



The « curse » of later entrants

*L. BENZONI, D. BASQUE, G. DACQUAY
and J. LAGIER*

2007

TERA Consultants
32, rue des Jeûneurs
75002 PARIS
Tél. + 33 (0) 1 55 04 87 10
Fax. +33 (0) 1 53 40 85 15

S.A.S. au capital de 200 000 €
RCS Paris B 394 948 731

**THE “CURSE” OF LATER ENTRANTS:
THEORETICAL DYNAMICS OF NON-CATCHING UP IN A SEQUENTIAL ENTRY MARKET.
THE CASE OF EUROPEAN MOBILE MARKETS**

LAURENT BENZONI

UNIVERSITY PARIS II - ERMES

With D.Basque, G.Dacquay and J.Lagier (TERA Consultants)

Latest version

January 2007

Corresponding author E-mail: Benzioni@tera.fr and Dacquay@tera.fr

Tel: +00 33 15 50 48 710 Fax: +00 33 15 34 08 515

The “curse” of later entrants. L. Benzoni / Telecommunications Policy

We acknowledge with gratitude comments and suggestions made by Nicolas Curien and Marc Bourreau.

Abstract

Adapting a typical Stackelberg's model (1934) of leader-follower to take into account specificities of a high fixed-cost and growing demand industry, we show that entry delay is a key factor to explain differences in firm's performances : the longer the entry delay vs. early entrants, the higher the risk of non catching up for the later entrants. The model is then applied to European mobile markets and explains very well that in almost all mobile markets in EU 15, early entrants are very profitable whereas later entrants lag behind. We conclude that assymmetric regulation is necessary to compensate for the adverse effect of sequential market entry.

Introduction

The economic theory of “**first mover advantages**” predicts that a firm which is first to enter a new market (**early entrant**) will accumulate so many advantages that **later entrants** will have difficulties to compete on equal terms. “first mover advantages” stem from early adoption by users which allows a firm to capture a large market share early on. Thus, by the time competitors are able to enter the market, the first-mover will, ideally, have already established advantages in brand-loyalty or recognition as well as cost advantages in distribution and/or infrastructure systems.

Whereas some studies show that pioneering advantages diminish over time (Brown and Lattin 1994; Kalyanaram & al. 1995; Shankar & al. 1998), or is not consistent (Tellis et Golder 1996), the analysis of European mobile markets shows a persistent gap in terms of the performances e.g. market share and profits, between first and later entrants. This phenomenon of “**non catching up with**” leads to investigate whether sequential market entry could be an explanation for such different performances. The purpose of this paper is to demonstrate, through a theoretical model and a case study on European mobile markets, that it is almost impossible for a later entrant (or follower) to catch up the early entrant (or mover). Considering a sequential market entry model, we determine the impact of entry delay on a firm performances in a market characterized by high fixed costs and fast growing demand, and show that the bigger the entry delay, the worse the performances of later entrant are. This model provides a good explanation of the differences in economic performances of mobile operators in Europe.

This paper will begin with an overview of the first mover advantages theory, with particular attention paid to its applicability to mobile market.

Then, we present a theoretical model in order to determine the impact of entry delays on a firms’ performances, for a market characterised by high fixed costs and externalities. After a presentation of model’ hypotheses, we evaluate empirically the gap between early and later entrant’ profits.

Overview of first mover advantages and entry delays

The value of being first is a prominent concept in economic literature for many years. Von Stackelberg, for example, showed already in 1934, that considering quantify-setting firms, the leader, i.e. first-mover, is able to get a larger market share and higher profits than the follower, ie second-mover or later entrant.

Lieberman and Montgomery (1987, 1998) defined first-mover advantages in terms of the “ability of pioneering firms to earn positive economic profits (e.g: profits in excess of cost of capital)”(1987), and developed the idea of a first-mover advantage that protect pioneers from competition (1998). Finally, they highlighted the main advantages of first-movers: technological leadership, preemption of scarce assets (employees, places), modification in customers’ preferences: brand awareness, network externalities and switching costs.

Advantages of main first-movers

- **Technological leadership**

A first-mover in a new market will develop new product and process technology, and therefore gains a head start in learning how to behave successfully in the marketplace. As the early entrant firm advances down the learning curve, the harder it will be for potential competitors to catch up with. This is due not only to the fact that the early entrant amasses a greater volume of knowledge sooner, but also to the fact that innovations in either product development or organizational management can translate into cost advantages for the early entrant (Spence 1981, Arrow 1962; Bahk and Gort 1993).

- **Pre-emption of scarce assets (Lieberman and Montgomery 1987)**

A first-mover may also gain advantages by acquiring resources and assets before its competitors. Such resources may include physical assets, positioning in geographic space or hiring best employees.

- **Modification of customers’ preferences**

There are three main methods to modify customers’ costs structure: brand awareness, switching costs, and network effects.

- **Brand awareness (Gabszewicz, Pepall, and Thisse 1992)** tends to be higher for early entrants, because being first in a market enables to secure a bigger recognition by consumers. Later entrants must engage in higher advertising expenses in comparison with first mover if they want to get similar brand awareness. In fact, some experiments have shown that order of entry can have a significant impact on customer preferences, memory and judgment (Carpenter and Nakamoto 1986 & 1989; Kardes and Kalyanaram 1992,

Zhang and Markman 1998) showed in a research paper that order of entry strongly influences consumer preferences.

- **Switching costs** make subsequent market entry more difficult, as the first movers' customers only change over to a later new entrant when the price advantage exceeds their switching costs. If a customer has already made a substantial amount of investment in a particular brand of product or services when a competing brand enters the market, the later entrant will have to devote more resources than the first mover and typically will have to offer a superior product in order to compel customers to switch and choose their product in a context of uncertainty about the quality it offers (Schmalensee 1981). Investments made by customers may be both financial (cost of the product or service including any complementary item that needs to be purchased) and psychological (loyalty to a particular brand, cost of learning how to use the product or the service) depending on the type of product or service. As a result, customers are facing 'lock-in' effect, which means that they don't want to (and in many cases couldn't) change their provider (see for further explanations: Arthur 1989; David 1985; Liebowitz and Margolis 1995 & 1998). Such “lock-in” effect constitutes a significant barrier to entry (Bain 1956), and explains why it is difficult for the later entrant to capture a large installed base.
- **Network effects** (Economides 1996; Witt 1997) (positive consumption externalities or direct network externalities) apply to industries where the value of a good or a service increases with the number of users. Network effects are most likely to confer substantial advantages to first-movers as these can increase exponentially if the first mover is able to effectively dominate the network earlier on. In other words, direct network externalities exist when an increase in the size of a network increases the number of others with whom one can directly « communicate ».

We believe that industries which are the most likely to confer substantial advantages to first-mover are those that exhibit network effects, like mobile markets.

Disadvantages of main first-mover

Nevertheless, Lieberman and Montgomery (1998) indicate that early entrants can also be penalised in case of one of the following elements: free-rider effects, resolution of uncertainty, shift in consumers need and first-mover inertia.

Later entrants can free ride on the technologies, processes, or organizational practices already developed by first-movers as imitation is often easier and cheaper than innovation, in the absence of patent protection or barriers to knowledge diffusion. A later entrant can also learn from the mistakes and failures of first movers, as uncertainties of a new market can apply to both technology as well as unformed consumer preferences (Gal-Or 1987; Shinkai 2000). Later entrants also need to devote fewer resources than first-movers on educating users on how and why to use a new type of product or service. It may be possible that consumers change their way to consume and stop consuming the products supplied by first-movers.

An early entrant may also suffer from a lack of flexibility inhibiting its ability to respond to competitive threats also called the “incumbent inertia” (see for example Hannan and Freeman 1984; Ghemawat 1991; Henderson 1993).

Before estimating with a case study the advantages of early entrants in a growing-demand market with high fixed costs, the European mobile markets, we will present the sequential entry model as a tool to articulate entry delay and differences in performance.

Assessing first mover advantages in a fast-growing fixed-cost industry

The first-mover analysis can be formalized by the Stackelberg’s model (1934), in which two firms (Leader-Follower) compete with a sequential delay. The leader moves in first and chooses its level of output. The follower observes the choice of the first-mover and then determines its own level of output. As a conclusion, firm *leader* has a higher market share as well as higher profits than firm *Follower*.

It is possible to apply the Stackelberg’s model of sequential entry of firms to sequential entry of groups of firms. In fact, we assume that it isn’t the number of the firms in presence, but the timing of entry for each of them, that matters to explain differences in market shares and profits.

The sequential market entry model

The purpose of the following model is to understand the impact of entry delays (timing of entry) on a firm performances in a market characterized by high fixed costs and fast growing demand. In order to insulate the parameter “entry delay”, we consider here two firms that enter the market at different periods, *ceteris paribus*, which means that the two firms are supposed to make same investments.

a) Hypotheses

- Hypothesis 1: product life cycle (H1)

Let us consider a market evolving according to the four phases of a typical life cycle: a launch phase, a growth phase, a maturity phase, a downwards phase. These typical market life cycles have been described by the Bass diffusion model¹ of the adoption and diffusion of new products and technologies.

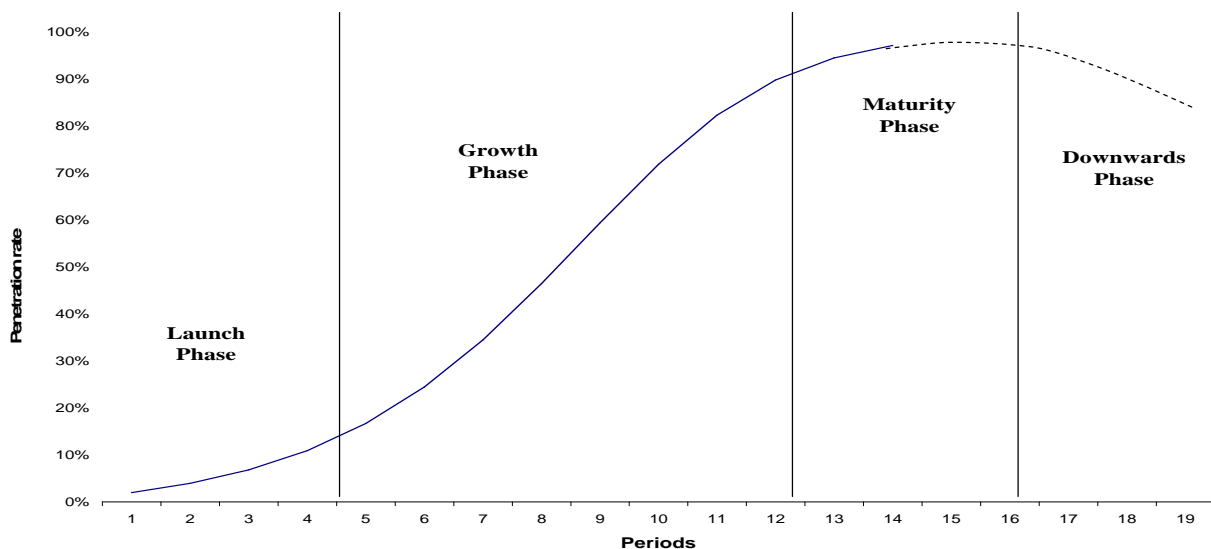
The Bass formula gives the number of consumers N_t at period t , depending on the number of consumers N_{t-1} at period $t-1$:

$$N_t = N_{t-1} + \alpha \times (m - N_{t-1}) + \beta \times N_{t-1} \times (m - N_{t-1})$$

Where:

- m is the market potential;
- α is the coefficient of innovation (external influence): this is the likelihood that a consumer who is not yet using the product will start using it because of mass media coverage or other external factors;
- β is the coefficient of imitation (internal influence): this is the likelihood that a consumer who is not yet using the product will start using it because of “word of mouth” or other influence from those already using the product.

Figure 1: Typical evolution in market penetration rate using Bass diffusion model²



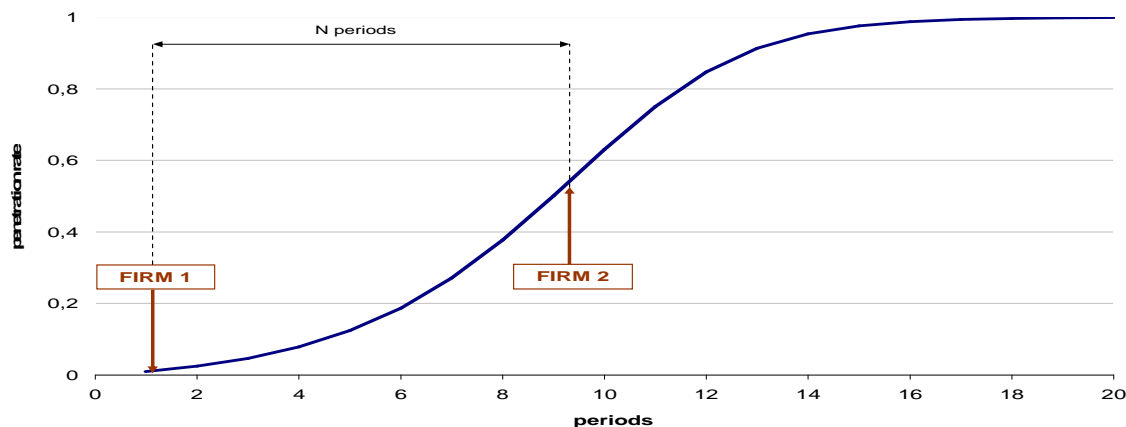
¹ The Bass diffusion model is one of the tools to describe, and sometimes predict, the number of purchases for new consumer durable products.

² The equation used is: $N_t = N_{t-1} + 0.01 \times (1 - N_{t-1}) + 0.50 \times N_{t-1} \times (1 - N_{t-1})$.

- **Hypothesis 2: Sequential entry (H2)**

Let us assume that two firms enter the market sequentially, Firm1 and Firm2, and compete on equal terms. Firm1 enters at period 1 and Firm2 enters T periods after Firm1 ($T > 1$)³. Period 1 is always in the “launch phase», whereas period T could be in the “launch”, “growth” or even “maturity phase”.

Figure 2: Sequential market entry



After entry, Firm2 obviously tries to compete on equal terms with Firm1 which implies that:

- Firm2 needs to catch up with all former investments (fixed costs) of Firm1;
- Firm2 and Firm1 have same prices P_t and same marginal costs⁴ C , with $P_t > C$.

Firm2 makes all efforts required to be as competitive as Firm1. Price before Firm2’s entry are monopoly prices P_m in this model. Prices after Firm2’s entry are competitive prices P_c . Thus, we have $P_m > P_c$.

We do not analyse the incentives of Firm2 to enter the market and the incentives of Firm1 to deter Firm2’s entry. Due to imperfect information, Firm2 cannot precisely assess the advantages or disadvantages of Firm1. And, in some markets such as European mobile markets, entry is a fully exogenous decision as it is *the national regulatory agency or the government that decides the entry of market players through the process of award-licences*.

- **Hypothesis 3: Same budget constraint (H3)**

³ For simplification, a period is assumed to have 1 year duration.

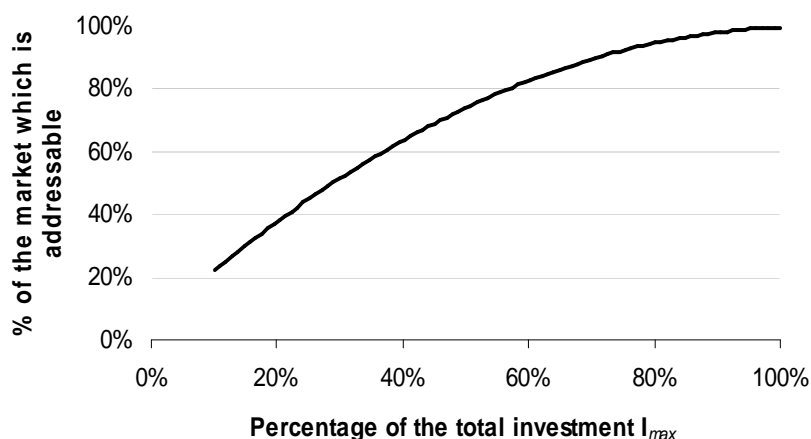
⁴ We assume C does not move over the time. On the one hand, it could be considered that C increases with the increase in competition. On the other hand, it could be considered that early adopters are harder to acquire and all the harder since networks effects are low at the launch phase of the market.

Let us assume that Firm1 and Firm2 have the same budget constraint M . This means that banks and shareholders cannot lend them more than M , so that the firms’ financial capacities are limited. This is an obvious and realistic assumption as we cannot imagine firms having unlimited budgets.

- **Hypothesis 4: Existence of incremental fixed costs (H4)**

Let us finally consider that, in order to address this market, Firm1 and firm2 need to undertake a large fixed cost investment, and that costs are incremental fixed costs: the higher this cost is, the bigger the potential addressable market is. The maximum cost I_{max} is achieved when the infrastructure system enable to address 100% of the market.

Figure 3: Typical evolution of the addressable market as a function of the level of investments



From all four hypotheses, only hypothesis 4 could be seen as little bit more restrictive because it refers to large fixed costs industries. This is typically the case for telecommunications operators, and especially mobile operators, but also for many manufacturing companies that need to build big plants before being operational: infrastructure industries (water distribution, electricity distribution industries, etc.), R&D industries (pharmaceutical industry, semi-conductor industries, etc.).

b) Description of the mechanism of non-catching up

- **Step 1:**

Before entry of the later entrant, the early entrant faces a low demand, as he enters the market in the “launch phase”. Therefore:

- On the cost side, the early entrant will not need to spend I_{max} immediately and will rather spread I_{max} over several periods, since these fixed costs are incremental and can follow

The “curse” of later entrants. L. Benzioni / Telecommunications Policy

the growth of penetration rate. Moreover, as entry of later entrants is given and their date can be anticipated, expenses can be spread over several periods,

- On the revenue side, the early entrant faces a low demand but is in a position to benefit from monopoly prices.
- The absolute value of Firm1’s profit at the end of period $T-1$, called $\pi_1(T-1)$, is low because of investment spreading. Subsequently, the financial risk is low.

$$\Pi_1(T-1) = \begin{cases} \sum_{t=1}^{t=T-1} \left[(P_m - C) \times N_t - \frac{I_{\max}}{k} \right] & \text{if } k > T-1 \\ \sum_{t=1}^{t=T-1} [(P_m - C) \times N_t] - I_{\max} & \text{if } k \leq T-1 \end{cases}$$

Where k is the number of periods over which investments are spread.

• **Step 2:**

- The later Firm2 enters the market, the higher the demand to be fulfilled by both firms, especially if Firm2’s entry occurs in the “growth phase”. Therefore, the later Firm2 enters the market:
- the less Firm2 can spread its investments over the time. First, because as demand is significant, it is necessary to invest enough to fulfil the demand. Second, because the early entrant has already made investments and Firm2 needs to catch up with those investments in order to compete on equal terms with Firm1;
- the higher revenues can be for Firm2. However, this assertion is lowered by the fact that prices are lower, making revenues not as high as expected. The absolute value of Firm2’s profits is in this case high due to the impossibility to spread investments. Therefore, the financial risk is higher for Firm2.

Before getting its first customer, Firm2 has to catch up with Firm1’s investments. Therefore:

$$\Pi_2(T-1) = \begin{cases} -(T-1) \times \frac{I_{\max}}{k} & \text{if } k > T-1 \\ -I_{\max} & \text{if } k \leq T-1 \end{cases}$$

• **Step 3:**

The need for Firm1 and Firm2 to compete on equal terms leads to higher profits for Firm1. Firm1 has a “profit advantage” ($\pi_1 - \pi_2$) equal to:

$$\Pi_1(T-1) - \Pi_2(T-1) = \sum_{t=1}^{t=T-1} (P_m - C) \times N_t$$

Even if N_t is low when $t < T$, price levels are high ($P_m > P_c$), and so “profit advantage” can be high. Moreover, the later Firm2 enters the market, the higher Firm1’s “profit advantage” is.

Firm1 can, thus, use this “profit advantage” to prevent Firm2 from competing on equal terms with it. By enhancing its investments, for example, advertising, acquisition costs, distribution networks, R&D, etc., Firm1 can become more competitive. The more it enhances its investments, the higher its market share will be. But, in order to compete on equal terms, Firm2 needs to enhance its investments up to the same level as Firm1. Thus, Firm1 can now enhance again its investments and so on... Firm1 is therefore always on step ahead due to its higher accumulated investments (advance in advertising, in acquisition, in quality of service, in technological leadership, etc.)⁵.

This kind of market dynamics is known as “**war of attrition**”. “War of attrition” concept⁶ has been introduced first in the biological literature by Smith (1974) and later applied to economic analysis by Tirole (1988). In such a war of attrition, there are two options for Firm2:

- **either Firm2 does not play the war of attrition:** Firm2 makes lower investments than Firm1 and ends up being less competitive than Firm1, meaning that Firm1 gets higher market shares;
- **or Firm2 plays the war of attrition:** due to same budget constraints and due to the relation $\pi_1 > \pi_2$, Firm1 has a “deeper purse” than Firm2 and will eventually win the war of attrition. Firm2 will stop investing before Firm1; otherwise it would “die”. Firm1 can therefore make higher investments and get higher market shares.

There is a high probability that Firm2 knows it will lose the war of attrition, because of Firm1’s earlier entry. Therefore, Firm2 cannot compete on equal terms without facing the risk of being evicted, admitting being less competitive than Firm1 (even though it has the same cost structure). Firm1 ends up getting higher market shares and higher revenues and Firm2 ends up being unable to match with Firm1.

From this analysis, it might be inferred that Firm1 can evict Firm2 on case of sequential market entry. The “**long-purse theory of predation**”, originally proposed by Telser (1966), indeed states that an incumbent firm with large financing resources may prey upon a rival with limited resources until these resources are exhausted, the rival exits the market, and the incumbent is left to earn monopoly profits. But, first of all, knowing this, the later entrants may be reluctant to initiate a war of attrition. Secondly, $(\pi_1 - \pi_2)$ may be not enough high to exit Firm2 but sufficient to weaken Firm2. Finally, it must be

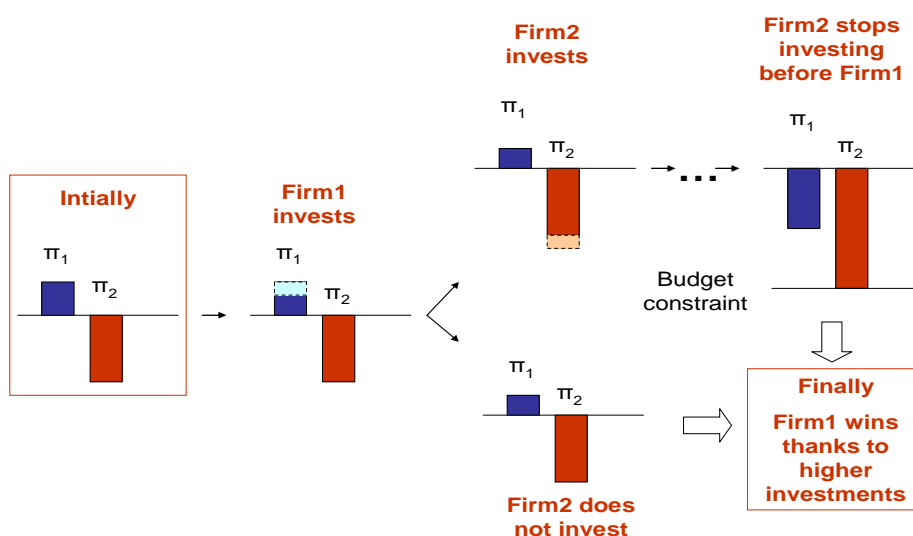
⁵ It must be noted that, by spreading its investments over several years, firm 1 may lower **both** the risk associated and its financial costs, which firm 2 cannot do. This would make the “profit advantage” even higher.

⁶ Originally, the *war of attrition* describes two animals fighting over a prey. Besides animal conflict, the war of attrition has also been used to model political contests (Bulow and Klemperer, 1997) standard-setting games (Farrell, 1996), strikes (Kennan and Wilson, 1989).

stated that neither Firm2 nor Firm1 are looking for competitors’ eviction. Due to the importance of fixed costs in the considered market, the eviction of one competitor could imply a right-off of the other, meaning that a new entrant could launch activities on the market by using the evicted firm’s infrastructures and without bearing fixed costs. Therefore, the surviving firm would compete with a stronger competitor. Subsequently, the best choice for Firm1 is to prevent competitor’s eviction and thus avoid a war of attrition.

Because of Firm1’s “longer purse” and because none of the firms wants to evict the other, Firm1 is mechanically more competitive than Firm2 and gains more market share.

Figure 4: War of attrition



It must be kept in mind that, in our model, we only consider the mechanical effect of sequential entry on firm’s performances. But, there are other mechanisms generated by entry delay between the two firms that enhance the “profit advantage” of Firm1. By pre-empting scarce assets such as best employees, best places, by setting switching costs, by profiting of superior brand awareness or thanks to its technological leadership, Firm1 can increase its “profit advantage” and lower make Firm2’s competitiveness. Among the studies mentioned in our overview of management and economic literature on first mover advantages, several have indeed indicated these additional first mover advantages.

Case of limited firms’ life length

We consider here that market players’ life is infinite as generally assumed in economic literature. However, in reality, some markets are characterized by finite life lengths: through concessions, market players are granted a resource (by national authorities for example) for a typical length of 15 or 20 years. This juridical instrument is used for scarce resources such as oil or radio frequencies.

Introducing concessions in our model, at Firm2’s entry, Firm1’s expected life length is lower than Firm2’s expected life length. Firm2 can generate revenues on a longer period than Firm1. As a

consequence, Firm2’s budget might be bigger than Firm1’s one since the budget granted to firms by banks or shareholders is linked to the time required to get return on investments. Firm2 might have more incentives to play a war of attrition than under our model hypotheses.

In such a war of attrition, either Firm1 exits: in that case, a write-off would imply the entry of a new competitor for Firm2. This competitor would use Firm1’s infrastructure without bearing fixed costs. It would be a stronger competitor for Firm2. Or Firm1 does not play the war of attrition and is weakened by Firm2 until the end of the concession. Then, either Firm1 does not get a new concession: Firm1’s right-off implies the entry of a stronger competitor for Firm2. Or Firm2 gets a new concession and can now play a war of attrition that it will win thanks to the longer length life it has now.

This sequential game can be infinite. Therefore, it is relevant to refer to our precedent model to draw any conclusion. In any case, Firm2 will be weaker than Firm1 and Firm1 will win higher market shares.

The case study of European mobile markets

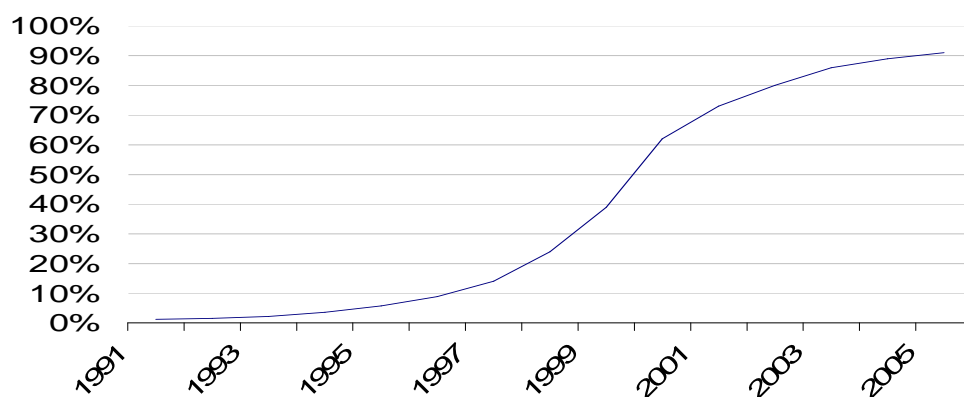
Economic theory does not provide a threshold above which the value of the “profit advantage” of the early entrant prevents the later entrant to enter a war of attrition. In the following, we propose to apply the theoretical model to a typical European mobile market in order to evaluate Firm1’s treasure.

a) European mobile is a fast-growing fixed-cost industry

First of all, let us notice that the four hypotheses asserted previously are indeed realistic in almost all European mobile markets:

- **H1:** The growth of European mobile markets is very similar to a Bass model:

Figure 5: Evolution of the penetration rate in EU 15



Source: OMSYC (Databases: 1997, 2001, 2005)

- **H2:** There were sequential entries in all European mobile markets, except in Sweden and in the United Kingdom (see below table 1):

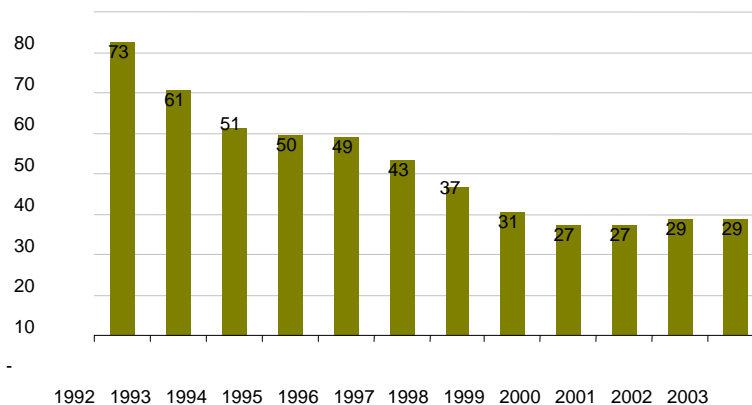
Tableau 1 : Entry delays for European mobile operators

	Early entrants	Numeric licence	Later entrants	Numeric licence
 Austria	Mobilkom	1994	One	1997
	T-Mobile	1996	Tele.ring	1999
 Belgium	Proximus	1994	Base	1998
	Mobistar	1995		
 Denmark	TDC	1991	Telia	1997
	Sonofon	1991		
 Finland	Radiolinja	1990	DNA	1996
	Sonera	1990		
 France	Orange	1991	Bouygues	1994
	SFR	1991		
 Germany	T-Mobile	1990	E-Plus	1993
	Vodafone	1990	O2	1997
 Greece	Vodafone	1992	Cosmote	1995
	STET Hellas	1992	Q-Telecom	2001
 Ireland	Vodafone	1993	Meteor	2000
	O2	1996		
 Italy	TIM	1994	Wind	1998
	Vodafone	1994		
 Netherlands	KPN Mobile	1994	Telfort	1998
	Vodafone	1995	T-Mobile	1998
 Portugal	Vodafone	1991	Orange	1998
	TMN	1992	Optimus	1997
 Spain	Vodafone	1994	Amena	1998
	Telefonica	1995		
 United Kingdom	Vodafone	1992	T-Mobile	1993
	O2	1992	Orange	1994

Source: Sixth report on the implementation of the Telecommunications regulatory package adopted by the Commission on 7 December 2000.

On average, the delay between first and second entrant is about 6 months, 4 years between first and third entrant, and then 5 years between first and latest entrant.

Figure 6: Evolution of ARPU in EU 15



Source: OMSYC (databases: 1997, 2001 and 2005)

Between 1992 and 1999, the ARPU (Average revenues per Users) has decreased by 50%, whereas the number of players increased. This can be explained by:

- Competition leads to a decrease in prices from monopoly's prices to competition's ones.
 - As the market grows, the later entrants are characterized by an inferior ARPU, as early entrant have secured the more lucrative market segments,
 - And, later entrants launch and expand their networks with consumers who have a lower propension to paid.
-
- **H3:** Naturally, mobile operator's shareholders do not have infinitely deeper purses, which means that mobile operators have budget constraints. As many first entrants in Europe are subsidiaries of the fixed national incumbent, first entrants' purses might be deeper than later entrants'.
 - **H4:** Mobile telephony networks are characterised by a cost structure with high fixed and common costs and relatively low variable or incremental/marginal costs. The main part of a mobile operator's costs, therefore, does not vary with the number of customers, calls or connection minutes, but it is fixed and, to a large extend, also sunk. Moreover, the fixed costs are incrementals: the larger the population coverage offered by mobile operators is, the higher investment for the network is. Due to high urban concentration in Europe, rolling out mobile networks first in cities on a first enables to address a significant market potential.

Furthermore, the theoretical model remains stable if **two groups of MNOs** (a group of leaders and a group of followers – or a group of early entrants and a group of later entrants) are considered **instead of two MNOs**.

b) Results of the case study confirm output of the sequential entry model

Let us consider two Mobile Network Operators (MNO1 and MNO2) that enter a “representative” European mobile market that is characterized by a same penetration growth of mobile services (Figure 5) and by a same decrease in prices as observed in Europe at that time.

The country considered has a size of 100,000 km² and a population density equal to EU 15's: 120 inhabitants per km².

MNO1 has similar features to early entrants in Europe that is to say:

- it enters the market in the “launch phase” (in average, first entrants entered in 1992 in EU 15).
- during this “launch phase”, the demand came predominantly from business users. This benefited to mobile operators very much because: (i) business users show significantly higher Average Revenue per User; and (ii) business users – when using their phones for professional purposes only - could be served by a much more concentrated network coverage⁷. As a consequence, MNO1 can spread its network investments (fixed costs) over 5 years (to obtain the investment that are made each year, the total network investment is divided by 5).

MNO2 enters T years after MNO1 in the market and make all the investments necessary to compete on equal terms (that is to say to acquire as many customers as MNO1), which means that:

- it has to spend in only two phases the cumulated expenses made by the early entrant before its entry (as observed in European mobile markets);
- it offers same prices as the early entrant;
- it has the same acquisition costs;

⁷ This distribution of population in European markets implies that if a mobile operator covers 20% of the territory, it will cover 45% of the population, which can be sufficient when mobile services are offered predominantly to business users and mainly used for professional purposes. On the contrary, when addressing residential users who may move and live in more rural areas, it is necessary to offer a much high coverage of the population, and achieve rapidly to cover 90% of the population

The “curse” of later entrants. L. Benzoni / Telecommunications Policy

- it has the same advertising expenses;
- All the parameters have been chosen so that they match with what is generally observed in European markets⁸
- network investments that depends mainly on the size of the country. Given these features, the cost of a GSM network that enables to cover the whole country has been modelled and is estimated at 750.000,000 € (cost of a GSM network in the nineties);
- advertising expenses that have the same proportions has advertising expenses in Germany (country for which those data are available on a long period);
- revenues in the long term that are similar to revenue today (27€/user/month, without VAT);
- variable costs that are similar to current variable costs (18€/user/month)⁹;
- a 20% churn rate, which is an average European churn rate. Each year, customers that churn are added to new acquisitions and are equally distributed between both MNOs¹⁰, once MNO2 has totally caught up network investments.

⁸ Source: OMSYC, 1997-2005.

⁹ Variable cost per user : weighted average of the difference [ARPU – EBITDA] per users in UE 15 in 2004 ; source : EBITDA, ARPU, number of users per operator : OMSYC 2005 and activity reports of 49 operators in UE 15 in 2004.

¹⁰ Source : churn rate calculated since activity reports of operators in four European countries : France, Belgium, UK and Germany in 2004.

Figure 7: Cumulative profits of early and later entrants with 1-year entry delay

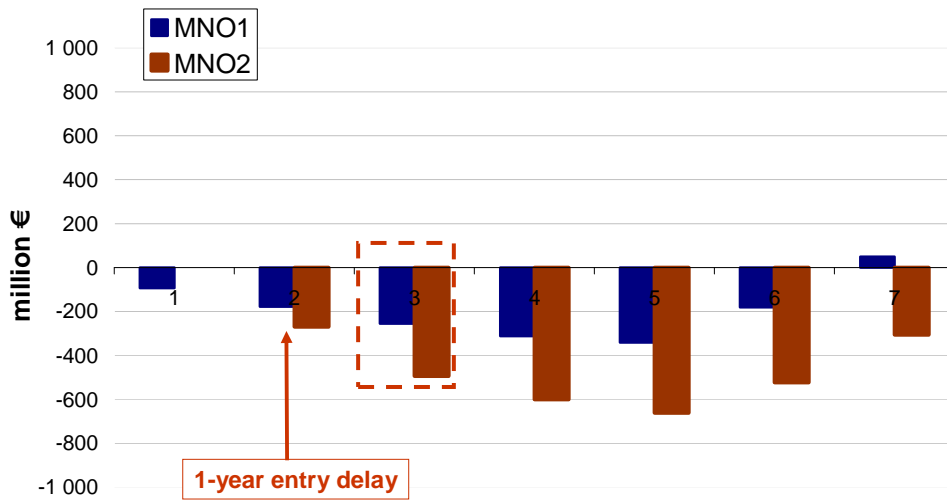


Figure 8: Cumulative profits of early and later entrants with 3-year entry delay

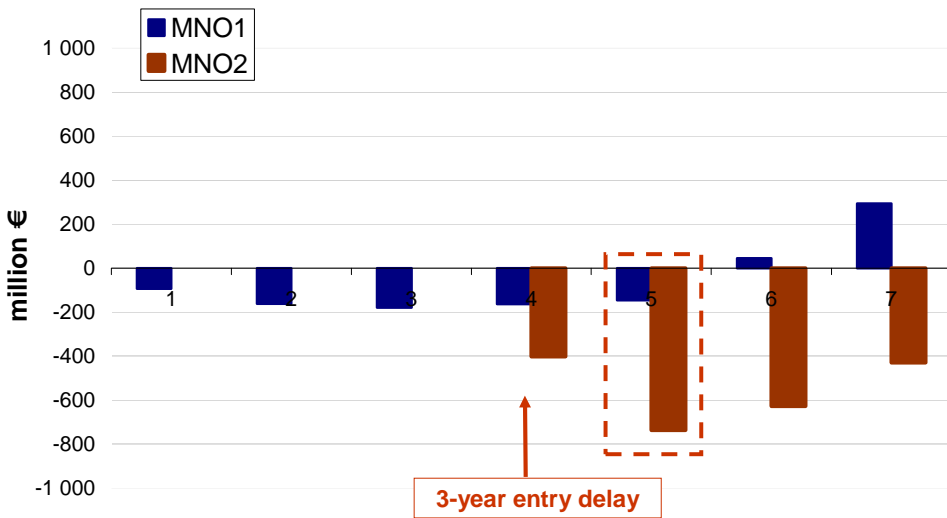
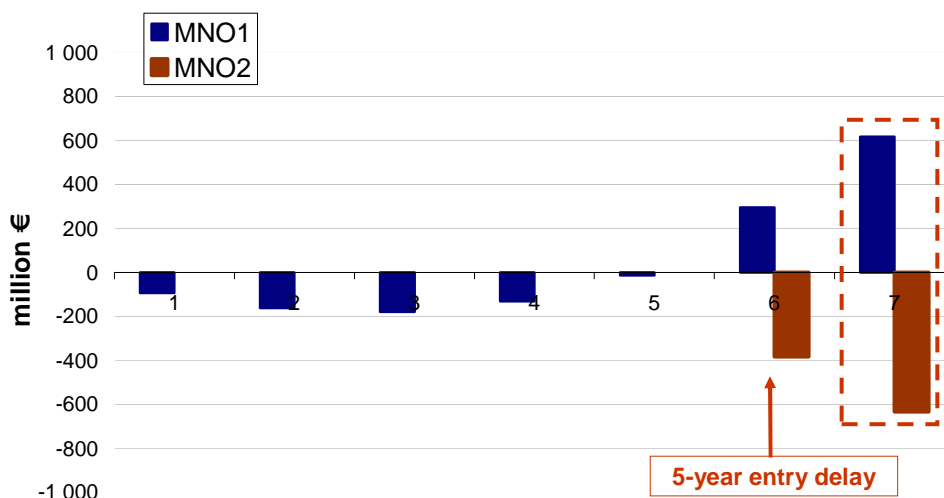


Figure 9: Cumulative profits of early and later entrants with 5-year entry delay



The application of the model shows that:

- the later MNO2 enters the market, the higher the difference between the early and the later entrants is at the time of investment catching-up: around 200 million euros with 1-year entry delay, around 550 million euros with 3-year entry delay, around 1,250 million euros with 5-year entry delay;
- at the time of entry, investments required are huge for the later entrants. The financial peak is high and it is therefore hard to imagine that later entrants will choose to compete on equal terms. They would certainly lower some expenses and decide not to compete on perfect equal terms. If we refer to the explanation of the mechanical disadvantages of later entrants in mobile markets, we find similar conclusions:
- at entry, there is a large difference in profits between MNO1 and MNO2;
- this difference increases with entry delay.

To compete on equal terms, later entrants must make huge expenses and even if they compete on equal terms, they will never financially catch up with early entrants. But, these initial expenses are so huge that it cannot be excluded that later entrants could not be able to make such financial efforts. The hypothesis of same expenses for both first and later entrants can be discussed: if later entrants can benefit from lower costs by entering later, in Europe, later entrants were granted DSC licences that make the network cost far higher than first entrants' network costs. Moreover, later entrants must face higher distribution costs to be as competitive as early entrants, since early entrants have pre-empted best places. Thus, they would not be able to compete on equal terms and would not attract as many customers as early entrants. The higher the difference in profit, the least probable that later entrants have a chance to win the attrition war and to be as competitive as early entrants.

c) Other case studies in mobile telephony confirm results of the sequential entry model

Although the specific features of European mobile markets are particularly relevant, case studies on first-mover advantages or drawbacks in mobile markets are a fairly recent phenomenon, which indicates that it took some time to be in a position to become conscious that a general phenomenon of eviction was underway.

A study published by the Tinbergen institute in 2005, about the early mover advantages in European mobile market, concludes stating that *“Depending on the specific conditions of entry, it seems fair to conclude that the first entrant may still gain a large market share, but that subsequent entrants have much more difficulties gaining market share.”* In an other study, for the Swiss regulatory authority, which compare the development of the Swiss telecommunications market with the rest of Europe, the WIK institute (2003) stated also that a sequential award of mobile licences can have a negative impact on competition dynamics, because of major disadvantages of later entrants (especially linked to network coverage and to the high switching costs for business customers of early entrants) compared to early entrants. Finally, an empirical study ordered by the International Telecommunications Society and based on a panel of 94 mobile operators in 27 OECD member states over the years 1998-2003 shows *“a one year increase in the age of an operator leads to an increase of 0.9% (0.7%) in the market share (EBITDA margin), respectively”* (Sung, 2005).

Conclusion

In accordance with economic literature, we confirm the existence of later entrants' inherent disadvantages in a fixed-cost industry with fast growing demand. The later a firm enters such a market, the higher its initial investment must be. As later entrant cannot spread its investments over several years if it wants to offer immediately the same quality of service as an early entrant, it will have to face a financial abyss at entry and will have no room for manoeuvre to develop its commercial strategy. In a way, competition begins with a real “asymmetry of purse”: the first entrant made profits while it was a monopoly and could spread its investments over years, whereas the later entrant starts with a huge loss, and must realise its investments very quickly. Because of firms' financial constraints (a firm cannot have an infinite budget to launch its service), the later entrant cannot compete on equal terms with the first entrant: it cannot afford the first entrant's commercial expenses (advertising, distribution, special offers) and as a result, the first entrant tends to acquire more consumers than the later entrant. Thus, in terms of market shares and profits, the gap between the two competitors gets wider and wider, and since they compete in a fixed-cost economy, the first entrant keeps on being more and more profitable, while the later entrant have difficulties in returning on its initial investment.

The hypotheses of our model match very well with the characteristics of European mobile markets: in almost all mobile markets in EU 15, early entrants are very profitable whereas later entrants¹¹ lag behind. And yet, European mobile markets have been regulated since the beginning, which tends to prove that National Regulatory Authorities have not appropriately addressed the inherent disadvantages suffered by later entrants in such markets, that we point out here.

Thus the question that can be raised is how a later entrant can successfully enter such a fixed-cost growing demand market? We indeed know that early entrants are not always leaders. The key for later entrants is to produce and sell differentiated products from the early entrants, or to benefit from a disruptive technology (radical innovation). Selling a differentiated product does not necessarily require a larger purse but better ideas. By doing so, the later entrant has an opportunity to catch up with early entrants. On the other hand, in markets where firms sell non-differentiated products, catching-up with early entrants seems very difficult. However, a hope remains for later entrants that play in regulated markets because asymmetric regulation, according to the investment ladder approach (Cave, 2004) could allow to later entrants to spread out their investments in their network and apply their commercial strategy. As the European Regulators Group (ERG, 2004) states: “without on-going vigilance new entrants may never be able to develop a sufficient market presence to justify making investments and the long-term vision of investment-based competition will never emerge”.

¹¹ Except Cosmote in Greece, which is the subsidiary of the fixed incumbent.

Table and figures

Table

[Tableau 1 : Entry delays for European mobile operators](#) 17

Figures

[Figure 1: Typical evolution in market penetration rate using Bass diffusion model](#) 9

[Figure 2: Sequential market entry](#) 10

[Figure 3: Typical evolution of the addressable market as a function of the level of investments](#) 11

[Figure 4: War of attrition](#) 14

[Figure 5: Evolution of the penetration rate in EU 15](#) 16

[Figure 6: Evolution of ARPU in EU 15](#) 18

[Figure 7: Cumulative profits of early and later entrants with 1-year entry delay](#) 21

[Figure 8: Cumulative profits of early and later entrants with 3-year entry delay](#) 21

[Figure 9: Cumulative profits of early and later entrants with 5-year entry delay](#) 22

Bibliography

- Arrow, K. (1962). The economic implications of learning by doing. *Review of Economic Studies*, 29, 153-173.
- Arthur, W. B. (1989). Competing technologies, increasing returns, and lock-in by historical events. *Economic Journal*, 97, 642-665.
- Bahk, B-H., and Gort, M. (1993). Decomposing learning by doing in new plants. *Journal of Political Economy*, 101 (4), 561-583.
- Bass, F.M. (1969). A New product Growth Model for Consumer Durables. *Management Science*, 15, 215-227.
- Bijwaard, G.E., Janssen M.C.W and Maasland E. (2005). Early mover advantages. *Faculty of Economics, Erasmus Universiteit Rotterdam*.
- Brown, C.L., and Lattin, J.M. (1994). Investigating the relationship between time on market and pioneering advantage. *Management science*, 40 (October), 1361-1369.
- Carpenter, G. and Nakamoto, K.(1986). Market pioneers, consumer learning, and product perceptions: a theory of persistent competitive advantage. *Research Paper, Columbia University and University of California*.
- Carpenter, G. and Nakamoto, K.(1989). Consumer preferences formation and pioneering advantage. *Journal of Marketing research*, 26 (August), 285-298.
- Cave, M. (2004). Making the ladder of investment operational. *Working paper*, University of Warwick, UK.
- David, P. A. (1985). Clio and the economics of QWERTY. *American Economic Review* 75, 332-7.
- Dixit, A. (1980). The role of investment in entry deterrence. *Economic Journal*, 90, 95-106.
- Dixit, A. (1982). Recent developments in oligopoly theory. *American Economic Review*, 72, 12-17.
- ERG (2004). Common position on the approach to appropriate remedies in the new regulatory framework. Report approved at the ERG8 Plenary on 1 April 2004.
- Farrell, J. et Klemperer, P. (2001). Coordination and lock-in : competition with switching costs and network effects. *Preliminary draft for Handbook of industrial Organization, forthcoming*.
- Gabszewicz, J. Jaskold, Lynne Pepall, and J.-F. Thisse (1992). Sequential entry with brand loyalty caused by consumer learning-by-doing. *Journal of Industrial Economics*, 40 (December), 397-416.

- Gal-Or, E. (1987). First mover disadvantages with private information. *Review of economic Studies*, 54, 279-292.
- Ghemawat, P. (1991). Market incumbency and technological inertia. *Marketing Science*, 10 (Spring), 161-171.
- Hannan, M.T., and Freeman, J. (1984). Structural inertia and organizational change. *American Sociological Review*, 49 (April), 149-164.
- Henderson, R.M. (1993). Underinvestment and incompetence as responses to radical innovation: evidence from the photolithographic alignment equipment industry. *Rand journal of economics*, 24 (Summer), 248-270.
- Kardes, F.R. and Kalyanaram, G. (1992). Order-of-entry on consumer memory and judgment: an information integration perspective. *Journal of Marketing research*, 29 (August), 343-357.
- Kalyanaram, G., Robinson, W.T. and Urban, G.L. (1995). Order of market entry: established empirical generalizations, emerging empirical generalizations, and future research. *Marketing Science*, 14 (3), part2, 212-221.
- Lieberman, M. and Montgomery, D. (1987). First mover advantages. *Strategic Management Journal*, Vol. 9, Nr.1.
- Lieberman, M. and Montgomery, D. (1998). First mover (dis)advantages: retrospective and link with the resource-based view. *Strategic Management Journal*, Vol. 19, Nr.12.
- Liebowitz, S. J. and Margolis, S. E. (1995). Path dependence, lock-in and history. *Journal of Law, Economics, and Organization*, 11, 205-226.
- Liebowitz, S.J. and Margolis, S.E. (1998). Path dependence. Entry in *The New Palgrave Dictionary of Economics and the Law*, MacMillan.
- Economides, N. (1996). Network externalities, complementarities, and invitations to enter. *European Journal of Political Economy*, Elsevier, vol. 12(2), 211-233.
- Schmalensee, R. (1981). Economies of scale and barriers to entry. *Journal of Political Economy*, 89(6), 1228-1238.
- Shinkai, T. (2000). Second mover disadvantages in a three-player Stackelberg game with private information. *Journal of Economic Theory*, 90, 293-304.
- Shankar, V., Carpenter, G.S. and Krishnamurthi, L. (199_). Late mover advantage: how innovative late entrants outsell pioneers. *Journal of Marketing research*, 35 (February), 54-70.
- Smith, J.M. (1974). The Theory of Games and Evolution in Animal Conflict. *Journal of Theoretical Biology*, 47, 209–221.

The “curse” of later entrants. L. Benzoni / Telecommunications Policy

- Spence, M. (1981). The Learning Curve and Competition. *Bell Journal of Economics*, 12, 49-70.
- Stackelberg, V. (1934). Marktform und Gleichgewicht. *Springer-Verlag*, 1934.
- Sung, N. (2005). The Determinants of Market Share for Mobile Telecommunications Operators. University of Seoul, Department of Economics, International Telecommunications Society, 16th European Regional Conference.
- Tellis, G.J. and Peter N. G. (1996). First to Market, First to Fail? The Real Causes of Enduring Market Leadership. *Sloan Management Review*, 37(2), 65-75.
- Telser, L.G. (1966). Cutthroat Competition and the Long Purse. *Journal of Law and Economics*, 9, 259-77.
- Tirole, J. (1988). *The theory of industrial organization*. MIT-press, Cambridge, Massachusett.
- WIK Consult, (2003). Stand des Schweizer telekommunikationsmarktes im internationalen Vergleich. *Studie im Auftrag von BAKOM, Biel, Schweiz, 30 April 2002, Korrigierte Fassung vom 24 February 2003*.
- Witt, U. (1997). 'Lock-in' vs. 'critical masses': Industrial change under network externalities. *International Journal of Industrial Organization* 15, 753-773.
- Wong, Ya-De T. (2003). Move over, first mover, a theoretical and empirical analysis of first-mover advantage in the Internet Economy. *Department of Economics, Stanford University*.
- Zhang, S and Markman, A.B. (1998). Overcoming the early entrant advantage : the role of alignable and nonalignable differences. *Journal of Marketing Research*, 35 (November), 413-426.