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## Modeling innovation diffusion patterns

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## Chapter 5

### Diffusion of franchising in Spain

#### 5.1. Introduction

In this study we consider the diffusion of an organizational innovation, namely franchising. This organizational form creates thousands of jobs and generates a turnover of millions of euros. In Spain provisional data for 2004 puts the level of turnover at 15,017 million euros and the jobs (directly and indirectly) generated at 309,000 (Franquiciashoy, 2004). These figures reveal the importance of franchising for managers in Spain.

In this study we consider the diffusion of franchising as an organizational innovation and hence, we focus on the innovation at the level of the firm. We use diffusion modeling to analyze the diffusion of franchising among firms as an organizational innovation from the point of view of the franchisors. Although there are previous studies, such as Nevers (1972), that analyze the diffusion of franchising at the franchisee level (i.e. intra-firm diffusion), there are no previous studies at the franchisor level (i.e. inter-firm diffusion). The adoption of an innovation at the level of the firm is conceived as a means of changing an organization either as a response to changes in the external environment or as an anticipatory action to influence the environment (Damanpour, 1991, 1996; Waarts, Van Everdingen and Van Hillegersberg, 2002).

Any firm that intends to survive must submit itself to a process of evolution directing its efforts not only to the development of new products (goods or services), but also to the renovation of its organizational form, namely organizational innovation<sup>1</sup>. The implementation of organizational innovations often implies important changes in functions, tasks, responsibilities, systems and cultures that are difficult to understand and to apply (Mahajan, Sharma and Bettis, 1988; Meyers, Sivakumar and Nakata, 1999). Examples of organizational innovations are

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<sup>1</sup> See Damanpour (1991), Wolfe (1994), Gatignon, Tushman, Smith and Anderson (2002) for research on and contributions to organizational innovations.

the creation of subsidiaries, new divisions, joint ventures, partnerships and franchising. We define franchising as “a system of commercialization of products and/or services and/or technologies based on a close collaboration among companies that are legally and economically different and independent, the franchisor and his/her individual franchisees. The franchisor gives his/her franchisees the right, and imposes the obligation of exploiting a firm in conformity with the franchisor’s concept. The right given authorizes and obliges the franchisee, in exchange for a direct or indirect financial contribution, to use the trademark of the products and/or services, the “know-how” and the rest of the rights of intellectual property, sustained by the continuous benefit of commercial and/or technical attendance within the frame and along the time of the written contract of franchise” (Deontological European Code of Franchising). The contracts of franchise are identified in literature as hybrid forms of economical organization (Rubin, 1978; Mathewson and Winter, 1985; Norton, 1988).

In this study we apply diffusion models to analyze the diffusion of franchising, as organizational innovation, in Spain during the period 1974-1999. We follow a 4-steps procedure. First, we briefly review diffusion models that have been developed in marketing. Then we discuss examples of studies that consider the diffusion of organizational innovations<sup>2</sup>. We use two sets of models to obtain an appropriate description of the diffusion process of franchising. The first set of models is used to test whether imitation in the adoption of franchising is structural or random<sup>3</sup>. In this respect we follow Mahajan, Sharma and Bettis (1988) who, focusing on organizational innovations, question the imitation hypothesis behind the classical diffusion models. The second set of models is used to select the most appropriate diffusion model given that there is imitation and that the imitation is not random. We introduce the data and provide empirical evidence for an appropriate model to analyze the diffusion process of franchising in Spain. Finally, the outcomes are interpreted and discussed.

## 5.2. Modeling the diffusion of innovations

Diffusion models describe the spread of an innovation among a set of prospective adopters over time. A diffusion model depicts successive increases in

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<sup>2</sup> Despite the wide application of diffusion models to consumer innovations, their use in industrial/business settings is very limited (Kahn, 2002).

<sup>3</sup> When we say “random”, we mean that it is not possible to find a mathematical specification to explain imitation behavior because only randomness can explain it. However, we use “structural” to show that this mathematical specification can be found.

the number of adopters and predicts the continued development of a diffusion process (Mahajan, Muller and Bass, 1993).

We start from the diffusion model proposed by Bass (1969). It is the most parsimonious aggregated diffusion model suggested in the marketing literature (Parker, 1994) and the most accepted in the field of diffusion of innovations<sup>4</sup>. It can be specified as:

$$n(t) = \frac{dN(t)}{dt} = \beta_1 [M - N(t)] + \beta_2 \frac{N(t)}{M} [M - N(t)] \quad (5.1)$$

where  $N(t)$  is the cumulative number of adopters at time  $t$ ,  $M$  is the total number of potential adopters (e.g., consumers or firms -agents- who ultimately adopt),  $n(t)$  is the non-cumulative number of adopters at time  $t$ ,  $\beta_1$  represents the influence of a “change agent” in the diffusion process, which may capture any influence other than that from previous adopters (innovative behavior), and  $\beta_2$  can be interpreted as the word-of-mouth effect of previous adopters upon potential adopters (imitating behavior).

The first term in Equation (5.1) represents adoptions that are not influenced by the number of effective adopters. The second term represents adoptions that are influenced by the number of previous adopters. This model is a mixed influence model. An increase in  $N(t)$  is modeled as the sum of two terms, each having its own interpretation. For  $\beta_1 = 0$  we have the internal influence model or the Mansfield (1961) model, which does not account for external influence. For  $\beta_2 = 0$ , we have the external influence model or the Coleman (1966) model.

Although both the parameters  $\beta_1$  ( $\beta_1 \geq 0$ ) and  $\beta_2$  ( $\beta_2 \geq 0$ ) affect the shape of the diffusion curve, their impact is different. The parameter  $\beta_1$  affects mainly the intercept of the model and, therefore, the necessary time to reach the maximum number of adoptions. Thus, the larger  $\beta_1$  is, the sooner this moment arrives. The parameter  $\beta_2$  affects mainly the magnitude of adoptions per period; so the larger  $\beta_2$  ( $\beta_2 \geq 0$ ) is, the greater the number of adoptions will be. Apart from being positive, it is expected that  $\beta_1 < \beta_2$ , reflecting that the forces behind the innovating behavior are of less intensity than the ones behind the imitating behavior: see also Figure 5.1.

<sup>4</sup> See also Sultan, Farley and Lehmann (1990) and Mahajan, Muller and Bass (1993).

Figure 5.1.  
The incremental effect of the coefficients  $\beta_1$  and  $\beta_2$  on diffusion curves,  
holding others in the model constant

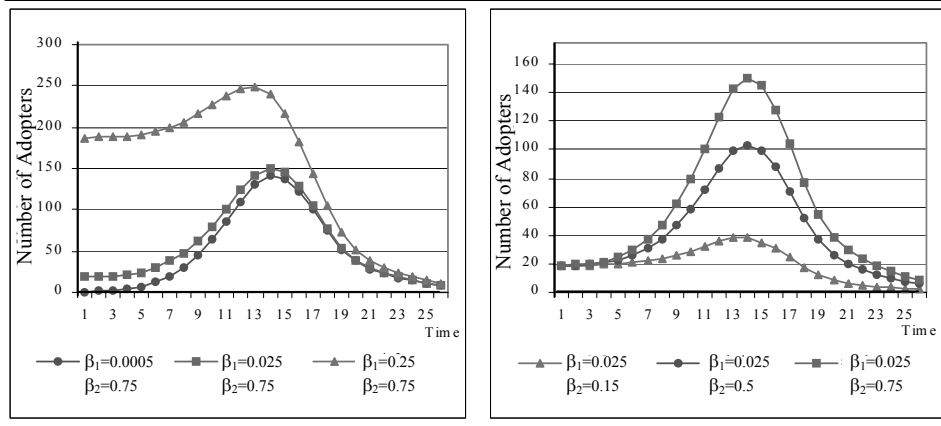


Figure 5.1 starts at  $t=1$

There are several refinements and extensions of the Bass diffusion model<sup>5</sup>. Jeuland (1981) proposes a mixed influence model in which the effective potential market,  $[M-N(t)]$ , obtains an exponent:  $\beta_3$  ( $\beta_3 \geq 0$ ), where  $\beta_3$  accounts for the heterogeneity of the population of potential adopters. The parameter allows for differences among adopters in their propensities to adopt an innovation. When adopters are firms, these differences are referred to objectives, strategies, abilities to change, and so on. Hence we get:

$$n(t) = \frac{dN(t)}{dt} = \left( \beta_1 + \beta_2 \frac{N(t)}{M} \right) [M - N(t)]^{(1+\beta_3)} \tag{5.2}$$

The incorporation of the parameter  $\beta_3$  affects both the external and the internal influence. That is,

$$\beta_i(t) = \beta_i [M - N(t)]^{\beta_3}, \quad i = 1, 2 \tag{5.3}$$

where  $\beta_1(t)$  and  $\beta_2(t)$  represent the external and the internal influence, respectively. The  $\beta_i(t)$  change over time in this way. As

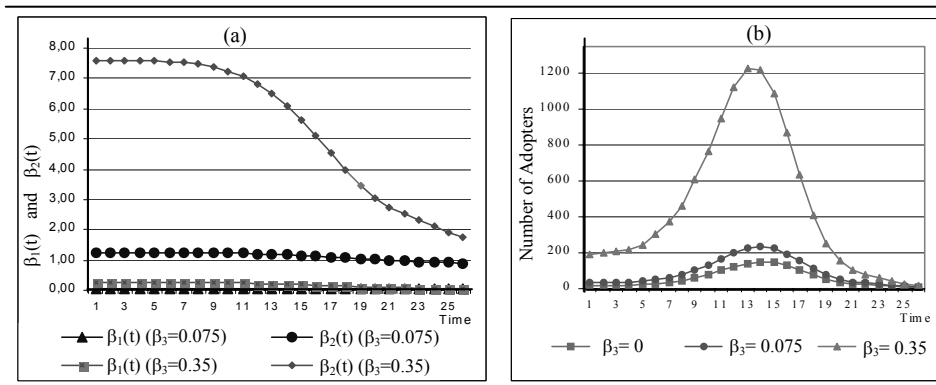
$\left[ \frac{d\beta_i(t)}{dN(t)} \right] = -\beta_i \beta_3 [M - N(t)]^{\beta_3-1} < 0$  with  $i = 1, 2$  and  $\beta_3 > 0$ ,  $\beta_1(t)$  and  $\beta_2(t)$  will decrease in the passage of time (see Figure 5.2a). Furthermore, the larger  $\beta_3$  is, the

<sup>5</sup> See also Mahajan, Muller and Bass (1993), Parker (1993), Mahajan, Muller and Wind (2000).

sooner the time to peak arrives and the larger the number of adoptions will be. This is illustrated in Figure 5.2b for different values of  $\beta_3$ .

Figure 5.2.

- (a) The time-varying coefficients of external,  $\beta_1(t)$ , and internal,  $\beta_2(t)$ , influence (Assumption:  $\beta_1=0.025$  and  $\beta_2=0.75$ ).
- (b) Effect of the coefficient of heterogeneity,  $\beta_3$ , on diffusion curves.



Figures 2a and 2b start at  $t=1$

Easingwood, Mahajan and Muller (1981, 1983) developed models in which the impact of the word-of-mouth effect on potential adopters is flexible and may increase, decrease or remain constant over time. The Non-Uniform Influence Innovation Diffusion model (NUI) of Easingwood, Mahajan and Muller (1983) is a mixed influence model where the parameter of internal influence systematically varies over time as a function of penetration level. That is,

$$\beta_2(t) = \beta_2 \left[ \frac{N(t)}{M} \right]^{\beta_4} \tag{5.4}$$

where  $\beta_4$  ( $\beta_4 \geq -1$ ) is the parameter of non-uniform influence. Substituting  $\beta_2$  for  $\beta_2(t)$  in Equation (5.1), and then Equation (5.4) into Equation (5.1) we get

$$n(t) = \frac{dN(t)}{M} = \left[ \beta_1 + \beta_2 \left( \frac{N(t)}{M} \right)^{(1+\beta_4)} \right] [M - N(t)]. \tag{5.5}$$

In the Non-Symmetric Responding Logistic model (NSRL) of Easingwood, Mahajan and Muller (1981) the parameter of external influence ( $\beta_1$ ) is zero. We may have two different situations:

(i) If  $-1 < \beta_4 < 0$ ,  $\beta_2(t)$  will fall with the passage of time ( $\frac{d\beta_2(t)}{dN(t)} = \frac{\beta_2\beta_4}{M} \left[ \frac{N(t)}{M} \right]^{\beta_4-1} < 0$ ) and the speed of the diffusion process will

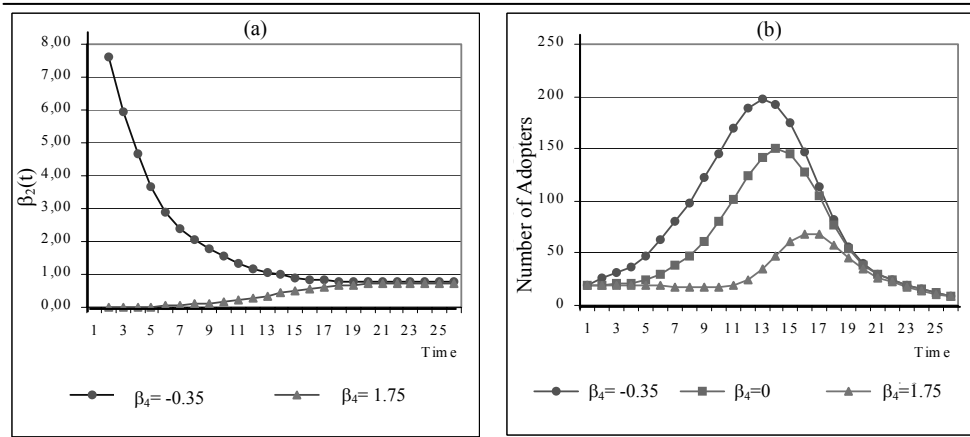
accelerate. As we can see in Figure 3a, the passage of time reduces  $\beta_2(t)$ , accelerating the diffusion process and showing a diffusion curve slanted towards the left: see Figure 5.3b.

(ii) If  $\beta_4 > 0$ ,  $\beta_2(t)$  will grow with the passage of time ( $\frac{d\beta_2(t)}{dN(t)} = \frac{\beta_2\beta_4}{M} \left[ \frac{N(t)}{M} \right]^{\beta_4-1} > 0$ ) and the speed of the diffusion process will reduce.

As we can see in Figure 3a, the passage of time increases  $\beta_2(t)$ , decelerating the diffusion process and showing a diffusion curve slanted towards the right: see Figure 5.3b.

Figure 5.3.

- (a) The time-varying word-of-mouth effect,  $\beta_2(t)$  (Assumption:  $\beta_1=0.025$  and  $\beta_2=0.75$ ).
- (b) Effect of the nonuniform influence coefficient,  $\beta_4$ , on diffusion curves.



Figures 5.3a and 5.3b start at  $t=1$

There are extensions of the Bass model that specify the potential market as a function of relevant variables that affect the potential market. Examples of these variables are the growth in the number of households (Mahajan and Peterson, 1978; Sharif and Ramanathan, 1981; Parker, 1993), price (Kamakura and Balasubramanian, 1988; Jain and Rao, 1990), number of retail outlets where the (new) product is available (Jones and Ritz, 1991), and so on.

The models shown in Equations (5.1), (5.2), (5.5), the NSRL model and their counterparts with a dynamic potential market,  $M(t)$ , are nested in the following model (Parker, 1993):

$$n(t) = \frac{dN(t)}{dt} = \left( \beta_1 + \beta_2 \left( \frac{N(t)}{M(t)} \right)^{(1+\beta_4)} \right) [M(t) - N(t)]^{(1+\beta_3)}. \quad (5.6)$$

Table 5.1 summarizes these models. We return to these models in Section 5.

Table 5.1.  
Summary table.

Reference	Model equation	Applications
<i>Naïve model</i>		
Bass model (1969)	$n(t) = \left( \beta_1 + \beta_2 \left( \frac{N(t)}{M} \right) \right) [M - N(t)]$	Consumer durables
<i>Extension to...</i>		
<i>...Heterogeneity</i>		
Jeuland (1981)	$n(t) = \left( \beta_1 + \beta_2 \left( \frac{N(t)}{M} \right) \right) [M - N(t)]^{(1+\beta_3)}$	Consumer durables
<i>...Non-uniform Influence</i>		
Easingwood, Mahajan and Muller -NSRL- (1981)	$n(t) = \left( \beta_2 \left( \frac{N(t)}{M} \right)^{(1+\beta_4)} \right) [M - N(t)]$	Medical innovations
Easingwood, Mahajan and Muller -NUI- (1983)	$n(t) = \left( \beta_1 + \beta_2 \left( \frac{N(t)}{M} \right)^{(1+\beta_4)} \right) [M - N(t)]$	Consumer durables
<i>...Heterogeneity and Non-uniform Influence</i>		
Parker (1993)	$n(t) = \left( \beta_1 + \beta_2 \left( \frac{N(t)}{M} \right)^{(1+\beta_4)} \right) [M - N(t)]^{(1+\beta_3)}$	Consumer durables

### 5.3. Diffusion of organizational innovations

The diffusion models discussed in the previous section refer to diffusions of consumer durables. The study of the diffusion of organizational innovations has its origins in the 1980s, with the studies of Teece (1980), Thompson (1983), Antonelli



(1985) and Mahajan, Sharma and Bettis (1988). With the exception of Antonelli (1985), these authors base their studies on the multidivisional form structure (M-Form). Antonelli (1985) analyses the diffusion of International Data Telecommunications (IDT).

Teece (1980) applies the diffusion model of internal influence of Mansfield (1961). His study allows him to conclude that the innovation analyzed is subjected to a diffusion process that follows a logistic function similar to that described by the diffusion of certain technological innovations.

Thompson (1983) applies different functional forms to the adoption data of organizational innovation. He calibrated a cumulative normal, a logarithmic reciprocal, a cumulated log-normal and a logistic model. The results show the superiority of the logistic model and indicate that the model of internal influence (based on contagion) is appropriated in this context.

Antonelli (1985) analyses the structural and technological determinants of the diffusion of IDT (intra-firm and inter-firm) seen by him as an important innovation both technologically and organizationally. Insofar as this innovation implies changes in the organizational structure of the firm, this study is characterized in the area of the diffusion of business organizational innovations.

The imitation hypothesis has been accepted in many studies on the diffusion of organizational innovations; compare e.g. Mansfield (1961, 1963), Romeo (1975, 1977), Teece (1980), Thompson (1983), Hannan and McDowel (1984). Mahajan, Sharma and Bettis (1988), however, question its validity. The imitation hypothesis maintains that the ratio of inter-firm diffusion is governed by imitative behavior between adopters and non-adopters. Mahajan, Sharma and Bettis re-examine the imitation hypothesis and compare the models of Coleman (Coleman, Katz and Menzel, 1966) (exponential), Mansfield (1961) (S-type), Bass (1969) (S-type) and the square form (S-type) with a random walk process. Their results question the suitability of the imitation hypothesis, as it can not reject the hypothesis that the adoption of the organizational innovation analyzed is a random walk process.

In this study we analyze franchising as an organizational innovation. Franchising has its origins in the automobile industry in the United States in 1929, when the *General Motors* Company constructed the first franchise contract. Also, in the same year, in the textile sector in France, the wool factory *La Lainière de Roubaix* became the pioneer in franchising contracts in Europe when it opened the franchisee shops *Pingouin*. The real development in Europe starts in the 1970s along with the economic crisis originated by the petrol crisis in 1973. Although, the franchising system appears in the 1950s in Spain [*Rodier* in 1957, *Spar Española* in 1959, *Pingouin Esmeralda* in 1961, *Prenatal* in 1963 (Casa and Casabo, 1989)],

it is from 1974 that franchising is gradually adopted by Spanish firms<sup>6</sup>. A slow diffusion process for this organizational innovation can be expected given the large numbers of organizational possibilities (Cheung, 1969; Rubin, 1978; Mariti and Smiley, 1983; Mathewson and Winter, 1985; Norton, 1988) and the late legal regulation of franchising in Spain<sup>7</sup>.

The data provided by the Spanish Association of Franchisors demonstrate that between 1997 and 1999 there is an increase of more than 26 percent in the number of franchisors, reaching a total of 529 franchisors in 1999. That accounts for more than 23,000 franchisees and has created more than 93,000 jobs (directly and indirectly) generating a turnover in excess than 4,207 million euros. These figures show the extraordinary expansion of this managerial organization. The increasing number of attendants (expositors and visitors) at franchising fairs in Spain confirms the higher level of interest emerging from Spanish managers for this managerial mode<sup>8</sup>. It reveals how the Spanish companies<sup>9</sup> have considered changing their organizational structure in connection with the distribution of their products by means of franchising. Franchising has become the preferred option of business growth for many companies vis-à-vis opposed to other business alternatives (Fulop and Forward, 1997). The organizational benefits brought by franchising to the adopting company contribute to improvements in management and to distribution channels. We know that franchising is a mechanism that reduces the divergence of interest between the parties (franchisor and franchisee), reducing agency problems

<sup>6</sup> There is not a left censoring problem in our data given that: the study period starts in 1974, since although we only know of a few firms using this innovation in a sporadic manner as mentioned before; it is from 1974 that the innovation is, in fact, gradually introduced in Spain.

<sup>7</sup> The first steps towards elaborating specific regulation of franchising in Spain happened in 1996. Article 62 from Law 7/1996, January 15th, about Retailing Business Regulation, referring to the commercial activity in franchising was something new in the Spanish Law. This article opens the regulation development of the basic conditions for franchising, as well as the creation of the Register of Franchisors. Before this law, we had on one side the Regulation of the Commission of the EEC n° 4087/88, November 30th 1988, related to the application of point 3 of the article 85 from the Treaty Franchising Contracts, which went into effect on February 1st 1989; and on the other side, the European Code of Franchising applicable in Spain went into effect January 1st 1991, and it was assumed by Spanish Association of Franchisors.

<sup>8</sup> El Salón Internacional de la Franquicia (SIF) – considered the most important fair of the world of franchise-, was created in 1990 with 65 expositors and 3,282 visitors, and reaches 398 expositors and 30,225 visitors in its 1999-edition.

<sup>9</sup> There is not a specific type of company interested in franchising, we can find franchisors in different sectors of activity, such as: Food; Gifts, Decorations and Furniture; Second Hand Goods; Audio, Music, Video, Photography and Optics; Clothing, Fashion and Accessories, Sports; Cosmetics, Perfumery; Diet and medicines; Computers; Gardening, DIY, Hardware and Pets; Jewellery; Stationary; Leisure and Entertainment Goods; Catering, Restaurants, Bakers, Cake Makers and Ice Cream Bars; Services includes: Travel Agents; Estate Agents; Business Advisors and services to companies and/or individuals; Cars sector; Printing and Sign Making; Cleaning and Repair of Clothing; Cleaning and Restoration of Buildings; Leisure; Recycling; Telecommunications; Transport and Deliveries; Health and Beauty Treatments; Vending.

and allowing the possibility of reaching common goals, such as the maximization of the present value of the franchised unit. The franchisee, as a business person invests resources in the business, allowing the franchising company access to the resources necessary for expansion. Large companies can also benefit through franchising from the flexibility of small businesses. As franchisees own the residual rights, they put maximum effort into sales, cost control, quality management and provide a high level of customer service. The franchising company's control over the compliance of business directives by the franchisees is clearly defined through the contractual agreements between the franchisor and the franchisee. Therefore, without the franchisee losing autonomy, the franchising company is assured of a high level of organizational and operative control over its business units. This characteristic of franchising allows the establishment and maintenance of certain corporative standards that would be more difficult to achieve under a system of decentralized distribution (through intermediaries outside the franchising system as distributors or licensees) (Mendelsohn, 1992). As pointed out by Kaufmann (1996, p.5): *“there is strong theoretical support for franchising as an optimal organizational form. Given the correct set of contextual variables, franchising can take advantage of both economies of small scale (solving incentives issues) and economies of large scale (by combining and leveraging system-wide resources) at the same time”*.

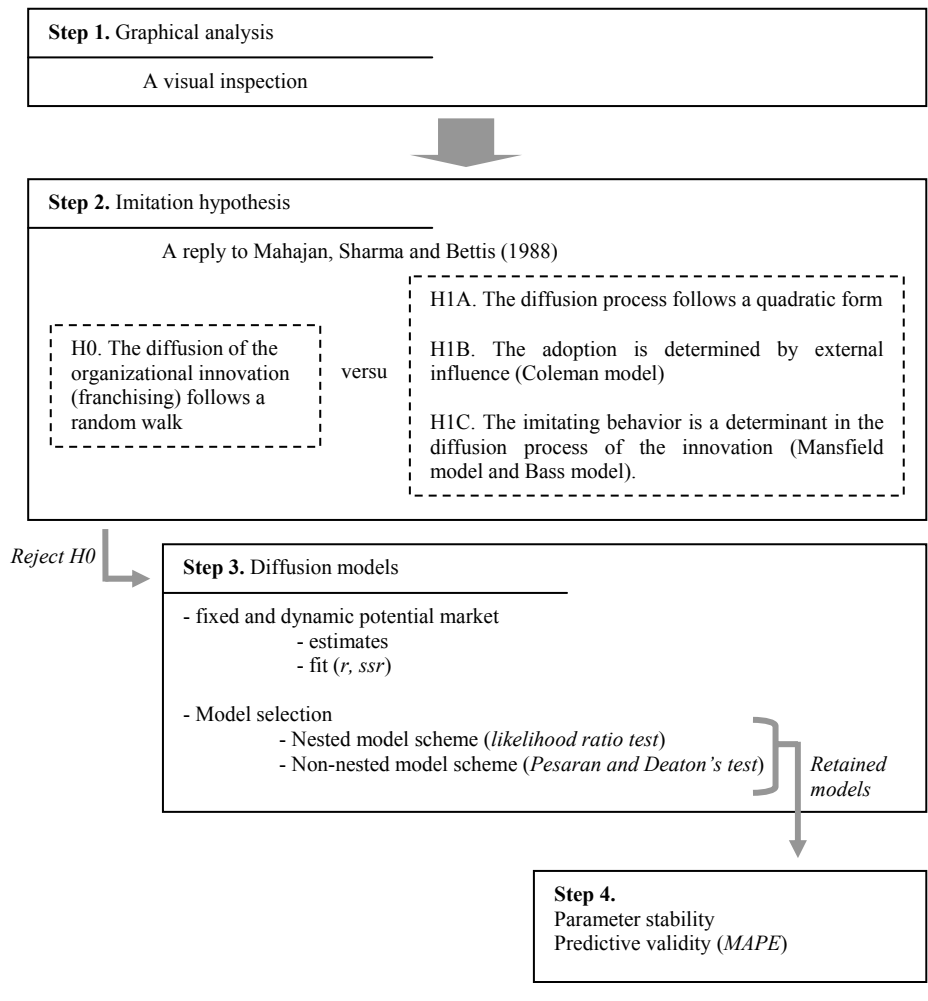
#### **5.4. Methodology**

The methodology that we propose consists of four steps (see Figure 5.4): (1) a graphical analysis of the diffusion curve; (2) a test to conclude whether there is imitation or not; (3) the selection of one or more diffusion models given that there is imitation; and (4) the ultimate choice of the most appropriate diffusion model using stability and predictive validity measures.

Graphical analysis of the adoption data indicates whether it is convenient to carry out an analysis of diffusion (employing diffusion models). Before selecting the most appropriate diffusion model, we have to demonstrate that the forces of adopter's behavior (innovative and imitating behavior), and not only randomness govern this diffusion process. Otherwise the employment of diffusion models (or any model) has no sense. For that reason we include step 2.

Steps 1 and 4 speak for themselves. In this section we discuss steps 2 and 3 in more detail.

Figure 5.4.  
Steps of the empirical analysis.



Step 2: Convenience of the hypothesis of imitation

We first test whether there is an imitation process or not<sup>10</sup>. In this respect we follow Mahajan, Sharma and Bettis (1988) who test the null hypothesis: the diffusion is a random walk vis-à-vis alternative hypotheses (H1A, H1B and H1C).

If the diffusion of an (organizational) innovation follows a random walk, we have

$$H0. \quad x(t) = x(t-1) + u(t) \quad (5.7)$$

where  $x(t) = N(t) - N(t-1)$  is the number of adopters in period  $t$ ,  $N(t)$  is the cumulative number of adopters at time  $t$  and  $u(t)$  is a disturbance term with zero mean, which is not correlated with  $u(t-k) \quad \forall k \neq 0$ .

Remark: we now use  $x(t)$  instead of  $n(t)$  where  $x(t)$  is the number of adopters in period  $t$ , and  $n(t)$  is the non-cumulative number of adopters at  $t$ . Hence we now use difference equations instead of differential equations.

The alternative hypotheses assume that:

H1A. The diffusion process follows a quadratic form;

H1B. The adoption is determined by external influence (Coleman model);

H1C. The imitating behavior is a determinant in the diffusion process of an innovation (Mansfield model and Bass model).

If we assume that the diffusion process follows a quadratic form we have

$$H1A. \quad x(t) = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + v(t) \quad (5.8)$$

where  $\alpha_1 > 0$ ,  $\alpha_2 < 0$  and  $v(t)$  is a disturbance term. Equation (5.8) can be rewritten by subtracting  $x(t-1)$  from  $x(t)$ . Hence we get:

$$H1A. \quad x(t) = \lambda_0 + \lambda_1 t + \lambda_2 x(t-1) + v(t) \quad (5.9)$$

where  $\lambda_0 = (\alpha_1 - \alpha_2) > 0$ ,  $\lambda_1 = 2\alpha_2 < 0$ ,  $\lambda_2 = 1$  and  $v(t)$  is a disturbance term.

If we reformulate Equation (5.1) with  $\beta_2 = 0$  as a difference equation, we get:

$$H1B. \quad x(t) = \lambda_2 x(t-1) + w(t) \quad (5.10)$$

where  $\lambda_2 = (1 - \beta_1) < 1$  and  $w(t)$  is a disturbance term.

We consider two alternative specifications that account for adoptions caused by imitation viz. the Mansfield model -Equation (5.1) with  $\beta_1 = 0$ - and the Bass model -Equation (5.1)-:

$$H1C. \quad \text{Mansfield:} \quad \frac{dN(t)}{dt} = \beta_2 \frac{N(t)}{M} [M - N(t)] \quad (5.11)$$

$$\text{Bass:} \quad \frac{dN(t)}{dt} = \left( \beta_1 + \beta_2 \frac{N(t)}{M} \right) [M - N(t)]. \quad (5.12)$$

<sup>10</sup> Imitation, sociocontagion or word-of-mouth has been found to be the most important factor that characterizes the diffusion process of an innovation (Bass, 1969; Moore, 1995; Kumar and Krishnan, 2002).

These models are rewritten as:

$$x(t) = \lambda_2 x(t-1) + \lambda_3 NN(t-1) + \varepsilon(t) \tag{5.13}$$

where  $\lambda_2 > 1$ ,  $\lambda_3 < 0$ ,  $NN(t-1) = N(t-1)^2 - N(t-2)^2$  and  $\varepsilon(t)$  is a disturbance term. In the Mansfield model  $\beta_1 = 0$ ,  $\beta_2 > 0 \Rightarrow \lambda_2 = (\beta_2 + 1) > 1$  and  $\lambda_3 = (-\beta_2/M) < 0$ , and in the Bass model  $\beta_1 > 0$ ,  $\beta_2 > 0$  and  $\beta_1 \gg \beta_2$  and hence  $\lambda_2 = (\beta_2 - \beta_1 + 1) > 1$  and  $\lambda_3 = (-\beta_2/M) < 0$ .

Table 5.2 summarizes the null and alternative hypotheses.

Table 5.2.  
Convenience of the hypothesis of imitation

Hypothesis	Equivalencies between the parameters of the models and the parameters of the similar regressions	Expected signs and values of the parameters				Values of the parameters to accept H <sub>0</sub>
		$\lambda_0$	$\lambda_1$	$\lambda_2$	$\lambda_3$	
H0				1		
H1A	$\lambda_0 = \alpha_1 - \alpha_2$ $\lambda_1 = 2\alpha_2$ $\lambda_2 = 1$	>0	<0	1		$\lambda_0 = 0, \lambda_1 = 0$
H1B	$\lambda_2 = (1 - \beta_1)$			<1		$\lambda_2 = 1$
H1C	<i>Mansfield model:</i> $\lambda_2 = 1 + \beta_2$ $\lambda_3 = -(\beta_2/M)$ <i>Bass model:</i> $\lambda_2 = 1 + \beta_2 - \beta_1$ $\lambda_3 = -(\beta_1/M)$			>1	<0	$\lambda_2 = 1, \lambda_3 = 0$

*Step 3: Selection of a diffusion model given that there is imitation*

We consider eight diffusion models with a fixed potential market:  $M(t) = M$ . These models are specified in Table 5.3. The models are well-known diffusion models, except models “3” and “6”, which are combinations of existing models. Model “1” coincides with the model of Parker (1993). Model “2” is the NUI model -Equation (5.5)-, model “4” the Jeuland model -Equation (5.2)-, model “5” the NSRL model, model “7” the Bass model -Equation (5.1)- and model “8” is the Mansfield model. Models “1”-“8” all have their counterparts with a dynamic potential market<sup>11</sup>. In the application it is assumed that for these models

$$M = M(t) = \beta_5 E(t) \tag{5.14}$$

where  $E(t)$  is the total number of Spanish firms that could adopt the innovation at least in principle, and  $0 < \beta_5 < 1$ . Small estimated values of  $\beta_5$  indicate few firms will eventually adopt franchising as an organizational innovation, while values of  $\beta_5$  that approach 1 indicate the opposite.

<sup>11</sup> Examples of models with dynamic potential market are Chow (1967), Dodson and Muller (1978), Lackman (1978), Mahajan and Peterson (1978, 1979), Sharif and Ramanathan (1981), Kamakura and Balasubramanian (1988), Jain and Rao (1990), Parker (1992), Bass, Krishnan and Jain (1994), Polo (1996) and Dekimpe, Parker and Sarvary (1998).

Table 5.3.  
Diffusion models

Model 1 (Parker model)	Model 5 (NSRL model)
$n(t) = \left( \beta_1 + \beta_2 \left( \frac{N(t)}{M} \right)^{(1+\beta_4)} \right) [M - N(t)]^{(1+\beta_3)}$	$n(t) = \left( \beta_2 \left( \frac{N(t)}{M} \right)^{(1+\beta_4)} \right) [M - N(t)]$
Model 2 (NUI model)	Model 6
$n(t) = \left( \beta_1 + \beta_2 \left( \frac{N(t)}{M} \right)^{(1+\beta_4)} \right) [M - N(t)]$	$n(t) = \beta_2 \left( \frac{N(t)}{M} \right) [M - N(t)]^{(1+\beta_3)}$
Model 3	Model 7 (Bass model)
$n(t) = \left( \beta_2 \left( \frac{N(t)}{M} \right)^{(1+\beta_4)} \right) [M - N(t)]^{(1+\beta_3)}$	$n(t) = \left( \beta_1 + \beta_2 \left( \frac{N(t)}{M} \right) \right) [M - N(t)]$
Model 4 (Jeuland model)	Model 8 (Mansfield model)
$n(t) = \left( \beta_1 + \beta_2 \left( \frac{N(t)}{M} \right) \right) [M - N(t)]^{(1+\beta_3)}$	$n(t) = \left( \beta_2 \left( \frac{N(t)}{M} \right) \right) [M - N(t)]$

Given the discussion in Section 5.2 we can summarize the expected signs of the parameter in the diffusion models: see Table 5.4.

Table 5.4.  
Expected signs of the parameters of the diffusion models

Parameter	Expected sign
External influence	$\beta_1 \geq 0$
Internal influence	$\beta_2 \geq 0$
Heterogeneity	$\beta_3 \geq 0$
Non-uniform influence	$\beta_4 \geq -1$
Penetration of the potential market	$0 < \beta_5 < 1$

## 5.5. Sample, data and measurement of variables

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. Nevers (1972) analyzed how a franchisor incorporates new franchise holders into its organization; i.e. intra-firm diffusion. In this study we investigate how franchising, seen as a form of business organization, is adopted by Spanish firms; i.e. inter-firm diffusion. Hence the adopting agents (franchisors) are Spanish firms. We consider the adoption of these firms for a period of 26 years: 1974-1999. We use annual data.

We obtained a list of franchisors from the Spanish Register of Franchisors. As registration to this Register is voluntary, there are far more franchisors than are registered. Hence, we collected additional data from three well-known franchising guides (Tormo Associated, Barbadillo Associated and the Spanish Association of Franchisors) as well as from the directories of the two most important franchising fairs in Spain (Expofranquicia and the International Salon of Franchising). The previous information was confirmed and also completed by directly contacting the franchisors by fax, telephone, post, e-mail or at the franchising fairs.

Data about the *dynamic potential market* variable in terms of the number of Spanish firms that could adopt franchising is obtained from the Commercial Register and publications of the National Institute of Statistics of Spain.

## 5.6. Empirical application

### 5.6.1. Step 1: Graphical analysis

A visual analysis<sup>12</sup> of the Spanish franchising data (Figures 5.5 and 5.6) shows a diffusion curve with a similar shape to other innovations discussed in the literature of diffusion of innovations (Mansfield, 1961; Nevers, 1972; Easingwood, 1988; Mahajan, Muller and Bass, 1990; Mahajan and Muller, 1994). Mansfield (1961) points out that the diffusion of a new technique is generally a rather slow process. The visual analysis confirms this and demonstrates that the diffusion of franchising has a rather slow start. The study performed by Mansfield (1961) shows that some firms take decades to adopt an innovation whereas others follow the innovator very quickly. His study shows that the number of years elapsing before half the firms had adopted an innovation oscillates between 0.9 and 15 years in the industries of bituminous coal and iron and steel. Easingwood (1988) considers several curves of diffusion for industrial and process innovations. He includes the (intra-firm)

<sup>12</sup> This visual inspection, made as a preliminary analysis, is intrinsically subjective.



diffusion of franchising as an innovation from Nevers's (1972) work and excludes consumer innovations of consumer products. The diffusion patterns that he presents differ in the number of years that an innovation takes to achieve a high penetration into the market. The number of years oscillates between 3.5 and 28.5 years. Figures 5 and 6 show the annual number of adopters and the cumulative number of adopters. From these figures it is clear that for franchising: (1) the cumulative number of adopters has probably not reached its maximum ( $M$ ) yet given that the innovation seems to be in its growth stage (there are no post-peak data points in this stage); (2) the stage of introduction is very long. It took about 22 years to reach 50 per cent of the total number of adopters at the end of the period that we investigated (26 years). This very slow rate of adoption can be explained by the lack of legal regulations governing this organizational innovation until 1996.

Figure 5.5.  
Number of adopters (franchisors) per time period

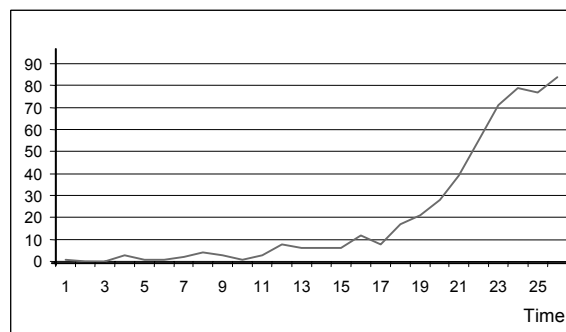


Figure 5.5 starts at  $t=1$

Figure 5.6.  
Cumulative number of adopters (franchisors)

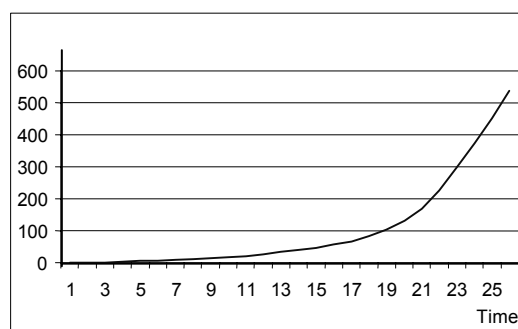


Figure 5.6 starts at  $t=1$

### 5.6.2. Step 2: Testing the hypothesis of imitation

The models represented by Equations (5.9), (5.10) and (5.11) are estimated by Ordinary Least Squares. A comparison of the parameters in Table 5.5 with the corresponding parameters in Table 5.2 demonstrates that the Quadratic form -Equation (5.9)- does not have appropriate signs. The Coleman model -Equation (5.10)- has a parameter with a 0.99 probability of being larger than 1. Hence we have to reject H1B. The Mansfield-Bass models -Equations (5.11) and (5.12)- have the appropriate signs and magnitudes. The sum of the squared residuals (ssr) is the lowest of all these models and the  $\chi^2$ -tests indicate that the null hypothesis of random walk has to be rejected and that imitation is one of the processes behind the adoption of franchising in Spain.

Table 5.5.  
Parameter estimates of the Quadratic form, Coleman and Mansfield-Bass models  
-Equations (5.9), (5.10) and (5.11-5.12), respectively-

Models	Parameter estimates (t values between brackets)				r <sup>a</sup>	ssr	Test H <sub>0</sub>	$\chi^2$
	$\hat{\lambda}_0$	$\hat{\lambda}_1$	$\hat{\lambda}_2$	$\hat{\lambda}_3$				
Quadratic Form	-2.29 (-1.80)	0.41** (3.18)	1		0.99	490.10	$\lambda_0=0,$ $\lambda_1=0$	14.03***
Coleman			1.13*** (21.72)		0.99	619.93	$\lambda_2=1$	6.04*
Mansfield- Bass			1.40*** (14.67)	-0.0005* (-2.63)	0.99	400.69	$\lambda_2=1$ $\lambda_3=0$	27.60***

<sup>a</sup> We use the correlation coefficient, r, which measures the correlation between the real and the estimated values of the dependent variables, because the Coleman and the Mansfield-Bass models do not have an intercept term (Judge et al., 1985, pp.30-31)

\*\*\* p ≤ 0.001; \*\* p ≤ 0.01; \* p ≤ 0.05.

### 5.6.3. Step 3: Selection of a diffusion model given that there is imitation

The eight diffusion models in Table 5.3 are estimated by non-linear estimation procedures (E-views and SAS-NLIN routine Marquardt) given the non-linearity of these models. Models where  $N(t)$  can not be expressed as an explicit function of time are estimated directly from their original expression (models “1”-“6”). The models where  $N(t)$  can be expressed as an explicit function of time (models “7” and “8”) are estimated following Srinivasan and Mason (1986) and Van den Bulte and Lilien (1997). We consider eight diffusion models with fixed potential market  $-M$ - and eight with dynamic potential market  $-M(t)$ -. Models from each group are estimated and two different tests are performed to determine which model or

models have the best statistical properties. Likelihood ratio tests are used for nested models. The test proposed by Cox (1961, 1962) and modified by Pesaran and Deaton (1978) (Judge et al., 1985) is used for non-nested models<sup>13</sup>.

### 5.6.3.1. Fixed potential market

Table 5.6 shows the parameter estimates and a number of statistical criteria of the diffusion models with a fixed potential market.

Table 5.6.  
Diffusion models with fixed potential market.

	Numbers of parameters	Parameter estimates ( <i>t</i> -values between brackets)						
		$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\beta}_3$	$\hat{\beta}_4$	$\hat{M}$	r	ssr
Model 2	4	0.001 (0.80)	0.64*** (7.13)		0.36** (3.58)	658*** (14.86)	0.99	230.48
Model 4	4	-0.22 (-0.59)	22.27 (0.64)	-0.66* (-2.28)		536*** (4.16)	0.99	388.05
Model 5	3		0.63*** (8.21)		0.33*** (4.23)	663*** (16.07)	0.99	233.33
Model 6	3		31.74 (0.90)	-0.74** (-3.47)		513*** (5.18)	0.99	429.20
Model 7 <sup>a</sup>	3	0.00002* (2.53)	0.39*** (18.14)			852*** (15.95)	0.99	207.57
Model 8 <sup>a</sup>	2		0.39*** (18.36)			852*** (15.92)	0.99	207.57

<sup>a</sup> estimated in a different way.

\*\*\*  $p \leq 0.001$ ; \*\*  $p \leq 0.01$ ; \*  $p \leq 0.05$ ; °  $p < 0.1$ .

The models “1” and “3” are unstable (the non-linear estimation procedure does not supply parameter estimates that converge) and are not appropriate to describe the adoption of franchising. Overall, the other models show an acceptable level of fit to the data. The parameter estimates have the right signs except for the parameter  $\beta_1$  of model “4” and the parameter  $\beta_3$  of the models “4” and “6”.

<sup>13</sup> See Parker and Gatignon (1994) for a detailed discussion in the field of diffusion models.

We perform the likelihood ratio test to select the most appropriate model<sup>14</sup> among the nested models “2” and “5”. We also do not consider models “4” and “6”, which have implausible parameter estimates. All the models where the parameter  $\beta_3$  has been included show problems<sup>15</sup>. Following the likelihood ratio test, the restricted model (the most parsimonious model) is retained when there is no significant difference between the restricted and the unrestricted model. The outcome of the test is shown in Table 5.7.

Table 5.7.  
Likelihood ratio test statistics (Fixed potential market)

Restricted Model (H <sub>0</sub> )		Unrestricted Model (H <sub>1</sub> )		$\chi^2$ test		Conclusions
Model	T*ln(ssr <sub>0</sub> ) p <sub>0</sub>	Model	T*ln(ssr <sub>1</sub> ) p <sub>1</sub>	-2lnN	(p <sub>1</sub> - p <sub>0</sub> )	
<i>Models: 2, 5</i>						
Model 5	141.76 3	Model 2	141.44 4	0.32	1	H <sub>0</sub> not rejected => Model 5

Likelihood ratio test:  $\chi^2 = -(T*\ln(ssr_0) - T*\ln(ssr_1))$   
 p<sub>0</sub>: number of parameters in the restricted model  
 p<sub>1</sub>: number of parameters in the unrestricted model

From this table we deduce that model “5” has better statistical properties than model “2”. Now we perform the Cox test to select the best model among the models “5”, “7” and “8”, which are non-nested models. This test discriminates between the two following non-nested models (Pesaran and Deaton, 1978; Judge et al., 1985):

$$H_0: (model a) \quad y = f(G, \gamma) + e, \quad e \sim N(0, \sigma^2 I) \tag{5.15}$$

$$H_1: (model b) \quad y = f(W, \omega) + u, \quad u \sim N(0, \mu^2 I) \tag{5.16}$$

where  $G$  and  $W$  are the variables to predict  $y$ ,  $\gamma$  and  $\omega$  are vectors of parameters, and  $e$  and  $u$  are random vectors. The test statistic is

$$C = \frac{T}{2} [\ln \hat{\mu}_m^2 - \ln \hat{\mu}^2] \tag{5.17}$$

where  $T$  is the number of observations,  $\hat{\mu}_m^2$  is the maximum likelihood estimator<sup>16</sup> of  $\mu^2$ ,  $\hat{\mu}^2 = \hat{\sigma}_m^2 + \frac{1}{T} ssr_1$ , and  $ssr_1$  is the sum of the squared residuals from regressing the fitted results of *model a* against the independent structure of *model b*. The C-statistic is normally distributed with mean zero and variance

<sup>14</sup> See, for example, Leeflang et al. (2000, Section 18.4.2).

<sup>15</sup> Compare also Parker (1993) who had the same problems.

<sup>16</sup> The estimates using the Marquardt non-linear estimation technique on SAS approach the Gauss maximum likelihood estimates (Parker and Gatignon, 1994).

$$V(C) = \frac{\hat{\sigma}_m^2}{\hat{\mu}^2} \left[ u_1' \left\{ I_T - Z(\hat{\gamma})' [Z(\hat{\gamma})' Z(\hat{\gamma})]^{-1} Z(\hat{\gamma}) \right\} u_1 \right] \quad (5.18)$$

where  $u_1$  is a vector of residuals that results from regressing the fitted results of *model a* against the independent structure of *model b*, and  $Z$  is a matrix with first order derivatives of *model a* evaluated at the maximum likelihood estimates of  $\gamma$ .

If the C-statistic is significant, the null hypothesis is rejected (*model a* is rejected), but it “does not imply that  $H_1$  is accepted, since  $H_1$  tested against  $H_0$  may also be rejected” (Judge et al., 1985, pp. 883-884). As the Cox test is not symmetric, we have to repeat the test changing the hypothesis (i.e.  $H_0$ : *model b*,  $H_1$  *model a*). Both models can be retained when there are no statistically significant differences between them, yielding inconclusive results. In this case, other criteria must be employed to select one of them. The outcomes of these tests are shown in Table 5.8.

Table 5.8.  
Test of non-nested models with fixed potential market

		Alternative hypothesis (C-statistics)			Conclusions (evaluated models => model retained)
		Model 5	Model 7	Model 8	
Null hypothesis	Model 5	-	-5.90**	-5.90**	Mod 5, Mod 7 => both models Mod 5, Mod 8 => both models Mod 7, Mod 8 => both models
	Model 7	-3.57°	-	0.00	
	Model 8	-3.57°	0.00	-	

\*\*  $p \leq 0.01$ ; °  $p < 0.1$ .

From this table we deduce that the models “5”, “7” and “8” remain in competition. Therefore, we compare these models in step 4.

### 5.6.3.2. Dynamic potential market

The dynamic models “1”, “3”, “4” and “6” again give unstable outcomes. What remains are the outcomes of the models “2”, “5”, “7” and “8”. Table 5.9 shows the parameter estimates and the values of a number of statistical validation criteria.

Table 5.9.  
Results: the diffusion models with dynamic potential market

	Number of parameters	Parameter estimates ( <i>t</i> -values in brackets)					r	ssr
		$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\beta}_4$	$\hat{\beta}_5$			
Model 2	4	-0.01 (-0.43)	0.98*** (7.65)	0.68** (2.87)	0.0004*** (25.58)		0.99	194.85
Model 5	3		1.01*** (10.64)	0.33*** (4.23)	0.0004*** (33.22)		0.99	196.99
Model 7 <sup>a</sup>	3	0.0001* (2.08)	0.34*** (13.04)		0.001*** (14.80)		0.99	229.24
Model 8 <sup>a</sup>	2		0.34*** (13.22)		0.001*** (14.79)		0.99	229.24

<sup>a</sup> estimated in a different way.

\*\*\*  $p \leq 0.001$ ; \*\*  $p \leq 0.01$ ; \*  $p \leq 0.05$ .

The results show that the models have a suitable fit to the data and all the parameter estimates have the right signs.  $\hat{\beta}_1$  of model “2” is an exception; this parameter estimate is not statistically significant.

Again, we perform the likelihood ratio test between model “2” and “5”, which are nested models. The outcome of this test is shown in Table 5.10.

Table 5.10.  
Likelihood ratio test statistics (Dynamic potential market)

Restricted Model ( $H_0$ )		Unrestricted Model ( $H_1$ )		$\chi^2$ test		Conclusions
Model	$T \cdot \ln(ssr_0)$ $p_0$	Model	$T \cdot \ln(ssr_1)$ $p_1$	$-2 \ln N$	$(p_1 - p_0)$	
<i>Models: 2, 5</i>						
Model 5	137.36 3	Model 2	137.08 4	0.28	1	$H_0$ not rejected => Model 5

Likelihood ratio test:  $\chi^2 = -(T \cdot \ln(ssr_0) - T \cdot \ln(ssr_1))$

$p_0$ : number of parameters in the restricted model

$p_1$ : number of parameters in the unrestricted model

From the outcomes of this test, we also have to conclude that model “5” is preferred to model “2”. Now we perform the Cox test to select among the models “5”, “7” and “8”, which are non-nested models. The outcomes of these tests are shown in Table 5.11.

Table 5.11.  
Test of non-nested models with dynamic potential market

		Alternative hypothesis (C-statistics)			Conclusions (evaluated models => model retained)
		Model 5	Model 7	Model 8	
Null hypothesis	Model 5	-	-6.10**	-6.10**	Mod 5, Mod 7 => both models Mod 5, Mod 8 => both models Mod 7, Mod 8 => both models
	Model 7	-9.43***	-	0.00	
	Model 8	-9.43***	0.00	-	

\*\*\*  $p \leq 0.001$ ; \*\*  $p \leq 0.01$

From this table we deduce that the models “5”, “7” and “8” remain in competition. We compare these models in step 4.

We are now able to investigate whether models “5”, “7” and “8” with a dynamic potential market have better statistical properties than models with fixed potential market. To answer this question, we also perform the Cox test. The outcomes of these tests are shown in Table 5.12.

Table 5.12.  
Test of non-nested models with fixed and dynamic potential market ( $M$  and  $M(t)$ )

		Alternative hypothesis (C-statistics)						Conclusions (evaluated models => model retained)
		Model 5M	Model 5M(t)	Model 7M	Model 7M(t)	Model 8M	Model 8M(t)	
Null hypothesis	Model 5M	-	-2.49***					Mod 5M, Mod 5M(t) => both models Mod 7M, Mod 7M(t) => model 7M Mod 8M, Mod 8M(t) => model 8M
	Model 5M(t)	1.85**	-					
	Model 7M			-	0.77			
	Model 7M(t)			-1.78*	-			
	Model 8M					-	0.77	
	Model 8M(t)					-1.77**	-	

\*\*\*  $p \leq 0.001$ ; \*\*  $p \leq 0.01$ ; \*  $p \leq 0.05$ .

The outcomes show that accounting for dynamics in the potential market does not yield a better specification when we analyze models “7” and “8”, whereas with model “5” this makes the new specification as good as the previous one.

Figures 5.7 and 5.8 show the diffusion curves of models “5”, “7” and “8” with a fixed potential market and the same models with a dynamic potential market respectively.

Figure 5.7.  
Real and estimated values (model 5, model 6 and model 8)  
with a fixed potential market

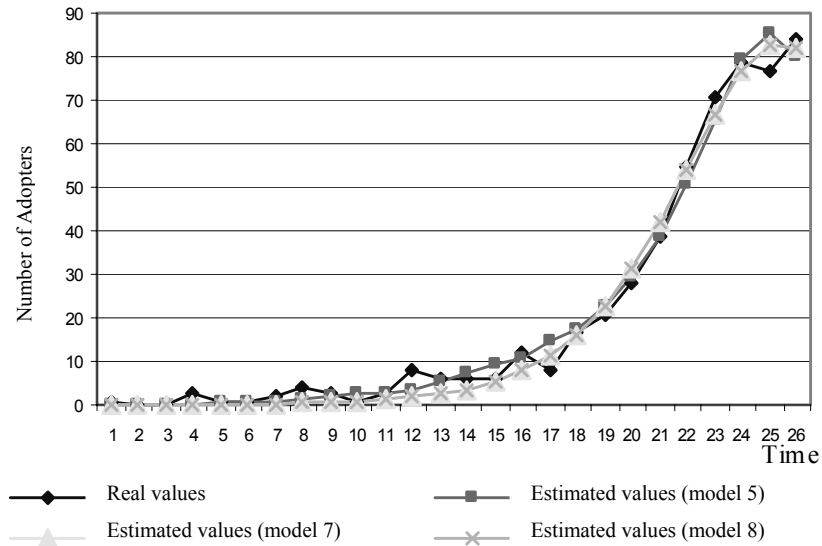


Figure 5.7 starts at  $t=1$

Figure 5.8.  
Real and estimated values (model 5 and model 8)  
with a dynamic potential market

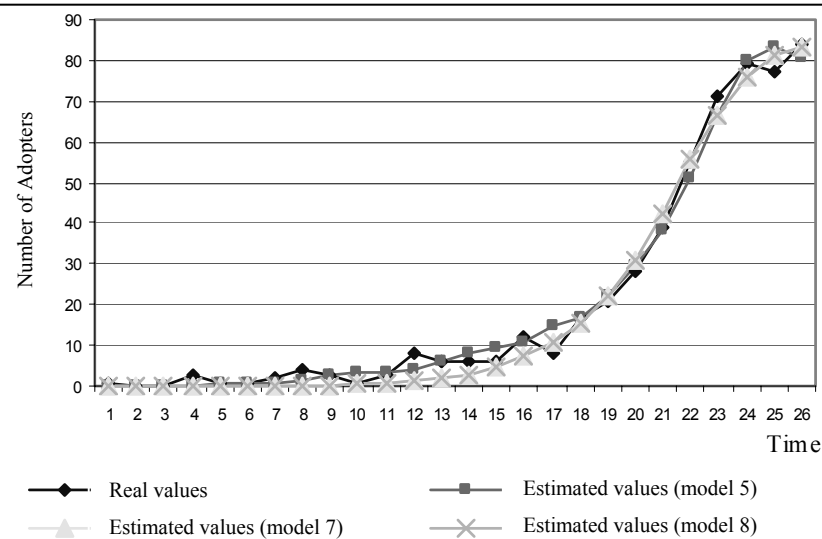


Figure 5.8 starts at  $t=1$



Given the inconclusive results of the Cox test, other criteria are needed to decide which model “5”, “7” or “8” is preferred. In the next step, we show the parameter stability and predictive validity of the models to select the most appropriate model among the retained models.

#### 5.6.4. Step 4: Model stability and predictive validity

Our major objective in this study is to propose alternative diffusion models to capture the diffusion process of an organizational innovation, such as franchising, in Spain. In the previous subsections we estimate the proposed diffusion models and show the face validity, the fitting results and some tests to select the most appropriate model. Previous analyses show that there are several models that appropriately describe the diffusion process of franchising in Spain. However, the analysis of each model’s performance is completed with an assessment of the parameter stability and the predictive validity of those models that seem to be the most appropriate.

##### Parameter stability

To evaluate parameter stability we follow Golder and Tellis (1998). We estimate each model repeatedly, starting with a short data series and adding one additional period every time we re-estimate. We use the two measures of parameter stability proposed by the above authors:

- STAB1, which captures fluctuations from the overall mean. This measure is “*the mean of the estimates of the parameter divided by the standard deviation of estimates, where the multiple estimates are obtained by adding an additional year to the data*” (Golder and Tellis (1998, p. 269)):

$$\text{STAB1} = \frac{\text{mean}(\hat{\beta})}{\text{stand.dev.}(\hat{\beta})} \quad (5.19)$$

where  $\hat{\beta}$  represents the parameter estimates.

- STAB2, which captures period to period fluctuations. This measure is “*the average period to period change standardized by the mean of the parameters*” (Golder and Tellis (1998, p. 270)):

$$\text{STAB2} = \sum \left| \frac{\hat{\beta}_t - \hat{\beta}_{t-1}}{\text{mean}(\hat{\beta})} \right| \frac{1}{K} \quad (5.20)$$

where  $\hat{\beta}$  represents the parameter estimates and  $K$  the number of estimation periods.

Higher STAB1 values indicate that the model presents greater parameter stability, and lower STAB2 values indicate that the model presents greater parameter stability (given that STAB2 captures instability). Table 5.13 shows the values of STAB1 and STAB2 for models “5”, “7” and “8” assuming fixed and dynamic potential markets. This table reveals that: i) assuming a fixed potential market yields greater parameter stability than assuming a dynamic potential market (except for STAB1 of  $\hat{\beta}_1$  in model “7”), and ii) the parameters of model “7” are more stable than those of models “5” and “8” in both cases (assuming a fixed or dynamic potential market). Therefore, the proposed measures of parameter stability show model “7”, with a fixed potential market, as the model with the most stable parameters.

Table 5.13.  
Measures of stability of parameters estimates

Fixed potential market - $M$ -									
	Model 5M			Model 7M			Model 8M		
	$\hat{\beta}_2$	$\hat{\beta}_4$	$\hat{M}$	$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{M}$	$\hat{\beta}_2$	$\hat{M}$	
STAB1	1.15	0.46	0.84	0.55	2.90	1.54	2.70	0.97	
STAB2	0.51	1.02	0.72	1.00	0.16	0.48	0.19	0.85	

Dynamic potential market - $M(t)$ -									
	Model 5M(t)			Model 7M(t)			Model 8M(t)		
	$\hat{\beta}_2$	$\hat{\beta}_4$	$\hat{\beta}_5$	$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\beta}_5$	$\hat{\beta}_2$	$\hat{\beta}_5$	
STAB1	0.86	0.40	0.67	0.61	1.47	0.84	1.45	0.54	
STAB2	0.59	1.43	1.46	1.17	0.39	0.74	0.50	1.37	

#### *Forecasting ability*

To compare the predictive qualities of the selected models we use step-ahead forecasting. We estimate the parameters of models “5”, “7” and “8” using the observations of twenty-four periods. We select the twenty-fourth period given that this is the last period before (or around) the peak in the diffusion rate (Bass, Krishnan and Jain, 1994). We do this for models with both fixed and dynamic potential markets. Then, we forecast adoption for the twenty-fifth period. We then re-estimate the models for twenty-five periods and forecast adoption for the twenty-sixth period. Table 5.14 represents the values of the mean absolute percentage error (MAPE) of the selected models. From this table we deduce that

model “7”, assuming a fixed potential market, has the lowest MAPE and hence the highest predictive power<sup>17</sup>.

Table 5.14.  
Predictive accuracy of the model 5, 7 and 8

One-step ahead forecasting results Prediction: 2 periods		
Model	MAPE (Mean Absolute Percentage Error)	
	Fixed potential market -M-	Dynamic potential market -M(t)-
	Model 5	35.12
Model 7	17.88	38.19
Model 8	26.36	38.20

$$MAPE = \frac{1}{n^0} \sum_i \left| \frac{y_i - \hat{y}_i}{y_i} \right| \text{ where } n^0 \text{ is the number of periods to be predicted.}$$

Among the models that previous analyses show as appropriate models to describe the diffusion process of franchising in Spain (models “5”, “7” and “8”), model “7”, with a fixed potential market (the traditional Bass model), shows better proprieties in terms of parameter stability and predictive validity. Model “7” shows that the adoption process of franchising is governed by both external influence and the influence of adopters (i.e. franchisors) that interact with each other in a contagious process (internal influence). The estimated value of  $\hat{\beta}_1$  (=0.00002) is positive, significantly different but close to zero whereas the magnitude of  $\hat{\beta}_2$  (=0.39) indicates intensive imitating behavior of Spanish adopting firms. The low relevance of the parameter of external influence,  $\beta_1$ , which represents the innovating behavior of the adopters (franchisors), indicates that there is weak external influence.

<sup>17</sup> Heeler and Hustad (1980) found that the Bass model generally generates better predictions if the time-series data used to calibrate the model includes the peak.

## 5.7. Conclusions

The literature of diffusion of innovations recommends the application of diffusion models to multiple and different areas in order to contrast how the forces of behavior of the adopters act in different situations. This paper provides insights on how diffusion theory can be applied to a popular organizational innovation, namely franchising. We investigate the diffusion process of franchising as a form of business organization (i.e. inter-firm diffusion). There is no previous research on this focus. Although Nevers (1972) studies the diffusion of franchising, he focuses on how franchisors incorporate new franchise holders (i.e. intra-firm diffusion). In Never's study, the adopters are the franchisees whereas in our study, the adopters are the franchisors. This study contributes to increasing the use of diffusion models in industrial/business settings which, according to Kahn (2002), is very limited. It also contributes to the research on organizational innovations which, according to Van der Aa and Elfring (2002) and Wolfe (1994), is relatively undeveloped.

We perform analyses to find the most appropriate model to describe the diffusion of franchising by Spanish firms between 1974 and 1999. We used four consecutive steps to find this model. Empirical analyses suggest that the long-run diffusion process of franchising in Spain is appropriately captured by several Bass-type diffusion models among a family of models. However, the traditional Bass model presents better properties in terms of parameter stability and predictive validity. Results show that the adoption of franchising in Spain is only marginally influenced by external influence whereas Spanish franchisors present strong imitating behavior. This suggests that if the Spanish Government, Spanish Franchising associations or Spanish Franchising fairs want to stimulate the adoption of franchising among Spanish firms, the external influence should be enhanced by marketing efforts.

Furthermore, the results show the suitability of the imitation hypothesis of the diffusion models to explain the diffusion process of franchising in Spain, which is questioned by Mahajan, Sharma and Bettis (1988) with regard to organizational innovations.

In this study we consider all Spanish firms and do not distinguish between firms in different industries. It is more informative to specify models that describe the adoption of franchising for the different industries. The appropriate data that are necessary to calibrate these models are however, not yet available. This offers opportunities for future research. This also holds true for studies in which the adoption of franchising is analyzed for different countries.

