We analyze the diffusion process of an organizational innovation, namely franchising, where we study the diffusion from the point of view of the franchisors (i.e. inter-firm diffusion). We apply various diffusion models to detect how firms are influenced by firms that have adopted the franchising concept (imitators) and how many firms have adopted the franchising concept due to external influence (innovators). Results show that the adoption of franchising in Spain is only slightly affected by external influence and that Spanish franchisors demonstrate strong imitating behavior.

Keywords
Marketing, diffusion models, organizational innovation, franchising.

1. Introduction

Research on the application of diffusion models to organizational innovations is scarce. In this study we analyze the diffusion process of 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). In Spain, the 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. Secondly, the use of the classical diffusion models to understand the diffusion process of organizational innovations that starts in the early 80’s suffers a setback when Mahajan/Sharma/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.

The diffusion of an innovation is defined as the spread of an innovation among a set of prospective adopters over time (Rogers 1962). One of the underlying concepts of the diffusion process is that different adopters (consumers or firms) adopt an innovation (products, services, technologies, organizational systems or ideas) at different times after it becomes available (Rogers 1962). We can detect two kinds of behavior among those who adopt an innovation: (1) innovative behavior, which involves the adopters’ intrinsic tendency to innovate and the influence exerted by sources of external communication, and (2) imitating behavior, which involves the tendency to adopt an innovation on the bases of interpersonal influence processes, such as word-of-mouth (internal) communication. Those who adopt the innovation influence later adopters. Positive interaction between current adopters and later adopters affects the growth of the diffusion process.

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: organizational innovation (See Wolfe (1994) and Gatignon et al. (2002) for research on and contributions to this topic).
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/Bettis 1988; Meyers/Sivakumar/Nakata 1999). Examples of organizational innovations are 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 the literature as hybrid forms of economical organization (Mathewson/Winter 1985).

We use mathematical models 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 firm level implies changing an organization either as a response to changes in the external environment or as an anticipatory action to influence the environment (Damapour 1996).

The aim of this study is to analyze the diffusion of franchising in Spain during the period 1974–1999. To this end we apply diffusion models and select the most appropriate model. We briefly introduce well-known diffusion models that have been applied in marketing. Then we discuss examples of studies that consider the diffusion of organizational innovations. We use two sets of models to obtain an appropriate description of the diffusion process of franchising. We use the first set of models to test whether imitation in the adoption of franchising is structural or random. We use the term random if it is not possible to find a mathematical specification to explain imitation behavior. We use the second set of models to select the most appropriate diffusion model, given that there is imitation and that the diffusion process is not driven by randomness only. We provide empirical evidence for the most appropriate model to analyze the diffusion process. Finally, we discuss the outcomes.

2. Modeling the Diffusion of Innovations

The diffusion model proposed by Bass (1969) is the most accepted and well-known aggregated diffusion model in the marketing literature (Parker 1993). Since the Bass model’s publication, hundreds of articles have been written (Mahajan/Muller/Bass 1993; Mahajan/Muller/Wind 2000) on the applications and extensions of the model (Bass 2004; Sultan/Farley/Lehmann 1990). Moreover, the Bass model is the basis for the formulation of empirical generalizations in marketing (Bass 1993, 1995). The Bass model is based on a number of rather restrictive assumptions (Mahajan/Muller/Bass 1993; Mahajan/Muller/Wind 2000). In this study we relax some of those assumptions. We begin by discussing the model specified by Parker (1993) in which other diffusion models are nested (Table 1).

This model has the following specification:

\[
\frac{dn(t)}{dt} = \beta_1[M(t) - N(t)]^{1+\beta}\]

\[+ \beta_2 \left[ \frac{N(t)}{M(t)} \right]^{(1+\beta)} [M(t) - N(t)]^{1+\beta},
\]

where \(n(t)\) is the non-cumulative number of adopters at time \(t\), \(N(t)\) is the cumulative number of adopters at time

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n(t) = \beta_1 + \beta_2 \left[ \frac{N(t)}{M(t)} \right]^{(1+\beta)} \left[ M - N(t) \right] )</td>
<td>(n(t) = \beta_1 \left[ \frac{N(t)}{M(t)} \right]^{1+\beta} \left[ M - N(t) \right] )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model 2</th>
<th>Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n(t) = \beta_1 + \beta_2 \left[ \frac{N(t)}{M(t)} \right]^{(1+\beta)} \left[ M - N(t) \right] )</td>
<td>(n(t) = \beta_2 \left[ \frac{N(t)}{M(t)} \right]^{1+\beta} \left[ M - N(t) \right] )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model 3</th>
<th>Model 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n(t) = \beta_1 \left[ \frac{N(t)}{M(t)} \right]^{(1+\beta)} \left[ M - N(t) \right] )</td>
<td>(n(t) = \beta_1 + \beta_2 \left[ \frac{N(t)}{M(t)} \right]^{(1+\beta)} \left[ M - N(t) \right] )</td>
</tr>
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</table>

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<thead>
<tr>
<th>Model 4</th>
<th>Model 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n(t) = \beta_1 + \beta_2 \left[ \frac{N(t)}{M(t)} \right]^{(1+\beta)} \left[ M - N(t) \right] )</td>
<td>(n(t) = \beta_2 \left[ \frac{N(t)}{M(t)} \right]^{1+\beta} \left[ M - N(t) \right] )</td>
</tr>
</tbody>
</table>

Table 1: Diffusion models
t, and \( M(t) \) is the total number of potential adopters at time \( t \) (e.g., consumers or firms – agents – who ultimately adopt). In Equation (1) it is assumed that the potential market is dynamic and is, at least in principle, a function of relevant variables. Examples are the growth in the number of households (Mahajan/Peterson 1978; Parker 1993), price (Jain/Rao 1990; Kamakura/Balasubramanian 1988), number of retail outlets where the (new) product is available (Jones/Ritz 1993), and so on.

The first term in Equation (1) represents adoptions that are not influenced by the number of effective adopters (innovative behavior). The second term represents adoptions that are influenced by the number of previous adopters (imitating behavior). The parameter \( \beta_1 \) (\( \beta_1 \geq 0 \)) represents the effect of external influence: variables that affect the innovative behavior. The parameter \( \beta_2 \) (\( \beta_2 \geq 0 \)) is the internal influence parameter, and the parameter \( \beta_3 \) accounts for the heterogeneity of the population of potential adopters. It allows for differences among adopters in their propensities to adopt an innovation. The parameter \( \beta_1 \) is the internal influence parameter, and the parameter \( \beta_3 \) represents the effect of external influence: variables that affect the innovative behavior. The parameter \( \beta_2 \) affects mainly the number of adoptions per period. We expect that in our study \( \beta_1 < \beta_2 \), reflecting that the forces behind innovating behavior are less intensive than the ones behind imitating behavior (Figure 1).

The parameters \( \beta_1 \) and \( \beta_2 \) affect the shape of the diffusion curve: \( \beta_1 \) affects mainly the intercept and, therefore, the necessary time to reach the maximum number of adoptions. The larger \( \beta_1 \), the sooner this moment arrives. The parameter \( \beta_2 \) affects mainly the number of adoptions per period. We expect that in our study \( \beta_1 < \beta_2 \), reflecting that the forces behind innovating behavior are less intensive than the ones behind imitating behavior (Figure 1).

Given that \( \beta_1 > 0 \), \( \beta_1(t) \) and \( \beta_2(t) \) will decrease with the passage of time (Figure 2 (a)). The larger the parameter \( \beta_1 \) is, the sooner the time to peak arrives and the larger the number of adoptions will be (Figure 2 (b)).

The parameter of non-uniform influence (\( \beta_3 \)) may be either negative or positive. This leads to different situations:

(i) If \( -1 < \beta_3 < 0 \), \( \beta_3(t) \) will fall with the passage of time \( \frac{d\beta_3(t)}{dt} = \beta_3 \frac{M(t)}{M} < 0 \) and the speed of the diffusion process will accelerate. As we can see in Figure 3 (a), the passage of time reduces \( \beta_3(t) \), accelerating the diffusion process and showing a diffusion curve slanted towards the left (Figure 3 (b)).

(ii) If \( \beta_3 > 0 \), \( \beta_3(t) \) will grow with the passage of time \( \frac{d\beta_3(t)}{dt} = \beta_3 \frac{M(t)}{M} > 0 \) and the speed of the diffusion process will reduce. As we can see in Figure 3 (a),

\[
\beta_2(t) = \beta_2 \left[ \frac{N(t)}{M} \right]^\beta_1.
\]

**Figure 1**: The incremental effect of the coefficients \( \beta_1 \) and \( \beta_2 \) on diffusion curves, holding other parameters in the model constant.

**Figure 2 (a)**: The time-varying coefficients of external, \( \beta_1(t) \), and internal, \( \beta_2(t) \), influence (Assumption: \( \beta_1 = 0.025 \) and \( \beta_2 = 0.75 \))

**Figure 2 (b)**: Effect of the coefficient of heterogeneity, \( \beta_3 \), on diffusion curves

**Note**: Figure 1 starts at \( t = 1 \)

**Note**: Figure 2a and 2b start at \( t = 1 \)**
the passage of time increases $\beta_2(t)$, decelerating the diffusion process and showing a diffusion curve slanted towards the right (Figure 3 (b)).

3. Diffusion of Organizational Innovations

The study of the diffusion of organizational innovations has its origins in the 1980s with the studies of Teece (1980), Thompson (1983) and Mahajan/Sharma/Bettis (1988). These authors analyze the multidivisional form structure (M-Form). Antonelli (1985) analyzes 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 M-Form 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 M-Form. 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 on the basis of classical statistical validation criteria such as t-values, $R^2$’s, F-statistics, etc. This indicates that the model of internal influence is appropriate in this context.

Antonelli (1985) analyzes the structural and technological determinants of the diffusion of IDT (intra-firm and inter-firm), which he describes as an important innovation both technologically and organizationally. Insofar as this innovation implies changes in the organizational structure of the firm, this study is included in the area of the diffusion of business organizational innovations.

Many studies on the diffusion of organizational innovations accept the imitation hypothesis; compare e.g. Mansfield (1961), Romeo (1975, 1977), Teece (1980), Thompson (1983), Hannan/McDowel (1984). Mahajan/ Sharma/Bettis (1988), however, question its validity. The imitation hypothesis maintains that imitative behavior between adopters and non-adopters governs the ratio of inter-firm diffusion. Mahajan/Sharma/Bettis re-examine the imitation hypothesis and compare the models of Coleman (Coleman/Katz/Menzel 1966) (exponential), Mansfield (1961) (S-type), Bass (1969) (S-type) and the square form (S-type) with a random walk process using F-tests. Their results question the suitability of the imitation hypothesis, as they cannot reject the hypothesis that the adoption of the organizational innovation analyzed is a random walk process.

The organizational innovation that we analyze, 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 with the opening of the franchisee shops Pingouin. The real development in Europe starts in the 1970s. Franchising has been introduced in the 1950s in Spain (Rodier in 1957, Spar Español in 1959, Pingouin Esmeralda in 1961, Prenatal in 1963 (Casa/Casabo 1989)). Franchising is gradually adopted by Spanish firms from 1974. The number of franchisors in Spain before 1974 is limited to the firms that are mentioned before. Hence we do not have a left censoring problem with our data. We might expect a slow diffusion process for this organizational innovation given the large numbers of organizational possibilities to cooperate (M-form, partnerships, joint ventures, etc.) (Cheung 1969; Norton 1988; Rubin 1978) and the late legal regulation of franchising in Spain. Important steps towards elaborating specific regulation of franchising in Spain occurred in the late eighties and in the nineties [1].

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. This created more than 93,000 jobs (directly and indirectly) generating a turnover in excess of 4,207 million euros. In 2005 the turnover is more than 16 billion euros, and the number of jobs exceeds 325,000 (Franquicias hoy 2005). These figures reveal how Spanish companies have changed their organizational structure in connection with the distribution of their products by means of fran-
chising. This organizational form provides important organizational benefits to the adopting company that contribute to improvements in management and to distribution channels. Franchising is a mechanism that reduces the divergence of interest between the parties (franchisor and franchisee), reducing agency problems and allowing the possibility of reaching common goals, such as the maximization of the present value of the franchised unit (Kaufmann 1996). The franchisee, as a business person, invests resources in the business, allowing the franchising company access to the resources necessary for expansion. Large companies 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 such as distributors or licensees).

4. Methodology

The methodology that we propose to select the most appropriate diffusion model consists of two steps: (1) a test to conclude whether there is imitation or not; and (2) the selection of one or more diffusion models given that there is imitation. Mahajan/Sharma/Bettis (1988) question the imitation hypothesis behind the classical diffusion models for organizational innovations. We therefore investigate first whether imitation is random or “structural”. The term structural is used in a sense that a specification can be found to explain imitation behavior.

4.1. Testing the Hypothesis of Imitation

We first test whether the imitation process is random or structural. We follow Mahajan/Sharma/Bettis (1988) who test the null hypothesis: the diffusion is a random walk vis-à-vis alternative hypotheses (H1A, H1B and H1C). The stringent null hypothesis of Mahajan/Sharma/Bettis is that the first differences in the non-cumulative adoption time series are random:

\[ H_0: x(t) = x(t-1) + u(t), \]

where \( x(t) = N(t) - N(t-1) \) is the number of adopters in period \( t \), and \( N(t) \) is the cumulative number of adopters at time \( t \) and \( u(t) \) is a disturbance term with zero mean, which is not correlated with \( u(t-k) \forall k \neq 0 \). 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: Imitating behavior is a determinant in the diffusion process of an innovation (Mansfield model (model “8”) and Bass model (model “7”)).

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

\[ H1A: x(t) = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + v(t), \quad (4) \]

where \( \alpha_1 > 0, \alpha_2 < 0 \) and \( v(t) \) is a disturbance term. We can rewrite Equation (4) by subtracting \( x(t-1) \) from \( x(t) \). Hence we get:

\[ H1A: x(t) = \lambda_0 + \lambda_1 t + \lambda_2 x(t-1) + v(t), \quad (5) \]

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 the Bass model (model “7”) with \( \beta_1 = 0 \) as a difference equation, we get:

\[ H1B: x(t) = \lambda_3 x(t-1) + w(t), \quad (6) \]

where \( \lambda_3 = (1 - \beta_1) < 1 \) and \( w(t) \) is a disturbance term. This model is the external influence model or Coleman model (Coleman/Katz/Menzel 1966). Equations (5) and (6) may include a unit root and we have to test this hypothesis.

We consider two alternative specifications that account for adoptions caused by imitation viz. the Mansfield model (model “8”) with \( \beta_1 = 0 \) and the Bass model (model “7”):

\[ H1C: Mansfield: \quad \frac{dN(t)}{dt} = \beta_1 N(t-1) [M - N(t)], \quad (7) \]

\[ Bass: \quad \frac{dN(t)}{dt} = \frac{\beta_1 N(t)}{M} [M - N(t)]. \quad (8) \]

These models are rewritten as:

\[ x(t) = \lambda_3 x(t-1) + \lambda_3 N(t-1) + \varepsilon(t), \quad (9) \]

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

4.2. Selection of a Diffusion Model Given That There is Imitation

We consider eight diffusion models (Table 1) with a fixed potential market: \( M(t)=M \). The models are well-known diffusion models, except models “3” and “6”, which are combinations of existing models. Models “1”–“8” all have their counterparts with a dynamic
powerful tools to analyze the diffusion of franchising as an organizational innovation. The innovation, while values of adopt the innovation at least in principle, and 0 < \beta_2 < 1. Small estimated values of \beta_2 indicate few firms will eventually adopt franchising as an organizational innovation, while values of \beta_3 that approach 1 indicate the opposite.

5. Empirical Application

5.1. Sample, Data and Measurement of Variables

The adopting agents in our study are Spanish firms (franchisors). When the franchisor takes the decision to incorporate the franchising system into its organization, we consider that this firm has adopted franchising. If in the future this firm decides to open new franchising outlets (to incorporate more franchisees) or to develop a different franchise (a different brand, for example), these decisions do not affect our study. The adoption happens the first time the firm takes this decision. Hence, the phenomenon of multiple franchise owners does not affect our study. We consider the adoption of franchising of these firms for a period of 26 years (1974–1999) and 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 (Torno 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). We confirmed and also completed the previous information by directly contacting the franchisors by fax, telephone, post, e-mail or at the franchising fairs. The dynamic potential market variable in terms of the number of Spanish firms that could adopt franchising proceeds from the Commercial Register and publications of the National Institute of Statistics of Spain.

Table 2: Testing the hypothesis of imitation

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Model</th>
<th>Equivalencies between the parameters of the models and the parameters of similar regressions</th>
<th>Expected signs and values of the parameters</th>
<th>Values of the parameters that do not reject H0</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H1A</td>
<td>Quadratic form</td>
<td>(\lambda_0 = \alpha_1 - \alpha_2, \lambda_3 = 2\alpha_2, \lambda_2 = 1)</td>
<td>&gt;0 &lt;0 1</td>
<td>(\lambda_0 = 0, \lambda_1 = 0)</td>
</tr>
<tr>
<td>H1B</td>
<td>Coleman</td>
<td>(\lambda_2 = (1 - \beta_1))</td>
<td>&lt;1</td>
<td>(\lambda_2 = 1)</td>
</tr>
<tr>
<td>H1C</td>
<td>Mansfield/Bass</td>
<td>(\lambda_2 = 1 + \beta_2, \lambda_3 = -(\beta_2/M))</td>
<td>&gt;1 &lt;0 (\lambda_2 = 1, \lambda_3 = 0)</td>
<td></td>
</tr>
</tbody>
</table>

5.2. Visual Analysis

A visual analysis of the Spanish franchising data (Figure 4 and 5) shows a diffusion curve with a similar shape to other innovations discussed in the literature of diffusion of innovations (Easingwood 1988; Mahajan/Muller 1994; Mahajan/Muller/Bass 1993; Mansfield 1961; Nevers 1972). 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.

Figure 4 and 5 show the annual number of adopters and the cumulative number of adopters. From these figures we can see 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

![Figure 4: Number of adopters (franchisors) per time period](image1.png)

Note: Figure 4 starts at \(t = 1\)

![Figure 5: Cumulative number of adopters (franchisors)](image2.png)

Note: Figure 5 starts at \(t = 1\)
about 22 years to reach 50 percent of the total number of adopters at the end of the period that we investigated (26 years).

5.3. Testing the Hypothesis of Imitation

This step is based on Mahajan/Sharma/Bettis (1988) and we test the imitation hypothesis in a similar way as they did. Hence, we estimate the Equations (5), (6) and (9) and use Ordinary Least Squares. We perform Augmented Dickey-Fuller unit root tests (on Equations (5) and (6)) and find that the null hypothesis of a unit root can be rejected [4]. A comparison of the parameters in Table 3 with the corresponding parameters in Table 2 demonstrates that the Quadratic form – Equation (5) – does not have appropriate signs. The Coleman model – Equation (6) – has a parameter with a 0.99 probability of being larger than 1. Hence we have to reject H1B. The Mansfield-Bass models – Equations (7) and (8) – have the appropriate signs and magnitudes. The sum of the squared residuals (SSR) is the lowest of all these models. Through the dissemination of Word-of-Mouth (WoM) information. The key sources of WoM are franchisors and franchisees. Although we study the diffusion from the point of view of franchisors there may also be (external) influences emerging from the franchisees [5]. Given that we have no data about the number of franchisees, we are not able to differentiate between two kinds of WoM-effects emanating from franchisors (internal effects) and WoM-effects due to franchisees (external effects).

5.4. Selection of a Diffusion Model Given That There is Imitation

We estimate the eight diffusion models in Table 1 by using non-linear estimation procedures (E-views and SAS-NLIN routine Marquardt) given the non-linearity of these models. Models where \( N(t) \) cannot be expressed as an explicit function of time are estimated directly from their original expression (models “1”–“6”). We follow Srinivasan/Mason (1986) and Van den Bulte/Lilien (1997) in estimating the models where \( N(t) \) can be expressed as an explicit function of time (models “7” and “8”). We consider eight diffusion models with fixed potential market – \( M \) – and eight with dynamic potential market – \( M(t) \). We estimate the models from each group and perform two different tests to determine which model or models have the best statistical properties. We use Likelihood ratio tests for nested models and the test proposed by Cox (1961, 1962) and modified by Pesaran/Deaton (1978) (Judge et al. 1985) for non-nested models (See Parker/Gatignon (1994) for a detailed discussion in the field of diffusion models).

5.4.1. Fixed Potential Market

Table 4 shows the parameter estimates and a number of statistical criteria of the diffusion models with a fixed potential market.

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 \( \beta_1 \) of model “4” and \( \beta_3 \) of models “4” and “6”. We do not consider these models in what follows [6].

We perform the likelihood ratio test to select the most appropriate model among the nested models “2” and “5” and found that the most restrictive model “5” could not be rejected.

We perform the Cox test (Pesaran/Deaton 1978; Judge et al. 1985) to discriminate between the non-nested models “5”, “7” and “8”. We could not reject any of these models, and we compare these models on their predictive validity.

5.4.2. Dynamic Potential Market

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

The results show that the models have a suitable fit to the data and all parameter estimates have the right signs. \( \beta_1 \) of

---

### Table 3: Parameter estimates of the Quadratic form, Coleman and Mansfield-Bass models – Equations (5), (6) and (9), respectively –

<table>
<thead>
<tr>
<th>Models</th>
<th>Parameter estimates (t values in brackets)</th>
<th>( t^* )</th>
<th>SSR</th>
<th>Test</th>
<th>( \chi^2 )</th>
</tr>
</thead>
</table>
| Quadratic form  | \( \lambda_0 = -2.29 \) \( \lambda_1 = 0.41^{**} \) \( \lambda_2 = 1 \) \( \lambda_3 = 1 \) | 0.99   | 490.10 | \( \lambda_0 = 0 \) | 14.03*
| Coleman         | \( \beta_1 = 1.13^{***} \) \( \beta_2 = 0.99 \) \( \beta_3 = 619.93 \) \( \beta_4 = 6.04^{*} \) | (21.72)|      |      |          |
| Mansfield-Bass  | \( \lambda_0 = 1.40^{***} \) \( \lambda_1 = -0.0005^{*} \) \( \lambda_2 = 0.99 \) \( \lambda_3 = 400.69 \) \( \lambda_4 = 27.60^{***} \) | (14.67)|      |      |          |

* 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
model “2” is an exception; this estimate is not statistically significant. Again, we perform the likelihood ratio test between models “2” and “5”, and conclude that model “5” is preferred to model “2”. We perform the Cox test to select among models “5”, “7” and “8”, which are non-nested models, and conclude that these models remain in competition.

The Cox test is also used to investigate whether the models with a dynamic potential market have better statistical properties than models with a fixed potential market. The outcomes of this test reveal that there are no significant differences and that we need other criteria to decide which model (“5”, “7” or “8”; “dynamic” or “fixed”) is preferred.

5.5. Model Stability and Predictive Validity

Previous analyses show that there are several models that appropriately describe the diffusion process of franchising in Spain. We complete the analysis of each model’s performance with an assessment of the parameter stability and the predictive validity of those models.

To evaluate parameter stability we follow Golder/Tellis (1998) and estimate each model repeatedly by adding observations of one additional period. We measure parameter stability by:

(i) \( \text{STAB1} \), which captures fluctuations from the overall mean: "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/Tellis 1998, p. 269):

\[
\text{STAB1} = \frac{\text{mean}(\hat{\beta}_i)}{\text{stand.dev.}(\hat{\beta}_i)}.
\]

where \( \hat{\beta}_i \) represents parameter estimate of \( \beta_i \).

(ii) \( \text{STAB2} \), which captures period to period fluctuations, is "the average period to period change standardized by the mean of the parameters" (Golder/Tellis 1998, p. 270):

\[
\text{STAB2} = \frac{\sum |\hat{\beta}_i - \hat{\beta}_{i-1}|}{\text{mean}(\beta_i)} \cdot \frac{1}{K},
\]

where \( K \) represents the number of estimation periods.

<table>
<thead>
<tr>
<th>Number of parameters</th>
<th>Parameter estimates (t-values in brackets)</th>
<th>( \hat{\beta}_1 )</th>
<th>( \hat{\beta}_2 )</th>
<th>( \hat{\beta}_3 )</th>
<th>( \hat{\beta}_4 )</th>
<th>( \hat{\beta}_5 )</th>
<th>( r )</th>
<th>SSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 2 4</td>
<td></td>
<td>0.001</td>
<td>0.64***</td>
<td>0.36**</td>
<td>658***</td>
<td>0.99</td>
<td>230.48</td>
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<tr>
<td></td>
<td></td>
<td>(0.80)</td>
<td>(7.13)</td>
<td>(3.58)</td>
<td>(14.86)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 4 4</td>
<td></td>
<td>-0.22</td>
<td>22.27</td>
<td>-0.66**</td>
<td>536***</td>
<td>0.99</td>
<td>388.05</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>(-0.59)</td>
<td>(0.64)</td>
<td>(-2.28)</td>
<td>(4.16)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 5 3</td>
<td></td>
<td>0.63***</td>
<td>0.33***</td>
<td>665***</td>
<td>0.99</td>
<td>233.33</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>(8.21)</td>
<td>(4.23)</td>
<td>(16.07)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Model 6 3</td>
<td></td>
<td>31.74</td>
<td>-0.74**</td>
<td>513***</td>
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<td>429.20</td>
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<tr>
<td></td>
<td></td>
<td>(0.90)</td>
<td>(-3.47)</td>
<td>(5.18)</td>
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</tr>
<tr>
<td>Model 7** 3</td>
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<td>0.39***</td>
<td>852***</td>
<td>0.99</td>
<td>207.57</td>
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<tr>
<td></td>
<td>(2.53)</td>
<td>(18.14)</td>
<td>(15.95)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Model 8* 2</td>
<td></td>
<td>0.39***</td>
<td>852***</td>
<td>0.99</td>
<td>207.57</td>
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<tr>
<td></td>
<td></td>
<td>(18.36)</td>
<td>(15.92)</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

\* estimated in a different way
*** p ≤ 0.001; ** p ≤ 0.01; * p ≤ 0.05

Table 4: Results for the diffusion models with fixed potential market

<table>
<thead>
<tr>
<th>Number of parameters</th>
<th>Parameter estimates (t-values in brackets)</th>
<th>( \hat{\beta}_1 )</th>
<th>( \hat{\beta}_2 )</th>
<th>( \hat{\beta}_3 )</th>
<th>( \hat{\beta}_4 )</th>
<th>( \hat{\beta}_5 )</th>
<th>( r )</th>
<th>SSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 2 4</td>
<td></td>
<td>-0.01</td>
<td>0.98***</td>
<td>0.68**</td>
<td>0.0004***</td>
<td>0.99</td>
<td>194.85</td>
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<tr>
<td></td>
<td></td>
<td>(-0.43)</td>
<td>(7.65)</td>
<td>(2.87)</td>
<td>(25.58)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 5 3</td>
<td></td>
<td>1.01***</td>
<td>0.77***</td>
<td>0.0004***</td>
<td>0.99</td>
<td>196.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(10.64)</td>
<td>(7.06)</td>
<td>(33.22)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 7* 3</td>
<td>0.0001</td>
<td>0.34***</td>
<td>0.001***</td>
<td>0.99</td>
<td>229.24</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(2.08)</td>
<td>(13.04)</td>
<td>(14.80)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Model 8* 2</td>
<td></td>
<td>0.34***</td>
<td>0.001***</td>
<td>0.99</td>
<td>229.24</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>(13.22)</td>
<td>(14.79)</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

\* estimated in a different way
*** p ≤ 0.001; ** p ≤ 0.01; * p ≤ 0.05

Table 5: Results for the diffusion models with dynamic potential market
Higher STAB1 and lower STAB2 values indicate that the model presents greater parameter stability. Table 6 shows the values of STAB1 and STAB2 for models “5”, “7” and “8” for fixed and dynamic potential markets, and reveals that: (a) 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 (b) the parameters of model “7” are more stable than those of models “5” and “8”, assuming either a fixed or a dynamic potential market. Hence, the proposed measures of parameter stability indicate that model “7”, with a fixed potential market, is the model with the most stable parameters.

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/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 7 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.

Among the models that are the most 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), demonstrates the best properties in terms of parameter stability and predictive validity. This 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 $\hat{\beta}_1 = 0.39$ 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.

### 6. Conclusions

This study contributes to the increasing use of diffusion models in industrial/business settings which, according to Kahn (2002), is very limited, and to research on organizational innovations which is relatively undeveloped (Van der Aa/Elfring 2002; Wolfe 1994).

We consider the diffusion of franchising by firms (interfirm diffusion) in Spain during the period 1974–1999. The adoption of this system of commercialization has important consequences for the adopting organization (the franchisor). Franchising is a mechanism that reduces the divergence of interest between the two parties (franchisor and franchisee), reducing agency problems and allowing the possibility of reaching common goals. We apply well-known diffusion models to detect how many firms are influenced by the timing of the adoption by other firms (“innovators”).
We first test whether the adoption follows a purely random process or whether firms imitate the adoption of the franchising concept. In the second step we estimate several diffusion models and compare these nested and non-nested models. The final selection of the most appropriate model is based on parameter stability and predictive validation criteria.

Our results suggest that several Bass-type diffusion models, taken from a family of models, appropriately capture the long-run diffusion process of franchising in Spain. The traditional Bass model (model “7”) presents better properties in terms of parameter stability and predictive validity. Results show that the adoption of franchising in Spain is only slightly affected by external influence and that 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, external influence should be enhanced by marketing efforts. Additionally, 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/Bettis (1988) regarding organizational innovations.

In this study we do not distinguish between different industries or sectors, however this distinction would be informative. The appropriate data necessary to calibrate the models in different industries or sectors is not yet available. This offers opportunities for future research. This also holds for studies which analyze the adoption of franchising in different countries. Future research could also be directed to modeling the dynamics of the potential market in a more advanced way. Another limitation of this study is that we are not able to use the effects of Word-of-Mouth information among franchisees on the diffusion of franchising.

Although this study represents a valuable starting point for the reexamination of organizational innovations with diffusion models, other useful studies for managers are those that answer questions such as “which of the characteristics of a franchising system have mainly favored its diffusion?” or “what is the role played by the competitive environment in the diffusion of franchising?”. These research questions, offer many opportunities to continue studying the adoption of innovations.

Notes
[1] Article 62 from Law 7/1996, January 15th, about Retailing Business Regulation, referring to the commercial activity in franchising was an important step in the development of franchising in Spain. 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, there was the Regulation of the Commission of the EEC nº 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 the European Code of Franchising. This code went into effect in Spain on January 1st 1991, and it was assumed by Spanish Association of Franchisors.
[2] The numbers refer to the models in Table 1.
[4] The Augmented Dickey-Fuller test statistics are equal to –3.79 (Equation 5, critical value 5%-level: –3.60) and –2.19 (Equation 6, critical value 5%-level: –1.96), respectively.
[5] We thank the reviewer for this suggestion.
[6] Hence, the models which include $b_2$ show problems. Compare also Parker (1993) who had the same problems.

References
Franquischayhoy. La franquicia en cifras [Franchising in figures], a report by Torno & Asociados (www.franquischayhoy.es, 27/02/2006).


