that networks independently choose prices that will maximise their profits, given the prices charged by the other networks. The equilibrium is the situation in which none of the competing networks wish to change their prices.

The use of these models demonstrates that, as we would expect, there is a tendency for mobile networks to push up access charges, in pursuit of a Nash equilibrium. Left to its own devices, a mobile network would raise its F2M access charge, because it could use the profits from this to entice customers away from a rival network; and it would raise the mobile-to-mobile (M2M) access charge to its rival simply to increase that rival’s costs. It would have to act in such a way, because if it did not, its rival would.

However, even if the pursuit of a Nash equilibrium forces operators to set high access charges, this does not necessarily mean that profits are higher. For that to be the case, as we have shown, raising access charges would have to reduce the intensity of competition between operators. Use of these models demonstrates that the link between the intensity of competition and access charges is complex, and depends on the structure of retail prices.

Using these models it is easy to show that changes in F2M access charges do not affect the equilibrium level of profits earned by mobile firms: an increase in F2M charges increases profits from F2M calls but the volume of outbound calls by mobile customers is unaffected, because outbound prices have not changed. Thus, the value to the networks operator of each mobile customer increases by an amount exactly equal to the extra profit generated from F2M calls. The mobile companies compete away all of this profit in lower subscriptions in order to keep their customers. These models therefore show that, as regards F2M access charges, the waterbed is always 100% effective, regardless of the degree of competition between networks.

And that is, in practice, how networks behave. They compete using a bundle of prices, including call charges, handset prices and monthly subscriptions. Moreover, they almost always distinguish between on-net and off-net call charges as well. This pattern of competition has consequences that may seem perverse. In pursuit of a

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Nash equilibrium, networks are driven to raise M2M access charges; but the result is to reduce total profits, not increase them¹. As in the classic prisoners' dilemma, when acting independently the networks are driven to act in a way that will earn them lower profits than they could achieve if it were possible for them to collude.

The intuition behind this finding is that, as M2M access charges increase, the value to each network of stealing others' customers also increases dramatically, so as to avoid the cost of access charges. Hence increased M2M access charges greatly intensify inter-network competition.

CONCLUSION

These brief illustrations demonstrate that once we start to model competition between networks rigorously, the commission's commonsense approach unravels. Indeed, far from being obvious that if the retail market is imperfectly competitive mobile operators must pocket some proportion of excess access charges, we find that the opposite may be true.

Higher access charges will tend to intensify competition between operators, and so to reduce profits and increase consumer surplus. Conversely, consumers may actually lose out from an imposed reduction in access charges, if prices in the mobile sector end up higher overall. In the commission's terms, this may mean that the waterbed is actually more than 100% effective: a dent in one charge may lead to an uncomfortably large bulge elsewhere.

** This bulletin summarises one of the issues relating to mobile access charges addressed in the paper by Dan Elliott "Two-way access charges and on-net/off-net differentials", presented to the IDEI conference on Electronic Communications in Toulouse, October 15-16, 2004.*

SOURCE	1. See Gans, J.S & King, S.P. (2000), "Using 'Bill and Keep' Interconnection Arrangements to Soften Network Competition".
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