Mobile Virtual Network Operators: Beyond the Hyperbolae

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Abstract: In this article, we discuss several aspects related to the entry of mobile virtual network operators. Some aspects, such as entry barriers and exclusionary practices, relate to the entry process itself. Other aspects, such as prices or the characteristics of the entrant's product, relate to the consequences of the entry process.

1 Introduction

The diffusion of mobile telephony has been very fast. In the EU, in 2005, 426 million people, almost 93% of the population, had mobile telephones, whereas in 1998 only 18% of the population had a mobile telephone.[1] Although the market is maturing and the number of subscribers is stabilizing, new service providers, defined broadly, continue to enter the market. In the EU, between 2004 and 2005, the number of service providers increased from 166 to 214.[2] Value added 3G services and personalized services are becoming increasingly important. About five years ago, a particular type of mobile telephony firms was launched in the UK, Sweden and Finland: mobile virtual network operators.

In this article, we discuss briefly, and in non-technical terms, some aspects related to the entry of mobile virtual network operators. These aspects range from issues related to the entry process itself, such as barriers to entry and exclusionary practices, to the effects of entry on prices and product differentiation.

The article is organized as follows. Section 2 presents some useful definitions. Section 3 discusses entry barriers and describes the role of mobile virtual network operators. Section 4 discusses exclusionary practices. Section 5 analyses the impact on prices of the entry of mobile virtual network operators. Section 6 discusses the choice of product characteristics by mobile virtual network operators. Finally, section 7 concludes. Sections 4 and 5 are based on Brito and Pereira (2006a) and section 6 is based on Brito and Pereira (2006b).

[1] Source: 11th Report on the Implementation of the Telecommunications Regulatory Package, 2005, European Commission.

[2] Source: 11th Report on the Implementation of the Telecommunications Regulatory Package, 2005, European Commission. There is some of heterogeneity across the EU, ranging from the UK, with more than 50 service providers, to Cyprus, Malta and Slovakia with only two *GSM* network operators.

2 Basic Concepts

A *Mobile Network Operator, MNO,* is a firm that owns a public mobile telephony network.

A *Service Provider, SP*, is a firm that resells minutes purchased from an *MNO*.

A *Mobile Virtual Network Operator, MVNO,* is a firm that offers mobile telephony services without holding a license to use the radio-electric spectrum, and therefore without a mobile radio access network, but that issues its own branded SIM-cards, has its own unique mobile network code, and operates a physical network infrastructure comprising as a minimum: **(i)** a mobile switching centre, **(ii)** a home location register, and **(iii)** an authentication centre.[3] An *MVNO* my also have: **(i)** an Equipment Identity Register and associated signaling capabilities, and **(ii)** an Intelligent Network platform to provide its customers with its own value-added services. This definition is sometimes referred to as that of a full *MVNO*. However, there is no universally accepted definition, and the term *MVNO* is used to designate firms that range from a *SP* to a full *MVNO*.

There are significant differences in fixed costs and level of autonomy from the host between, a full *MVNO* and a *SP* or thin *MVNO*.[4] A full *MVNO* owns a comprehensive mobile telephony network. This implies that, compared with a *SP*, it has both higher fixed costs, and more autonomy from the host in the design of products, in the definition of price plans, and in the introduction of new services.

Fixed costs and level of autonomy from the host are complements. Since it has high fixed costs, a full *MVNO* needs a large customer base to benefit from economies of scale. Consequently, it needs to target broad market segments. To do so, a full *MVNO*

[3] A *radio access network* consists of: the masts, the base stations and the frequencies. Access to the radio access network requires, at least, roaming privileges. *Roaming* is the ability of a customer of a mobile telephony firm to use its handset to automatically access service from another *MNO*.
[4] A *host* is an *MNO* that gives access to its network to an *MVNO*.

needs to have considerable autonomy from the host. On the contrary, because it has small fixed costs, a *SP* can afford to target only niche market segments, for which no considerable autonomy is required.[5]

Since it needs to target broad market segments, the entry of a full *MVNO* may have a significant impact in the retail market, which may threaten the host *MNO*. On the contrary, because a *SP* can afford to target only niche market segments, entry by an *SP* may be welcomed by the host *MNO*. Hosting a *SP* can be a way of earning revenue from excess capacity, without increasing competition significantly.

From here on, when we refer to an *MVNO* we mean a full *MVNO*.

3 Entry Barriers and the Role of Mobile Virtual Network Operators

To operate a mobile network a firm has to be licensed to use the radio-electric spectrum. Since spectrum is scarce, this means that only a few firms will be licensed. The large investments required to deploy a mobile telephony network limit the number of *MNO*s that the market can accommodate. In addition, consumer inertia under the form of switching costs, network effects, or brand effects, makes entry difficult. This is particularly true now that mobile telephony markets are reaching their saturation levels, as illustrated by Table 1.

[Table 1]

The relative importance of the various entry barriers is unclear. However, there is at least a natural concern that the number of licensed firms may be smaller than the number of firms that would emerge in free entry equilibrium, in particular because mobile telephony markets are typically very concentrated, as illustrated in Table 2.

[Table 2]

[5] Examples of these are the firms targeting the ethnic minorities.

The entry of *SP*s, or any other type of firms that offers a limited range of services, can help promote competition, at least in some dimensions like price. However, to the extent that these firms have no autonomy from their hosts in terms of pricing policies, cannot replicate the full range of services offered by *MNO*s, or cannot develop new innovative services, their ability to compete with *MNO*s is limited.

In this regard, *MVNO*s are fundamentally different. *MVNO*s make possible the entry of firms that offer consumers a portfolio of services indistinguishable from those provided by *MNO*s, without requiring the allocation of additional radio-electric spectrum. *MVNO*s allow attaining a free entry equilibrium.

4 Exclusionary Practices

4.1 Market Foreclosure

In order to operate, an *MVNO* needs to obtain access to the radio access network of an *MNO*. The host and the entrant negotiate over several dimensions, such as the prices of origination and termination traffic, the elements of the host's network that the entrant will hire, and the capacity that the entrant expects to use. Typically, a contract between a host and an entrant involves non-linear price schedules, with payments flowing in both directions. The entrant might be compensated by the host: if it brings new customers to the network, if it increases the total network traffic, or, if it makes the use of the network more evenly divided throughout the day.

In principle, both parties can negotiate freely a mutually beneficial agreement, whereby the *MNO* concedes access to its network to the *MVNO*.[6] However, some wonder whether *MNO*s will voluntarily negotiate agreements with *MVNO*s, since the services the latter provide compete with the *MNO*s' own retail services. The regulation on *MVNO*s varies greatly across the EU. In countries like Denmark, Norway or the

[6] Typically, each *MVNO* buys access from only one *MNO*, although an *MNO* may sell access to several *MVNO*s.

Netherlands, *MNO*s with significant market power have open access obligations towards *MVNO*s. In other countries there are no such regulatory obligations.

The literature on market foreclosure addresses the question of whether a vertically integrated firm can increase its profit by foreclosing the downstream market to rivals.[7] As it is well known, the monopolist owner of a bottleneck production factor, which is also present in the downstream retail market, may have the incentive and the ability to restrict access to the bottleneck production factor, in order to restrict competition in the downstream retail market.[8] An example of this is a monopolist owner of a public switched telephone network, which may want to restrict access to its local loop, in order to restrict competition on the markets of fixed telephony or broadband access to the Internet.

In mobile telephony, because *MNO*s are not monopolist providers of a network, there are at least three reasons to suspect that *MNO*s have different incentives than fixed telephony incumbents, with respect to giving access to their networks. First, even if an *MNO* denies access to its network to an entrant, there is no guarantee that the entrant will not obtain access elsewhere. Second, an *MNO* that hosts an *MVNO* shares with other *MNO*s the revenue loss caused by an entrant. This mitigates the negative impact that entry may have on the revenues of the host *MNO*. Third, if entry cannot be blocked, then it is probably better for each *MNO* to be the one that gives access to the entrant. This allows the host *MNO* to earn additional wholesale revenues that at least partially compensate the loss in retail revenues caused by the entrant. Altogether, this suggests that *MNO*s may face a prisoners' dilemma. They would be better off if entry did not

[7] The case in which the upstream market is monopolized was reviewed by Tirole (1988), pp. 193-4. The case of oligopolistic vertical integration with an oligopolistic upstream market was analyzed by Ordover et al. (1990).

[8] See, e.g., Baumol and Sidak (1994), Biglaiser and DeGraba (2001), Economides (1998), Krattenmaker and Salop (1986), Sibley and Weisman (1998) or Weisman (2001). For a dissenting view see Bork (1954).

occur. However, individually, each has incentives to rush to be the one who gives access to the entrant.[9] This does not mean that such voluntary agreements should necessarily occur. Incumbents may still non-cooperatively foreclose the market, or may collude to foreclose the market.

4.2 Raising Rival's Costs

Once entry occurs, perhaps due to open access regulation, an upstream monopolist that participates in the downstream market may try the raise the costs of the downstream rivals, for instance by discriminatory quality degradation. By doing so it might induce the downstream rivals to contract their market share, leaving a larger share of downstream oligopoly profits for its downstream subsidiary.[10] In the case of *MVNO*s, the possibility of quality degradation may be mitigated by the competition between host *MNO*s. The host following a raising rival's costs strategy should consider that the entrant has other alternatives. To the extent that if entry occurs it is better to be the host, the other *MNO*s will be eager to take his place. Hence, competition between possible hosts should ensure a high quality access service.

5 Impact of Entry on Prices

Entry by an *MVNO* differs from entry by an *MNO*. An *MVNO* is simultaneously a rival and a customer of the host *MNO*. This affects the host's pricing strategy.

We make the helpful simplifying assumption that the host *MNO* is paid a constant access price for each of the *MVNO*'s customers. Note that if the access prices is

[9] In some cases, the host *MNO*'s may even be better off with entry. The *MVNO* may attract many new customers to the host network, because it has a comprehensive retail network, such as Virgin, 7-Eleven or Tesco, or because it has a global brand, such as Disney.

[10] Salop and Scheffman (1987), addressed the issue of whether an upstream monopolist participating in the downstream market would raise rivals' costs. Economides (1998) showed that an upstream monopolist that is also present in the downstream market has the incentive to raise costs of its downstream rivals through discriminatory quality degradation, until they are driven out of the market. Vickers (1995) showed that an upstream monopolist present in a downstream oligopolistic market, and regulated under asymmetric information, also has incentives to raise rivals' costs.

set above the marginal cost, and if the entrant is otherwise equally efficient than the incumbents, which we assume, then the entrant has higher costs than the incumbents.

Suppose that after the entry of an *MVNO*, all *MNO*s set the prices that prevailed before entry. If most of the consumers were already served, entry by an *MVNO* necessarily causes some consumers to switch from the firm they originally patronized to the entrant. If the host *MNO* loses a significant number of consumers to the entrant, it has an incentive to decrease its price. We call the *Retail Competition effect* to this downward pressure on the prices of the incumbents caused by the entrant stealing customers from them. There is another effect that is exclusive to the host. If a host decreases its retail price, it gains customers. However, it also decreases the demand of the entrant, and therefore its wholesale revenue. We call the *Wholesale effect* this upward pressure on the host's retail price, caused by the fact that by decreasing its retail price it reduces its wholesale revenues.

The *wholesale effect* and the *retail competition effect* have opposing signs. This implies that the impact on prices of the entry of an *MVNO* is potentially ambiguous. The entry of an *MVNO* may cause a price reduction, as one would expect, but it may also lead to higher prices.

The price of the host is more likely to increase when the *wholesale effect* is large and the *retail competition effect* is small. This happens when the access price is high, or when the entrant *MVNO* captures a large fraction of the consumers that switch of provider after an increase in the host's price.

If the access price is high, the entrant has higher costs than the incumbents. As a consequence, the entrant may charge a higher price than the prices the incumbents charged prior to entry. Consumers may be, nevertheless, better off, due to the increase in variety that the entry brings about. Instead of paying a lower price for a product for

which they do not have a strong preference, they pay a bit more for a product that is ideally suited to them, and for which they get a higher surplus.

The prices of the non-host incumbents are likely to move in the same direction as the demand for their services. If the *wholesale effect* is large and the access price is high, the prices of the non-host incumbents are more likely to rise after entry. The reason is that the eventual increase in the host's price and the high price set by the entrant mean that non-host *MNO*s will have a larger demand, particularly those selling services similar to the host's.

6 Entrants' Product Differentiation Decision

First we discuss the entrant's perspective regarding its product differentiation decision. Suppose that the host *MNO* and an *MVNO* have been matched, and that the constant access price per consumer has been set above marginal cost. Before making its product differentiation decision, the entrant should anticipate the implications that this choice will have on price competition.[11] If the entrant chooses to offer a product very similar to the products of any of the incumbent, the consumer's choice will be essentially based on price, and the firm with the lowest price will succeed in capturing a substantial number of consumers. The ensuing price competition between the entrant and the incumbent in question results in lower retail prices, and both firms end up with lower profits. Consequently, the entrant should try to offer a product as differentiated as possible from those of the other incumbents.

However, the incumbents do not have symmetric incentives in terms of pricing, because one of them is the host. As mentioned in section 5, among the incumbents, the host has the lowest incentives to cut its price after entry, due to the *wholesale effect*. This means that it would be less damaging for the profit of the entrant, to offer a

[11] We are assuming that the prices decisions can be changed more rapidly than the product characteristics, brand positioning or consumer perception, which are assumed to be fixed for a longer period.

product that consumers view as a closer substitute to the product of the host, than to the products of the other *MNO*s. Thus, anticipating the different price responses of the host and of the other *MNO*s, and holding everything else constant and symmetric among incumbents, the entrant should reduce the level of differentiation of its product compared to the product of the host, and increase the level of differentiation of its product compared to the product of the other incumbents. Recall that the higher the access price, the stronger the wholesale effect. Hence, the entrant should position its product closer to the product of the host, the higher the access price. However, it is not in the entrant's interest, either, to offer a product identical to the product of the host, because a strong price competition would emerge.

We now turn to the host's perspective regarding the entrant's product differentiation decision. The host benefits from entry because it allows him to capture, through the entrant, subscribers that originally patronized the other incumbents. It might seem that the best situation for the host is one in which the entrant offers a product that competes closely with the products of the rival *MNO*s, but not with the product of the host. However, this is not necessarily true. Given retail prices, if the entrant offers a service that competes closely with the products of the rival *MNO*s, the wholesale revenues of the host do not cannibalize its retail subscriber base, and hence do not reduce its retail profits. Additionally, with an access price above marginal cost, the wholesale profits will be large. In other words, given retail prices, it is in the host's interest that the entrant offers a product that competes more closely with the products of the other *MNO*s than with its own product. However, the relative positioning of the product of the entrant affects prices. If the access price is high, the entrant has a severe cost disadvantage compared with the incumbents. Under these circumstances, offering a product that competes closely with those provided by other *MNO*s and therefore

competing essentially on price while having a cost disadvantage, will lead to low revenues for the entrant and thus, to low wholesale revenues for the host. This is why the host may prefer that the entrant does not offer a product that competes closely with rival *MNO*s.

7 Conclusion

Mobile telephony is an oligopolistic market, where the number of competitors was initially limited to the number of licenses assigned by sectorial regulators. Mobile virtual network operators allow overcoming any eventual entry limitations caused by the scarcity of the radio-electric spectrum, and attaining a free entry equilibrium.

Additionally, the mobile telephony industry is one of the few in which more than one firm can provide access to a bottleneck input: a license to use the radio-electric spectrum. Incumbents may still foreclose the market. However, competition between them may lead the incumbents to voluntarily concede access to their networks.

Entry by mobile virtual network operators may cause prices to decrease. However, entry may also lead to higher prices for the entrant and the host. This is due to the *wholesale effect*. A host mobile network operator makes both retail and wholesale profits. This gives the host an incentive to raise its retail price. Due to the same effect, and in order to mitigate post-entry price competition, the entrant should seek to position its product such that the host is its closest competitor.

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Tables

Table 1

	Penetration rate Oct-05	Growth in percentage points (2004/05)
Austria	99%	5
Belgium	83%	5
Cyprus	99%	11
Czech Republic	105%	7
Denmark	96%	6
Estonia	104%	16
Finland	98%	3
France	76%	5
Germany	90%	8
Greece	89%	7
Hungary	90%	8
Ireland	96%	8
Italy	111%	9
Latvia	79%	14
Lithuania	117%	37
Luxemburg	150%	17
Malta	81%	6
Netherlands	94%	10
Poland	71%	16
Portugal	106%	10
Slovakia	80%	5
Slovenia	90%	-
Spain	94%	6
Sweden	101%	7
United Kingdom	103%	10
EU15	92%	-
EU25	91%	-

Source: 11th Report on the Implementation of the Telecommunications Regulatory Package, European Commission2005

Table 2

	Operators with licenses, Sep-05				Market shares based on customers, Oct-05	
	DCS or GSM	DCS and GSM	UMTS and GSM/DCS	UMTS	Leading operator	Main competitor
Austria	1	3	4	1	40%	25%
Belgium		3	3		47%	32%
Cyprus		2	2		93%	7%
Czech Rep		3	3		NA	NA
Denmark		3	2	1	31%	20%
Estonia	1	3	3		46%	32%
Finland		3	3		NA	NA
France		3	3		47%	36%
Germany	4		4	1	38%	37%
Greece	1	3	3		NA	NA
Hungary		3	3		45%	34%
Ireland		3	2	1	49%	40%
Italy		3	3	2	40%	32%
Latvia		3	4		NA	NA
Lithuania		3	0		37%	32%
Luxemburg	1	2	3		58%	29%
Malta	2		2		52%	48%
Netherlands	2	3	5		36%	24%
Poland		3	3		36%	34%
Portugal		3	3		NA	NA
Slovakia		2	2		56%	44%
Slovenia	1	2	1		74%	20%
Spain		2	3	1	48%	28%
Sweden		4	2	1	NA	NA
UK	4		4	1	25%	24%
EU15					42%	31%
EU25					43%	32%

Source: 11th Report on the Implementation of the Telecommunications Regulatory Package, 2005, European Commission