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Modeling innovation diffusion patterns

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Chapter 1

Introduction

The understanding of the diffusion process of new products is a key factor in the strategic planning of a company and, as such, justifies the amount of contributions from different fields, such as Industrial Economics, Strategic Management and Marketing. In fact, the diffusion process can well prevail over the innovation itself, since its economic and social impact is generated by adopters of the innovation, and hence it becomes an important stimulus for new innovations. Interest in the performance of innovations in the marketplace has generated many studies in an attempt to design a model of the spread of an innovation at the aggregated level over time (Mahajan and Muller, 1979).

The diffusion of an innovation is defined as the process through which the innovation “*is communicated through certain channels over time among the members of a social system*” (Rogers, 1983, p.5). Although diffusion is directly or indirectly affected by many different factors (such as the type of innovation, communication channels, either inter-personal and/or mass-media, the type of social system and time), the notion of diffusion is essentially a form of communication. That is, diffusion has to be considered as the propagation of messages related to new ideas that lead to subsequent innovations (products, processes, technology, etc.), with an expectation of change in receptor behavior, which will be evident in the adoption or the rejection of the innovation. Firms know that new products shape their future. Consumer-products firms churned out 31,000 new products in 2000 (Kotler, 2003). However, new products fail at a disturbing rate. Mahajan, Muller and Wind (2000) point out that the failure rates of new products are between 40 and 90%. Therefore, managers are interested in understanding the sales growth of innovations introduced in the market as well as the aspects that affect it. This implies understanding the diffusion process of innovations.

The underlying behavioral theory suggests that a time-lag exists during the adoption period among the different members of a social system. In the first stage of

the diffusion process, the new product is discovered and adopted by a small group of innovative consumers, known as innovators who, with time, begin to influence others, known as imitators. This social interaction between adopting pioneers and potential adopters explains the phase of rapid expansion in the diffusion process (Rogers, 1983). Taking into account this underlying innovation behavior, most researchers have tried to model the diffusion process of innovations through mathematical expressions; specifically, they have found an important area of knowledge around innovation diffusion models. Since firms are continually introducing new products in the marketplace and given the complexity and risk inherent in decisions on innovation management, diffusion models can be useful tools for managers to reduce the risk inherent in the introduction of an innovation.

Diffusion models in marketing have a main representative, the Bass (1969) model. Although the Bass model has a large acceptance in the literature on the diffusion of innovations, the assumptions on which this model is based limit its applicability. Researchers interested in the diffusion of innovations try to relax these limitations through modifications of the model. Furthermore, although the Bass model was intended for consumer durable innovations and the majority of its applications are on this kind of innovation, several researchers are demonstrating its applicability to other innovations (such as frequently purchased consumer products or services). However, more research is needed in that direction to consolidate the Bass model and its extensions as useful tools to understand the diffusion processes of different kinds of innovations in different settings.

1.1. Contribution of this research

The aim of our research is to contribute to the methodological and substantive evolution of diffusion models toward a better understanding of their application potential. In particular, we consolidate the convenience of using diffusion models to understand the diffusion process of any innovation (consumer products, services, organizational innovations, etc.), and extend diffusion models to accommodate effects that are not present in many of the existing models (such as marketing variables or repeat purchases).

Although most diffusion studies concentrate on new durable consumer products (such as blenders, calculators, clothes dryers, dishwashers, freezers, irons, microwave ovens or color and black and white TVs), we need to increase our knowledge on other innovation types. The enlargement of the traditional applications (consumer durables) of the diffusion models in marketing (especially Bass-type models) usually implies the relaxation of some of the mentioned restrictive assumptions through an extended diffusion model that accounts for specific details. The managers involved in the introduction of new products in the markets are interested in both useful tools to help

them to reduce the uncertainty inherent in innovation decisions and useful information on the performance of similar innovations in similar situations or contexts. The useful tools are the diffusion models extended to account for specific details and the useful information comes from the findings of research on different innovations in different markets or countries.

In this thesis we present applications in which we propose several specifications for diffusion models that relax some of the restrictive assumptions on which the classical models are based. The proposed extensions reduce the rigidity of this model type and bring them closer to reality. Specifically, we address three empirical applications where extended diffusion models are analyzed and innovations other than durable consumer products are considered. In the first application we focus on movies, which are entertainment and experience consumer products. In the second application, we study the diffusion of an organizational innovation, namely franchising. Finally, in the third application, we study the diffusion of several brands of prescription drugs, which are frequently purchased consumer products.

1.2. Study outline

Chapter 2, *Diffusion of innovations: Theoretical considerations*, is dedicated to theoretical issues concerning the diffusion of innovations. We present the origins of research on diffusion modeling, the value of the diffusion models in both the academic and business context. We introduce the market segments commonly considered in the diffusion process of innovations, the mathematical specification of a diffusion model and the terminology that is used in the remainder of this thesis. The last section of the chapter is dedicated to the assumptions -limitations- of the classical diffusion models. We review and discuss the body of research of diffusion models that relax these assumptions.

Chapter 3, *An introduction to three empirical applications*, outlines the empirical analyses developed in this thesis and specifies their characteristics regarding the type of innovation, the decision maker, the assumptions relaxed through the extended diffusion models and the country analyzed. In this short chapter we justify why we propose several extended diffusion models and their applications on the three studies presented in each of the following chapters.

In Chapter 4, *Diffusion of movies in neighboring Mediterranean countries*, we extend the Bass model by accommodating for distribution. This extension is especially relevant since this marketing decision variable is rarely incorporated and hence more research on the influence of this variable in the diffusion models is needed. Furthermore, this extension is also convenient, especially for the product analyzed, given that previous research on movies finds that distribution (i.e. the number of screens on which a movie is released) is the most important influence on

viewership among other factors (such as movie attributes such as genre or presence/absence of stars). We use diffusion models to analyze differences in the diffusion process of movies in several countries that are geographically close. Differences in revealed preferences and differences in the moment of entry in these countries are investigated. The understanding of the diffusion process of a new product in a specific geographical area (region or country) is obviously relevant and has clear implications to managers when planning the introduction of the new product (or another movie with similar characteristics) in another geographical area.

In Chapter 5, *Diffusion of franchising in Spain*, we analyze the diffusion process of an organizational innovation, namely franchising. This analysis presents a double interest for both managers and researchers. Firstly, there are no previous studies that analyze the diffusion of franchising among firms as an organizational innovation from the point of view of the franchisors (i.e. inter-firm diffusion). The extraordinary expansion of this managerial organization system has created thousands of jobs and has generated a turnover of millions of euros, which indicates the importance of franchising for managers and, in general, for the countries. Secondly, the use of the classical diffusion models to understand the diffusion process of organizational innovations that starts in the early 80's with the studies of Teece (1980) and Thompson (1983) on the multidivisional form structure and that of Antonelli (1985) on International Data Telecommunications, suffers a set back when Mahajan, Sharma and Bettis (1988) question the imitation hypothesis behind the classical diffusion models, for organizational innovations. Our study shows the suitability of the imitation hypothesis in the diffusion of franchising as an organizational innovation.

In Chapter 6, *Diffusion of prescription drugs in the United States of America*, we use diffusion modeling to investigate longitudinal and cross-sectional effects of marketing expenditures on the diffusion of new pharmaceuticals. The pharmaceutical industry is the most profitable industry in the USA for each of the ten years before 2002. The pharmaceutical industry spends billions of dollars on marketing. Diffusion models can be valuable tools to help managers to analyze the role of pharma marketing in the introduction of new drugs in the market. Hence, the classical diffusion models are not appropriate in this setting. We look for a diffusion model that differentiates between the trial and repeat rates of the new drugs and that also explicitly accounts for marketing variables.

Finally, in Chapter 7, *Summary and discussion*, we provide a summary of the results of this thesis. We present the conclusions and contributions of the thesis and discuss limitations and directions for future research.