Mobile licences: how many to grant?

In these recessionary times, with tax revenues plummeting, governments are under pressure to find alternative sources of income. One potential gold mine is to be found in licensing another mobile network operator. This has proved a popular and lucrative approach in the past, and several governments are now looking to replicate this success through granting new licences, in particular for 3G services.

The lazy regulator may simply acquiesce: "what's the harm?". Not only would the government obtain additional tax revenues, but a new entrant may disturb the rather too cosy relationships that often seem to exist between players in mobile markets. The additional competition created by a new and vibrant market entrant may help to bring prices down, improve service innovation and generally cause the mobile industry to lift its game. Compared with this the downsides seem negligible: in the worst case an entrant may struggle and in a few years be acquired by one of the existing players. There seems nothing to lose.

A more sophisticated regulator will want to understand the dynamics of competition, and seek evidence for whether an extra player will bring greater costs or greater benefits to consumers and the overall economy. In other words: what is the optimum number of mobile network operators?

Sunrise Consultants and Incyte Consulting have recently analysed this question as part of an assignment for a national regulatory authority in sub-Saharan Africa. This paper provides an overview of our findings.

The more the merrier

The principal reason for licensing new mobile network operators is to increase the level of competition in the market. In most product and service markets there is no limit to the number of potential entrants, and the mere possibility of a new competitor coming to market acts to keep the existing players on their toes, keeping prices down and service variety and quality up. With mobile communications networks such perfect market conditions do not exist because there are two substantial barriers to market entry: the high fixed costs of building a network and the limited availability of radio spectrum. These barriers to entry mean that it is not always possible to license a new operator, either because there is insufficient spectrum available or because the high network costs deter bids from potential licensees.

Subject to these constraints, there is an argument for licensing as many network operators. So, for example, if there are 100MHz of available spectrum and each operator requires 10MHz then 10 licences may be offered. The actual number of licences granted will depend on the number of acceptable bids received but, the argument goes, every acceptable bid up to and including the tenth should be granted a licence.

Of course, the economic benefit derived from each additional licence is likely to be less than the previous one. This is because the boost to competition becomes progressively less for each additional new entrant. However, there is always some marginal benefit from an additional licensee, and hence it could be argued that "the more the merrier" is the right approach to licensing policy.

In a recent study, Ofcom examined the economic effects of different numbers of mobile operators in the UK. The model shows that a reduction in the number of operators results in a loss of consumer surplus (resulting from a loss of output) and an increase of producer surplus (resulting from an increase in profit). Ofcom then added the changes in consumer surplus and producer surplus in order to calculate the overall welfare effect. Figure 1 shows the output from the model. While an increase in the number of operators does produce an overall benefit, the value of the benefit of an additional operator diminishes with the number of operators in the market. An increase in the number of operators from 3 to 4 produces an overall benefit of GBP 2 billion over 20 years. This value is halved if the number rises from 4 to 5, and halved again for an increase from 5 to 6.

Figure 1: Benefits of increasing numbers of mobile operators (Ofcom assessment)
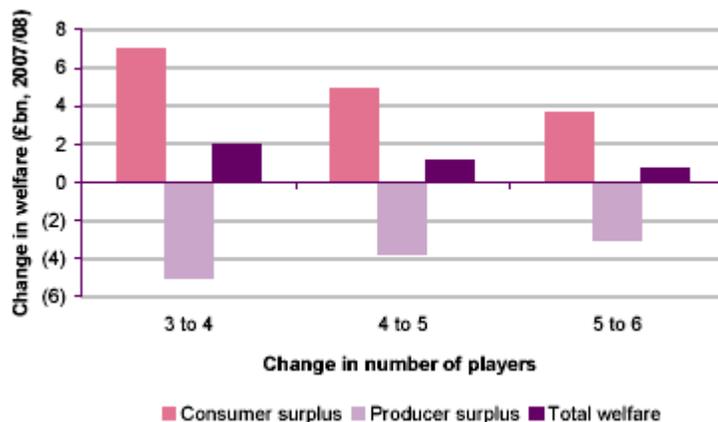
Source: Ofcom Application of spectrum liberalisation and trading to the mobile sector. September 2007. Annex 10, Economic welfare aspects of spectrum liberalisation, page 272..

The fewer the better

An alternative argument focuses on the total costs of service provision, and concludes precisely the opposite: the fewer mobile network operators the better. A mobile network has high fixed costs. Irrespective of the number of customers, a mobile operator has to deploy a network of masts and antennae, with supporting power and road access, a backhaul and transmission network, along with switches and routers, and extensive computer hardware and software to support billing, customer service and operational systems. It also needs to employ management, network maintenance, customer care, and support staff. Most of these have to be in place before the commercial launch. As the number of customers and traffic grows, additional network capacity, sales staff and

customer support staff may be necessary, but a high proportion of costs are independent of the size for the customer base.

Each additional operator has to make similar investments, although the costs can be reduced by national roaming arrangements, the sharing of mast sites, transmission networks, or the radio access network (such as with mobile virtual network operators). Otherwise each additional mobile operator has to invest in a new network, and hence the total costs of mobile provision that have to be recovered from retail customers increase in direct proportion to the number of mobile operators.

We illustrate the effect of these additional costs in Figure 2. We have taken a proprietary long run incremental cost model developed by Incyte Consulting, and assumed that the market is shared equally among the mobile operators in the country. Hence if there is one mobile operator, it has a market share of 100%; if there are seven, they each have a market share of around 14%. We have made the assumption that each of the operators operates efficiently, with the only cost variations between them being related to the scale of their operations. We have calculated the additional costs per minute for a market with different numbers of operators, ranging from one to seven. In the graph below, the cost per minute in a market with one operator is shown as 100%.

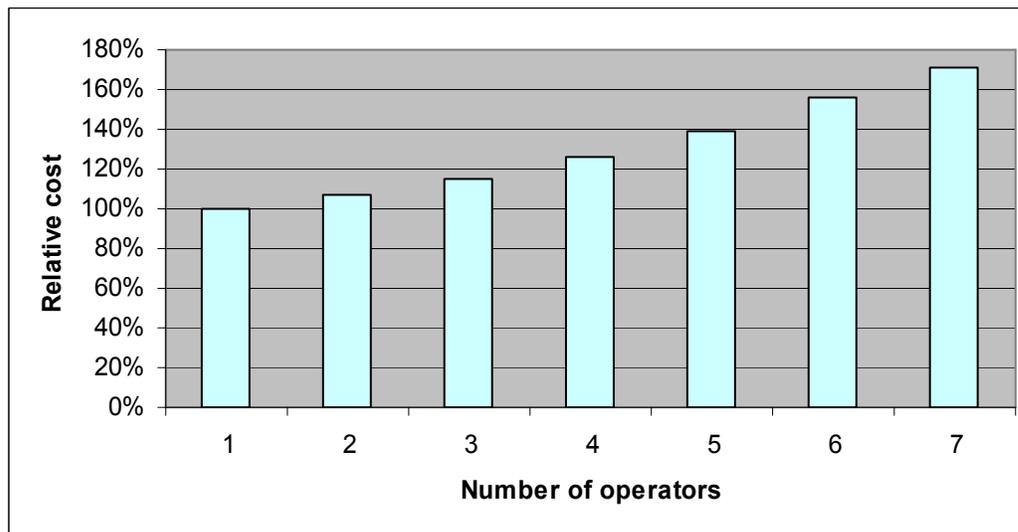*Figure 2: Costs of increasing numbers of mobile operators*

Figure 2 shows that average unit costs increase as more operators come into the market. This is because each operator has fewer customers from whom it can recover its fixed costs. These costs have to be recovered from customers through higher retail prices.

Enough is enough

The two arguments presented above may be synchronised by comparing the relative costs and benefits of additional mobile operators. To start, let us designate the additional costs of the first mobile competitor as C, and the competitive benefits provided by this operator

as B. The next mobile operator (the third in total) will result in additional costs of 1.08C (according to the cost analysis described above), but the benefits will be reduced to 0.5B (according to the benefits analysis described above). In the next figure we show how this relationship develops for additional operators.

Figure 3: Relative costs and benefits of additional mobile operators

Number of mobile operators	Incremental benefits of competition from introducing the last operator	Incremental costs of competition from introducing the last operator
2	B	C
3	0.5B	1.08C
4	0.25B	1.15C
5	0.125B	1.30C
6	0.0625B	1.46C

This table assumes that at each stage the market shares of individual operators are the same, and that each operator is efficient. The point at which the costs exceed the benefits depends on the relationship between the values assigned to the costs and benefits. If, for example, the costs of the first mobile operator are only 80% of the benefits, the point at which the costs exceed the benefits will come with fewer additional operators than if the benefits are (say) 50% of the costs. We illustrate this relationship in Table 4, which sets out the point of cross over according to the different proportions of costs and benefits.

Figure 4: The optimum number of mobile operators

| Number of mobile operators	Incremental benefits of competition from introducing the last operator[1]	Incremental costs , assuming ratio of costs/benefits =				
		80%	60%	40%	20%	10%
2	100	80	60	40	20	10
3	50	86	65	43	22	11
4	25	94	71	47	24	12
5	12.5	104	78	52	26	13
6	6.25	117	88	58	29	15
Optimum number of mobile operators		2	2	3	4	4

In the last line we show the number of operators at which the incremental costs exceed the incremental benefits. Even when the starting costs are only 10% of the benefits provided by mobile telecommunications, the optimum number of operators is four.

The power of four

From this analysis our hypothesis is that the optimum number of mobile network operators in any country is likely to be no more than four. We tested this hypothesis in a number of ways. Firstly, using accounting data from the operators in an African country,

we estimated the trends in consumer surplus (the benefits gained by consumers from reductions in retail prices) and producer surplus (the operators' profits) as more mobile network operators have launched, and compared these with total industry costs (operating costs plus a return on capital). Secondly, we took anecdotal evidence from stakeholders in the industry, many of whom are predicting some industry consolidation in the near future. Thirdly we compiled a chart of experience in Africa and Europe as shown in Figure 5. This shows that out of 84 countries in Africa and Europe, only 13 have more than four operators.

Figure 5: Number of mobile operators by country

Source: GSM Association http://www.gsmworld.com/roaming/gsminfo/
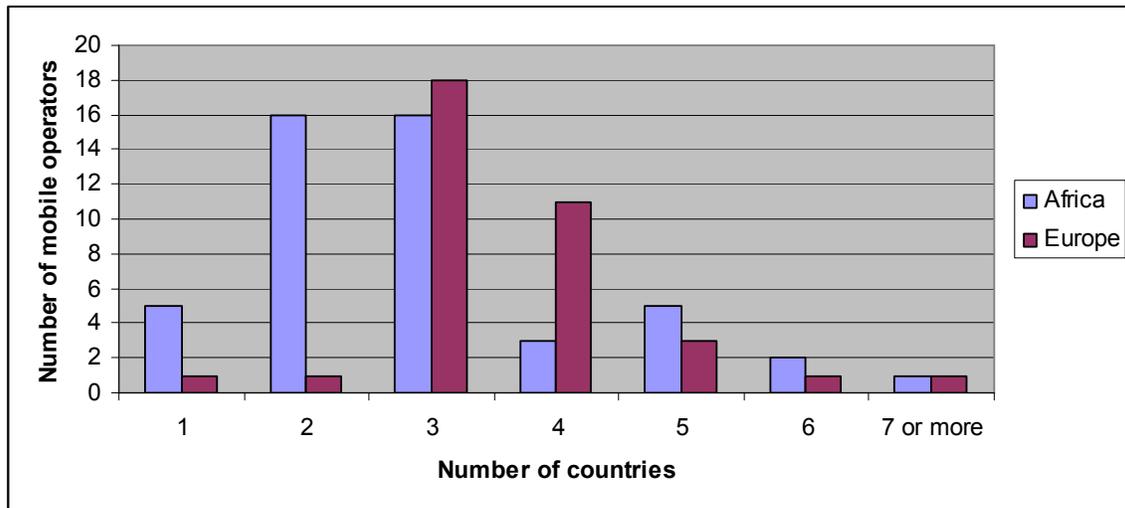
None of these approaches is definitive. Nevertheless, they all point to an optimum number of mobile operators that is somewhere between 3 and 6. Particularly in smaller countries, or those with lower GDP (and hence likely teledensity) or/and lower population density or/and lower urbanization, the optimum number will be towards the lower end of this scale. If regulators and governments are looking for a rule of thumb, they may be well advised to stick to the power of four. Any more than four mobile network operators runs the risk of reduced economic welfare with higher prices for consumers… and ultimately lower tax revenues from the industry as well.

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