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Diffusion models of mobile telephony in Greece

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Abstract

This paper examines and presents the diffusion rate of mobile telephony subscriptions in Greece. Following the evaluation of the most widely used aggregate technology diffusion models (such as the Bass model, the Fisher–Pry model, the Gompertz models and some representatives of the logistic variants), it becomes evident that these S-shaped models are suitable enough for accurate fitting and forecasting the diffusion of mobile telephony. The analysis of the diffusion process in Greece provides some interesting aspects of mobile penetration such as the correlation between the diffusion speed and the number of competing operators as well as other socioeconomic and regulatory aspects. As a result of the estimation of 2G's diffusion process parameters, the potential market size and the analysis of the techniques for the appropriate model selection, this analysis can be considered as a means of providing an insight into the estimation of the diffusion shapes of the forthcoming generations of mobile telephony and telecommunication products and services in Greece and elsewhere.

Keywords: Mobile diffusion; Mobile telecommunications; Bass model; Gompertz model; Fisher–Pry model; Logistic models

1. Introduction

As mobile communications have experienced significant development during recent years, a considerable volume of research has been carried out with particular emphasis on their diffusion at national (Botelho & Pinto, 2004) as well as at international level (Fildes & Kumar, 2002; Gruber, 2005) Mobile services have faced rapid diffusion in Europe, as a result of technological change and governmental decisions and regulations, as well as competition at national level (Gruber, 2005). The study of the diffusion process of mobile services is of paramount importance in understanding the factors influencing further development of mobile networks towards the introduction of 3G/4G networks and the derived knowledge should be seriously taken into consideration for building appropriate strategic plans and for constructing the necessary supporting infrastructure.

Diffusion theory is a methodological approach used for estimating the adoption of technological innovations or other products or services. Corresponding models based on diffusion theory are of major importance for the determination of the product's expected life cycle and associated parameters such as maximum penetration. The cumulative diffusion shapes of innovations are often described by sigmoid patterns, the so-called S-shaped growth patterns. The early stages of a diffusion pattern are usually based on a

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number of early buyers (adopters). These initial adopters of the services are forming the ''critical mass'', which is of critical importance for the ''ignition'' of the diffusion process and, consequently, for the saturation level and the time it will be achieved. Innovators' decisions to adopt the service are independent from the decisions of the rest of the population. Apart from the innovators, there is another category of adopters, the imitators, who proceed to the adoption of the service, influenced by interaction with innovators (word-of-mouth) and by external influences such as mass media communication and other communication channels. Finally, the market reaches maturity, when the maximum number of adopters among the considered population is met (market saturation) (Mahajan, Muller, & Bass, 1990; Mahajan, Muller, & Srivastava, 1990).

Based on these concepts, the present work attempts to provide an insight concerning estimation and forecasting of the underlying mechanics of mobile telephony. Towards this goal, a number of diffusion models are employed in order to study their ability to capture diffusion process dynamics. The corresponding results provide an overview of the estimations for the referenced market's ultimate potential and can be considered as the lower and upper forecasting boundaries of the ultimate values that the studied diffusion process of mobile telephony in Greece is expected to reach. These aspects constitute the main functional utility of the present work.

2. Mobile telecommunications sector in Greece—market overview

The telecommunications market in Greece is regulated by the National Telecommunications and Post Commission (EETT, http://www.eett.gr), which was established in 1994, although it did not become actually operational until 1998. The corresponding Ministry for Transport and Communications (MTC) retains responsibility for drafting legislation.

As far as mobile telecommunications are concerned, it is worth mentioning that Greece is the only European country that did not have any analog cellular network (although it was proposed in the late 1980s) and was the first to award licences through a sealed bid auction procedure (Gruber, 2005). The first two GSM 900 licenses were awarded in August 1992 to Telecom Italia's STET (later TIM and from mid-2007 WIND) Hellas and Panafon (now Vodafone) for a $160 million fee each. They both started operating during the following year with an exclusivity period for all mobile telecommunications frequencies, including GSM 1800 services, until 2000.

Greece's incumbent fixed-line operator, OTE, was initially excluded from the bidding and this was unusual for Western Europe, as the incumbent fixed-line monopolist was typically given a GSM licence. OTE was awarded its own license no earlier than 1995 and through the establishment of a subsidiary, CosmOTE, which was launched over a GSM 1800 network in April 1998, in order to operate mobile services. OTE exercises its option for a *de facto* access to radio frequencies without any other competitive process like an auction or a beauty-contest. CosmOTE was very successful in catching up with the competitors and was the first example in Europe where a third entrant is able to become a market share leader so rapidly.

Following the considerable penetration of mobile services, additional frequencies at 1800 MHz were awarded to Vodafone-Panafon and STET Hellas, during May 2001 and additional frequencies in 900 GHz for CosmOTE. At this time, a 2G spectrum licence was awarded to a new entrant, Q-Telecom, which introduced its services in 2002. Q-Telecom operated as a mobile network operator (MNO) in Athens, but in the rest of the major cities in Greece, it provided services as a mobile virtual network operator (MVNO) through Vodafone's network, exploiting national roaming legislation.

In April 2004, CosmOTE launched i-mode wireless internet services, based on proprietary technology licensed from Japan's NTT DoCoMo. By the end of 2004, the service had 114,000 subscribers, corresponding to 2.7% of CosmOTE's subscriber base.

The current state of the Greek telecommunications market reveals that growth of 2G services was limited during the years (2004–2005) as saturation was almost met. This can be also supported by the fact that new subscriptions during 2004 represented a year-to-year growth of 6.4%, against 13.1% in 2003 and 14.1% in 2002. Even though Q-Telecom was the fourth ranked provider, it turned out to be a major player in the market affecting growth positively. It managed to collect more than half of the new subscriptions in the year 2004, recording a growth of 96% as compared to 2003.