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Plural forms versus franchise and company-owned systems: A DEA approach of hotel chain performance☆

Laurent Botti[b,c], Walter Briec[c,d,*], Gérard Cliquet[a]

[a]CREM, Institut de Gestion de Rennes, 11 Rue Jean Macé, CS 70803, F-35 708 Rennes Cedex 7, France
[b]ERFI, Institut des Sciences de l'Entreprise de Montpellier, Université Montpellier I, Espace Richter-Bât B, CS 19519, F-34 960 Montpellier Cedex 2, France
[c]GEREM, Institut d'Administration des Entreprises, Université de Perpignan Via Domitia, 52 Avenue Paul Alduy, F-66 860 Perpignan Cedex, France
[d]LAMPS, Faculté des Sciences Exactes et Expérimentales, Université de Perpignan Via Domitia, 52 Avenue Paul Alduy, F-66 860 Perpignan Cedex, France

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Abstract

Plural form tends to be the most popular organization form in retail and service networks compared to purely franchised or purely company-owned systems. In the first part, this paper exposes the evolution of researchers' state of mind from the way of thinking which considers franchising and ownership as substitutable organizational forms to theories which analyze the utilization of both franchise and company arrangements. The paper describes the main attempts to explain theoretically the superiority of plural forms. In the second part, the paper discusses the hypothesis which says that there is a relationship between the organizational form of the chain and its efficiency score. It is demonstrated through the application of a data envelopment analysis method on French hotel chains that plural form networks are in average more efficient than strictly franchised and wholly owned chains. The Kruskal–Wallis test which is a distribution-free rank-order statistic is used to statistically verify this relationship. The result does not permit the rejection of the null hypothesis regarding whether an organizational form is more efficient than another one. Hence, this paper opens prospects for researches aiming at testing the organizational form effect on different samples and with other methods.

Keywords: Franchise; Company-owned system; Plural form; DEA; Efficiency, Kruskal–Wallis

1. Introduction

In service industries, companies have routinely hundreds of sites where their services are created. These geographically dispersed chains have to decide whether to sell their services to consumers themselves or via independent retailers. When a company performs the sales function internally, it owns the physical facilities and operates them by hiring employees managed through a traditional hierarchical structure. When a company does not perform the sales function internally but wants exclusive retailers, it usually contracts with a franchisee who uses the chain's trademark and receives the unit's profits (minus the royalty payment) as he invests capital in the unit and agrees to adhere to certain operating standards [1–3].

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* Corresponding author at: GEREM, Institut d'Administration des Entreprises, Université de Perpignan Via Domitia, 52 avenue Paul Alduy, F-66 860 Perpignan Cedex, France. Tel.: +33 468662263.
E-mail addresses: laurent.botti@univ-perp.fr (L. Botti), briec@univ-perp.fr(W. Briec), gerard.cliquet@univ-rennes1.fr (G. Cliquet).

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Then, chains are not the cookie-cutter replication of a simple business concept. Beneath a veneer of similarity reside two sharply differing organizational arrangements: company-owned units and franchised units. However, reality is different from the franchising versus company-owned system dilemma [4,5]. Indeed, if we consider various service industries in different countries such as fast-food in the United States [4], hotel and catering, bakeries or cosmetology in France [6,7], most chains are organized through a plural form, i.e. the simultaneous use of company-owned and franchised units.

Some researches recently demonstrated the superiority of plural forms compared to franchised chains or company-owned arrangements. Indeed, company-owned and franchised units complement each other [5]. By having both units together, a chain can leverage some of the strengths and overcome some of the weaknesses associated with each arrangement. For instance, Sorenson and Sørensen [8] argue that chains benefit from balancing the "exploitation" provided by company-owned units with the "exploration" emanating from franchised units. In the same way, franchisors control franchisees' incentive to underinvest in activities that foster brand name value relative to the chain by operating a large percentage of their outlets [9].

Then, it seems that there are many reasons why a mixture of company-owned and franchised units makes the chain stronger than an exclusive reliance on one or the other. However, to our knowledge, no current study has directly addressed how the decision to adopt a plural form impacts efficiency level of the chain. No study measures and compares the efficiency level of a plural form relative to the efficiency level of franchised chains and company-owned arrangements.

Efficiency refers to the technological relationship between inputs and outputs. In contemporary economics, efficiency at the level of the enterprise is a major issue. Indeed, in a competing environment, a company less effective than its competitors generally does not preserve a sufficient market share to survive. Then, if the decision to adopt a plural form increases efficiency, consumers would benefit from firm market share growth and vice versa. In this context, it is interesting to study how the chain arrangement determines the company efficiency.

So, our paper will discuss the hypothesis which says: There is a relationship between the organizational form of the chain and its efficiency score. To test this hypothesis, we use a data envelopment analysis (DEA) approach [10] and implement the Kruskal–Wallis test which is a distribution-free rank-order statistic [11]. We apply this method in the French hotel industry since it is an important and extremely competitive sector in France where there can be different kinds of organizational forms.

Knowing which organizational form is more efficient is good news for retailers or service companies which can then make their chains survive longer than their competitors. However, the stake of this research is not only for retail or service companies. Its results should also interest manufacturers who try to market their products through these chains.

The remainder of the paper is structured as follows. In the next section, the three theoretical approaches, franchising, company-owned arrangement and plural form are described. In this section, we examine why a company would choose a plural form. In Section 3, we expose the method and the empirical results. Section 4 deals with the results and finally in Section 5 we conclude.

2. Three theoretical approaches of chains organizational forms

The decision between franchising and ownership has been considered for a long time as a way of substituting one for another. The first subsection above deals with this antagonism. This way of thinking is now replaced by the idea of complementarity between these two organizational forms. The second subsection exposes the main approaches which analyze the concept of plural forms.

2.1. Franchising and ownership as a dichotomic approach

The literature on chains focuses almost exclusively on whether they should own or franchise units [5]. Several answer tracks have been proposed since company-owned and franchised units embody contrasting economic and managerial characteristics [12,13]. The main theoretical contributions that frame this debate are outlined here.

Oxenfeldt and Kelly [14] were among the first to deal with the switch from franchised to company-owned units. They argue that chains have a life cycle which explains their *ownership redirection*. This thesis says that once the initial constraints of financial resource availability, human resource availability and informational resource availability are relatively overcome, the attractiveness of franchising is greatly diminished. Then, franchisors may resort to ownership redirection rather than share revenue streams with their franchisees. Franchising, therefore, is seen as a temporary phenomenon in the life cycle of chains. Certain business

areas are consistent with this theory: American fast-food companies, convenience stores and automatic laundries during the 1960s and the 1970s, for example [1,15]. However, Dant et al. [16] examined the studies spawned by Oxenfeldt and Kelly's thesis and they showed that this literature has yielded inconsistent empirical conclusions.

Manolis et al. [17] gave another explanation to the Oxenfeldt and Kelly's ownership redirection thesis. They show that the redirection is caused above all by a reflexion on quality standards. If the costs of maintaining these standards are too high with some franchisees, the franchisor terminates the agreement and buys the unit. Quality control has also been used by Caves and Murphy [2]. Their research indicates that in industries where customers are not prone to repeat purchases (hotels and catering, car rental services) there are more quality control problems and a trend toward company ownership.

Based on resource constraints on the one hand and agency and transaction costs theories on the other hand, other researches present reasons leading to franchising one or several units.

Franchising bring speed, financial and human resources. Then, when the territory coverage is a critical key of success or when the local market is difficult to apprehend, retailers turn their chain into a franchise system [18,19]. Franchising is also less costly than calling for investors, because investors can demand higher profits than those expected by franchisees [20]. Moreover, choosing a franchisee is less risky than calling for investors as they can generate problems in the directors' board [3,20].

As the chain gets closer to its maturity stage, financial and human constraints begin to become weaker and weaker. Then, for several reasons, the company system takes over [14]. With less financial constraints, the franchisor can try to increase his profit and his managerial talent by controlling most profitable units and completing the territory coverage with franchisees. Buying franchised units refers then to two behavior: an opportunistic behavior looking for the systematical acquisition of the most profitable franchised units and a more responsible behavior aiming at the improvement of chain management and franchisees' performances. For instance, buying units located in a specific kind of location can be used to improve the profitability of franchisees in the same situation [21]. On the other hand, an opportunistic behavior can decrease the managerial quality of the franchise system by damaging the psychological climate and the solidarity between the franchisor and its franchisees [22].

In addition to the resource dependence view, the dynamics of franchised and company-owned outlets have been examined from an agency-theoretic and transaction cost analysis perspectives. According to the agency theory, the decision between company ownership and franchising depends on the individual characteristics of the outlets. Under the conditions of low monitoring costs, company-owned outlets, despite their low-powered incentive mechanisms, are more efficient than franchised outlets. However, when the monitoring costs rise, due to uncertainty and opportunism, franchised outlets are more efficient because of their high-powered incentive effects [23]. The transaction cost analysis explanation is based on the assertion that differences in asset specificity, frequency of transactions and uncertainty may explain the ownership of the individual outlets [24]. The investigations based on transaction cost analysis primarily attempted to evaluate the influence of specific investments on the tendency toward vertical integration by company-owned outlets [17]. However, due to the hostage effect of the outlet-specific investments, the franchisee is motivated to manage his outlet as well as possible [25–28]. Then, the franchisee's opportunism risk is reduced, requiring a lower degree of vertical integration.

Hence, different approaches lead to the ownership system, whereas others imply a franchise system. These theories deal with the way of thinking which considers franchise and ownership as substitutable organizational forms and regard chains as collections of units i.e. simple sums of discrete own-or-franchise decisions, not as complex organizations [4]. But in some cases, both company-owned and franchised units are used in the same organizational form.

2.2. *The concept of plural form in chains*

The first explanations concerning the use of a mix of company-owned and franchised outlets in a chain are limited to specific situations. For instance, Rubin [29] shows that the franchise system is rather implemented for outlets located far from the company headquarters, whereas company-owned units are kept for nearby outlets. The concept of life cycle applied to chains enables Oxenfeldt and Kelly [14] to analyze over time the process of buying units. On the contrary, Rubin [29] shows that chains does not have to substitute company-owned units for franchised units over time but have to use their complementarity over space. Moreover, Markland and Furst [30] show that we can consider chains as portfolios of operating units. Then, chains succeed in buying the most profitable units, while the others

remain in a franchising system. Other reasons deal with regulation. In France for instance, it is compulsory to open some company-owned outlets before developing the chain through a franchise system [6].

Since traditional approaches to franchised/company-owned outlets' choice, whatever the theoretical bases, imperfectly analyze the mix complexity, researchers from Harvard University have proposed successively a price-authority-trust approach [31] and a model [4,5].

The idea of diversifying organizational forms in firms has been treated through Harrigan's concept of *taper integration* [32]. Taper integration occurs "when firms are backward or forward integrated but rely on outsiders for a portion of their supplies or distribution" [32, p. 643]. Taper integration implies that some activities are pursued in a parallel manner, both in-house and through outsourcing. Thus, taper integration embodies varying mixes of the two typical organizational forms and their corresponding coordination mechanisms [33]: the hierarchy form which relies on the authority mechanism and the market form which relies on the price mechanism.

Bradach and Eccles [31] have criticized this *market versus hierarchy* dichotomy approach since it does not justify many organizational forms. On the one hand, elements belonging both to market and to hierarchy can sometimes be found. On the other hand, transactions are also embedded in social structures based on trust. Thence, there arises the necessity for decomposing transactions into three coordination mechanisms: Price, authority and trust, which are combined two by two or all the three together.

Transactions in chains deal with these three coordination mechanisms. Indeed, in the company-owned part of the chain, where there is a hierarchical mechanism related to authority, incentive programmes are introduced and can be considered as elements linked to market mechanisms. Concerning the franchised part of the chain, franchisees can be entrepreneurs governed solely by contract [34]. However, this depiction is misleading. Often, a contractually introduced hierarchical authority controls the franchisee's business. Moreover, franchisees can own multiple units and then organize them in hierarchies [4]. To this market-hierarchy combination, a confidence relation is necessarily added without which bad consequences on the brand image of the chain can occur [35]. Indeed, franchisees may feel as if they could ride on their franchisor's reputation and shirk quality and customer service. Trust has effective properties for the coordination between franchised units and company headquarters [36]. So, chains have to deal with authority, price and trust mechanisms to succeed.

Bradach [4,5] constructed a model that explains how chains do with the simultaneous use of these three mechanisms. Indeed, interpreting the choice of the coordination mechanism for a given site cannot tell much about the dynamics at work in chains. So, he explained how chains mix company and franchise arrangements. As we have seen and as Bradach [4,5] says, usual arguments on franchise and company systems explain very little about chains organizational form since they focus almost exclusively on whether chains should own or franchise outlets. Explaining chain organization with theories justifying company-owned systems or franchising sheds little light on this issue and turns up with errors.

In Bradach's model [4,5], the proportion of franchised and company-owned units is a "product of micro-level decisions and macro-level strategic objectives". So, choosing a form is a function of vagaries of circumstances and, concretely, concerning a new site, questions can be asked about who has cash (the franchisor or the potential franchisee) or whether a qualified manager is available or not. Then, the search for optimal mix between in-house and outsourcing seems to be in fact a long trial and error process [37].

The consideration of franchise and ownership combination consists in taking up four essential challenges [5]: (1) adding new units, (2) maintaining uniformity across units, (3) responding locally when appropriate and (4) adapting the system as a whole when threats and opportunities arise. These challenges are contingent to three factors: (1) the strategy of the chain in terms of development and adaptation, (2) the size of the chain which corresponds more or less to the life cycle stage, (3) the competitive dynamics of the industry.

Then, Bradach [5] provides a model for understanding the management of chains. He argues that, "the process of plural form may enable organizations to escape their natural tendency to ossify over time by creating a built-in constructive tension between parts that keeps the organization receptive to new influences, yet in control" [5, p. 301]. Despite his idea that plural forms strengthen chains performance, he did not study how different chain architectures shape organizational performances and said that performance questions need to be examined. The remainder of our article provides a framework to analyze performance differences between different organizational forms.

3. A comparison between chain organizational forms: a DEA approach

Our framework to compare chains through their choice between a franchise system, a company-owned

arrangement and a plural form lies in the context of production micro-economics and is based on the DEA methodology. Basically, DEA is a non-parametric technique that can be used to measure the relative efficiency of decision making units (DMU) as part of a collection of DMUs that utilize similar resources, inputs, to produce similar goods or services, outputs [10].

We proceed as follows. The next paragraph contains an introduction to the idea of DEA and discussion of appropriate DEA formulation with respect to our goal. Indeed, DEA is a highly useful tool, but it is context sensitive. That is, the rules for model choice, variable choice and results interpretation change depending upon managerial or research purposes [38]. Then, numerical results are provided.

3.1. The method

The DEA methodology, introduced by Charnes et al. [10] and generalized by Briec [39] is a non-parametric method for the estimation of Pareto-optimal frontiers from which the efficiency of DMUs can be determined. The direct consequence of the non-parametric feature of DEA is that this method does not require, unlike deterministic and stochastic parametric methods, the specification of a functional form for the production technology. With DEA, one circumvents the problem of specifying an explicit form of the production function by making assumptions about the technology. For a comprehensive exposition of these assumptions, the reader may refer to Ray [40] and Coelli et al. [41]. Another consequence of this non-parametric feature is that there is no sample constraint. At least it has been accepted as a convention that the size of the DMUs sample must be greater than two times the sum of inputs and outputs [42]. At this time, a large number of articles on theoretical extensions and empirical applications of DEA have been published. Surveys of these papers can be found in Lovell and Schmidt [43], Lovell [44] and Tavares [45].

Before turning to technical details, let us briefly expose how the methodology works. Indeed, while the procedure is computationally rigorous, a simple literal and graphical presentation can demonstrate its fundamental idea. The method separates the efficient DMUs from the inefficient on the basis of whether they—i.e. the input–output bundles—lie or not on the *efficient frontier* of the *production possibility set* (or simply the *possibility set*). The latter is composed of all the input–output vectors that are feasible with a *production technology* transforming a vector of inputs $x = (x_1, \ldots, x_N) \in \Re_+^N$ into a vector of outputs $y = (y_1, \ldots, y_P) \in \Re_+^P$. It can be simply written as

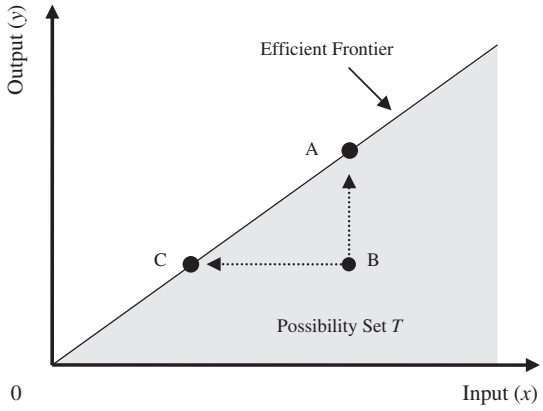

Fig. 1. The possibility set T and the efficient frontier.

$$T = \{(x, y) \in \Re_+^{N+P} : x \text{ can produce } y\}. \quad (1)$$

In Fig. 1, we measure input x along the horizontal axis and output y up the vertical axis. Points A, B and C represent the input–output bundles of DMU A, B and C, respectively. The vector A is efficient because we cannot decrease proportionally the input quantity used to produce the same amount of output. On the other hand, the DMU B is not efficient as it is possible (i) to reduce proportionally the input quantity used until reaching vector C or (ii) expand proportionally the output quantity produced until reaching vector A.

Then, when using DEA, an alternative occurs in the identification of the inefficiency as it is possible to maximize the outputs given the inputs or to minimize the use of inputs given the outputs. The latter alternative is the definition of the Debreu–Farrell measure of technical efficiency which can be written as follows [46,47]:

$$E_{\mathrm{DF}}(x, y) = \min\{\theta : \theta x \in L(y)\}, \quad (2)$$

where $L(y)$ is the *input correspondence* or the *consumption set of* y [48], i.e. the set of all input vectors that yield at least y.

With m observed DMUs (x^1, y^1), $(x^2, y^2), \ldots, (x^m, y^m)$, the possibility set can be defined as follows:

$$T = \left\{ (x, y) : x \geqslant \sum_{i=1}^{m} \lambda_i x^i,\ y \leqslant \sum_{i=1}^{m} \lambda_i y^i,\ (\lambda_1, \ldots, \lambda_m) \in \Gamma \right\}, \quad (3)$$

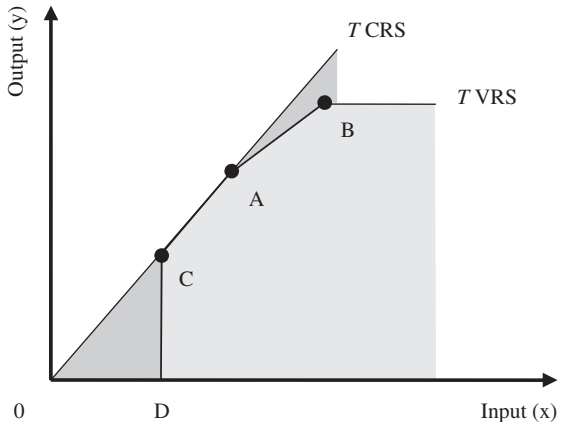

Fig. 2. DEA efficient frontier under constant and various returns-to-scale.

where λ represents the intensity of each production unit and Γ the set which characterizes the *returns-to-scale*, i.e., the way the production process can be scaled up and down for each observation. Obtained efficiency measures are quite sensitive to alternative specifications of returns-to-scale. While recognizing this fact, the efficiency literature does not provide much guidance on the issue of how to evaluate the appropriateness of choices in this respect [49]. In DEA, the possibility set can be based on the hypothesis of constant returns-to-scale (CRS) or can assume variable returns-to-scale (VRS). According to the chosen return-to-scale hypothesis, the set Γ can be defined as follows:

(a) CRS [10]:

$$\Gamma=\{(\lambda_1,\ldots,\lambda_m):\lambda_i\geqslant 0,\ \forall i\in(1,\ldots,m)\}. \tag{4}$$

(b) VRS [50]:

$$\Gamma=\left\{(\lambda_1,\ldots,\lambda_m):\sum_{i=1}^{m}\lambda_i=1,\ \forall i\in(1,\ldots,m)\right\}. \tag{5}$$

In Fig. 2, the complete line (C, A) is the efficient frontier of the DEA CRS model. The broken line DCAB represents the frontier under VRS.

From the seminal article of Charnes et al. [10], the following linear program computes the Debreu–Farrell measure with CRS:

$$E_{\mathrm{DF}}(x^j,y^j)=\min\theta,$$

$$\text{s.t.}\quad \theta x_n^j\geqslant\sum_{i=1}^{m}\lambda_i x_n^i,\quad n=1,\ldots,N,$$

$$y_p^j\leqslant\sum_{i=1}^{m}\lambda_i y_p^i,\quad p=1,\ldots,P,$$

$$\lambda_i\geqslant 0,\quad i=1,\ldots,m. \tag{6}$$

This original DEA model has been extended to allow for varying returns-to-scale (i.e., first increasing and then decreasing) in Banker, Charnes and Cooper [50]. According to their article, the following linear program computes the Debreu–Farrell measure with VRS:

$$E_{\mathrm{DF}}(x^j,y^j)=\min\theta,$$

$$\text{s.t.}\quad \theta x_n^j\geqslant\sum_{i=1}^{m}\lambda_i x_n^i,\quad n=1,\ldots,N,$$

$$y_p^j\leqslant\sum_{i=1}^{m}\lambda_i y_p^i,\quad p=1,\ldots,P,$$

$$\sum_{i=1}^{n}\lambda_i=1,$$

$$\lambda_i\geqslant 0,\quad i=1,\ldots,m. \tag{7}$$

3.2. Data and results

A number of empirical studies have been generated by DEA in almost all industries. In 1996, Seiford already counted multiple hundreds of articles using this methodology [51]. Uses of DEA have involved a wide range of different kinds of entities that include business firms but also not-for-profit entities including university departments [52], schools, hospitals or military units as well as nations [53], regions or professional football clubs [54,55]. As far as chains are concerned, this methodology has already been used [56–63] in different contexts such as restaurant, grocery retail or hypermarket retail companies. But to our knowledge, there is as yet no published paper using the DEA methodology to compare chains efficiency in regard to their organizational form. There is also no paper studying the French hotel industry.

When one talks about the efficiency of a firm, one usually means its success in producing as large as possible an output from a given set of inputs [47]. Our paper adopts this direction and will therefore analyze the efficiency using an input-oriented projection model. Data are derived from the official French publication, “Annuaire de la Franchise”. This publication was completed and sometimes modified according to informations given by companies themselves.

Table 1
Data on hotel chains in France[a]

Rank	Hotel chains in France	Number of franchised hotels	Number of hotel subsidiaries	Hotel room cost	Territory coverage	Chain duration (years)	Sales 1997 (MF)
1	Campanile	244	81	16 113	0.9230	22	2800
2	Ibis	165	123	4011	0.8996	24	2723
3	Mercure	125	78	36 640	0.8736	25	2326
4	Formule 1	18	262	18 883	0.8963	13	827
5	Climat de France	165	0	0	0.8880	14	820
6	Première classe	126	23	1755	0.8835	8	382
7	Etap Hôtel	26	70	6445	0.8136	7	299
8	Balladins	77	0	0	0.8101	12	290
9	CI Primevère	55	5	648	0.8274	11	242
10	Clarine	53	1	132	0.7737	3	150
11	Comfort Inn	38	0	0	0.4913	5	140
12	Bleu Marine	5	8	2816	0.5398	6	140
13	Hôtel B & B	1	52	4940	0.7720	8	140
14	Nuit d'Hôtel	51	0	0	0.7955	4	113
15	Quality Inn	13	4	1308	0.5438	6	88
16	Akena	7	10	995	0.4398	6	40

[a]The authors are very thankful to the French Federation of Franchising (FFF) for its help for this research.

We measure output by

(i) sales

and inputs by

(ii) costs,
(iii) territory coverage,
(iv) chain duration.

Costs are given by the number of hotel rooms multiplied by a certain coefficient depending on the hotel category (from 0 stars for low profile hotel chains to 4 stars for high-level hotel chains, as it is classified in France). Costs are a function of the number of hotel rooms which are managed by chains employees. When the chain is a strictly franchised one, it is the franchisees who own the physical facilities. Therefore, the chain does not invest capital in the unit and its costs are equal to zero. Territory coverage, assessing the notoriety of a hotel chain and its position on the chain life cycle curve, is measured by relative entropy through figures between 0 and 1 [64]. Chain duration is measured by the number of years since the beginning of the chain.

The choice of the inputs stems from the fact that sales depend on costs in the hotel industry but also on marketing elements such as market notoriety. This notoriety depends on the chain duration (the more the chain exists in the market, the more it has a chance to be known by customers) and territory coverage (and not the number of hotels since they can be more or less geographically concentrated).

Table 1 presents the institutional settings. French hotel chains are ranked according to their annual sales amount in 1997.

Since we want to develop a comparative study concerning the productive performance of hotel chains and their organizational form, we have to identify different kinds of chains. We identify three kinds of chains according to the proportion of franchised units. Table 2 presents this proportion of franchised units and chains which set up each group. In the last column, DFC is used to identify the dominantly franchised chains (i.e. % of franchised units $> 75\%$), DCC is used to identify the dominantly company-owned chains (i.e. % of franchised units $< 25\%$) and PFC is used to identify the plural form chains (i.e. % of franchised units $> 25\%$ and $< 75\%$). In this table, French hotel chains are ranked according to their total number of hotels.

This classification in three categories corresponds not only to a simple proportion of franchised units but also to a real state of mind. Some entrepreneurs and/or managers implement a real philosophy of franchising, or plural form or company-owned system. Most of the time, especially for franchise and company-owned systems, these arrangements are not "pure". For instance, if a chain acquires another chain, it could find hotels managed in a way they are not accustomed to.

Metters et al. [38] provide some practical guidelines for the application of DEA. They have suggested a

Table 2
Proportion of franchised units and chains groups

Rank	Hotel chains in France	Belonging to hotel group	Stars	Total number of hotels	Franchised units (%)	Kind of chain
1	Campanile	Envergure	**	325	75.08	PFC
2	Ibis	Accor	**	288	57.29	PFC
3	Formule 1	Accor	0	280	6.43	DCC
4	Mercure	Accor	***	203	61.58	PFC
5	Climat de France	Hôtels et C^{ie}	**	165	100.00	DFC
6	Première classe	Envergure	*	149	84.56	DFC
7	Etap Hôtel	Accor	*	96	27.08	PFC
8	Balladins	Hôtels et C^{ie}	**	77	100.00	DFC
9	CI Primevère	Choice Hotels	**	60	91.67	DFC
10	Clarine	Envergure	**	54	98.15	DFC
11	Hôtel B & B	Galaxie	**	53	1.89	DCC
12	Nuit d'Hôtel	Hôtels et C^{ie}	**	51	100.00	DFC
13	Comfort Inn	Choice Hotels	**	38	100.00	DFC
14	Akena	Promogest	**	17	41.18	PFC
15	Quality Inn	Choice Hotels	***	17	76.47	DFC
16	Bleu Marine	Envergure	***	13	38.46	PFC

Table 3
CRS, VRS and scale efficiency scores of hotel chains in France

Rank	Hotel chains in France	Overall efficiency scores (CRS)	Technical efficiency scores (VRS)	Scale efficiency scores	Position of the chain in frontier
1	Climat de France	1	1	1	Constant
2	Campanile	1	1	1	Constant
3	Ibis	1	1	1	Constant
4	Mercure	0.8777	0.9519	0.9221	Increasing
5	Clarine	0.6847	1	0.6847	Increasing
6	Formule 1	0.4998	0.7056	0.7084	Increasing
7	Nuit d'Hôtel	0.4823	1	0.4823	Increasing
8	Comfort Inn	0.4780	1	0.4780	Increasing
9	Première classe	0.4162	0.7239	0.5749	Increasing
11	Balladins	0.4126	0.7145	0.5775	Increasing
16	Etap Hôtel	0.3356	0.7563	0.4437	Increasing
10	CI Primevère	0.2823	0.6045	0.4671	Increasing
12	Bleu Marine	0.1931	0.8953	0.2157	Increasing
13	Hôtel B & B	0.1406	0.6343	0.2217	Increasing
14	Quality Inn	0.1278	0.8780	0.1456	Increasing
15	Akena	0.0590	1	0.0590	Increasing
Mean		0.4994	0.8665	0.5763	

number of specific rules, for instance using variable returns-to-scale models when modeling DMUs of largely varying size and when scale size is controllable by the DMUs. The choice of an assumption about returns-to-scale (constant versus variable) is not neutral because this choice conditions the representation of the possibility set. The assumption of constant returns-to-scale implies a long term vision where units' size can be modified. With the variable returns-to-scale assumption, the reasoning takes place in the short run and units' size is fixed. In our case, since hotel chains have different size (according to their total number of hotels) and their scale size is controllable by their central management, the variable return-to-scale hypothesis was chosen. The VRS score measures pure technical efficiency only. However, for comparative purposes, we also present the constant returns-to-scale index which is composed of a non-additive combination

of pure technical and scale efficiencies. A ratio of the overall efficiency score (the CRS score) to pure technical efficiency score (the VRS score) provides a scale efficiency measurement. The CRS, VRS and scale efficiency scores of the analyzed chains are presented in Table 3. The ranking in Table 3 is in hierarchical order of CRS technical efficiency scores, starting from the most efficient to the least efficient.

4. Discussion

The DEA score is equal to 1 for 3 chains when the overall level of efficiency is assumed (CRS scores). Since a larger number of chains (7) are efficient when VRS is assumed, it is possible to say that the dominant source of inefficiency is due to scale economies. Scale efficiency equals 1 if and only if the technology exhibits CRS. Scale inefficiencies exist because of either increasing (IRS) or decreasing (DRS) returns-to-scale. The last column of Table 3 gives the position of the chain in the VRS frontier. Managerially, the returns-to-scale can be interpreted by stating that if chains have increasing returns-to-scale it would be worthwhile to increase the input and decrease the input value (via closure or consolidation for example) if there are decreasing returns-to-scale. Here, a majority of chains are positioned in the part of the frontier where the increasing return-to-scale exists. Hence, these chains can realize efficiency gains through expansion.

The average efficiency score under CRS is equal to 0.4994, i.e. chains could use, on average, 49.94% of their current input level to maintain their current output value. It means that, when all sources of inefficiency are included, hotel chains waste 50.06% of their resources. However, the average efficiency scores assuming VRS is equal to 0.8668, i.e. given the scale of operation, a majority of chains are efficient in managing their resources.

We can see that hotel chains that belong to the same group get various results. *Accor* (Ibis, Formule 1, Etap Hôtel…), *Hôtels et C*^{ie} (Climat de France, Nuit d'Hôtel…), *Envergure* (Campanile, Première Classe, Bleu Marine…) or *Choice Hotels* (Comfort Inn, Quality Inn…) have very different results according to their different chains. It means that there is no relation between efficiency scores and group membership. However, it is possible to develop a comparative study concerning the productive performances of hotel chains and their proportion of franchised units. Table 4 presents the comparison between the three chain kinds in regard to their percentage of wasted resources.

As we can see on this table, whatever the method, plural form chains are more efficient than franchise systems and much more efficient than company-owned systems. Then, it seems that we can validate the assumption saying that the plural form is a more efficient organizational form than the franchised and the company-owned ones.

Precision should be brought to this result. If data concerning sales, chain duration and territory coverage are reliable because of coming from interviews and documents given by companies themselves, data about cost are more questionable. Evaluating this variable is rather rough. We just multiply the number of hotel bedrooms belonging to a chain by a coefficient corresponding to its positioning in the market. The real unit cost is likely to be different. The problem is that this piece of information is strategic and then difficult to obtain. If a certain number of hotel groups are ready to give these figures, it is not the case for all.

Moreover, as far as our method is concerned, it is necessary to precise that DEA approaches traditionally assumed a convexity constraint which ensures that when two or more input–output combinations are known to be feasible, any weighted average of the input bundles can produce a similarly weighted average of the corresponding output bundles. Then, any given unit's observed inputs and outputs are compared to those of a composite unit built as a convex combination of other unit's inputs and outputs [65]. Of the different assumptions made about the technology in defining the possibility set faced by a DMU, by far the strongest is the assumption of convexity [40]. This assumption, a typical neoclassical one equivalent to decreasing marginal rates of substitution (between inputs, between outputs and between inputs and outputs), is difficult to motivate in the context of our paper.

In another model, the so-called free disposability hull (FDH) model of Deprins et al. [66] (further developed by Tulkens [49]), it has been proposed to relax this convexity constraint. In this regard, this model is of course the most attractive approach as it always uses a single actually observed input–output bundle as the basis for efficiency evaluation of any DMU [48,49]. However, the frontier of the FDH production possibility set is a *step function*. Then, in comparison with CCR and BCC frontiers, it has a more *generous* nature as it always lies much closer to the data [49]. As a result, efficiency scores are of course always higher with FDH than with all other reference technologies. For example, in the retail banking application reported by Tulkens [49], 74.6% of units were classified as efficient under a non-convex approximation, whereas only 5.2% of units remained efficient when the convexity assumption was

Table 4
Plural form chains compared to dominantly franchised or dominantly company-owned chains

Organizational form groups	Strongly company-owned chains	Plural form chains	Strongly franchised chains
Number of hotel chains	2	6	8
Average percent of wasted resources with CRS (%)	67.98	42.24	51.45
Average percent of wasted resources with VRS (%)	33.00	6.61	13.49

added. In our case, because of the paucity of the observations, i.e. the small size of the sample of French chains, 81.3% of chains are efficient under FDH. In this perspective, despite our inability to justify the convexity assumption, it is impossible to use the FDH method to discuss our hypothesis.

Furthermore, as our sample is small, statistics such as the average become sensitive to aberrant values. So, average differences are not necessarily statistically meaningful, i.e. the comparison of the average efficiency of the different organizational forms do not determine if the differences observed are statistically significant or are possibly attributable to chance differences [67]. To statistically document the existence of an organizational form effect, we apply the Kruskal–Wallis test [11,68] which is a non-parametric one. Here, several reasons motivate the use of a non-parametric test to examine a null hypothesis regarding whether a group of chains is more efficient than another group. For instance, this kind of test does not impose a structure to the distribution of DEA efficiency scores which is good news because it is not true that these scores follow assumptions associated with parametric approaches [68].

The Kruskal–Wallis test [11,68] is the generalization of the Mann–Whitney U-test [69] in the manner that the former test can deal with more than two groups. Rather than examining the means of the data, this method relies on the ranks of the scored values and the means of those ranks. To the knowledge of the authors, few papers use one of these tests in combination with DEA. Sueyoshi and Aoki [68] used the Kruskal–Wallis test to examine whether or not any frontier shift occurs among observed periods while Hsu and Hu [70] used it to compare different hospital types and Brockett et al. [67] to study insurance companies.

The Kruskal–Wallis test allows the study of the connections between a quantitative and a qualitative character with k classes. The test statistic for the Kruskal–Wallis test is H.

$$H = \frac{12}{n(n+1)} \sum_{i=1}^{k} \frac{R_i^2}{n_i} - 3(n+1), \tag{8}$$

where k is the number of sample, i.e. the number of organizational forms ($k = 3$), n is the total number of observations, i.e. the number of chains ($n = 16$), n_i is the number of observations in sample i and R_i is the sum of the ranks for sample i.

We have set up a simple hypothesis test that assumes there is no difference between the efficiency scores of any of the organizational forms. The null hypothesis is H_0, and the research, or alternate hypothesis is H_1.

H_0: There is no difference in the mean of technical efficiency scores across the organizational forms.

H_1: There is a difference in the mean of technical efficiency scores across the organizational forms.

H_0 assumes that there is no statistically significant difference between the means. When using the Kruskal–Wallis test, what is tested is the validity of this hypothesis. If the null hypothesis is rejected, it implies that there is an organizational form effect.

When sample sizes are small in each group ($\leqslant 5$) and the number of groups is less than 4, a tabled value for the Kruskal–Wallis should be compared to the H statistic. Otherwise, a χ^2 with $(k-1)$ degrees of freedom can be used.

Once we decide how sure we want to be about our conclusion—in this case we use a 0.05 significance level (95% level of confidence)—we conduct the Kruskal–Wallis test to decide whether any organizational form is statistically different from the others with the specified degree of significance. In our case, the test statistic H will follow a χ^2 distribution with 2 degrees of freedom.

The results of the Kruskal–Wallis test using the statistical package STATA is $H = 4.437$ with 2 degrees of freedom. The value of χ^2 statistic is insignificant at 5% level, i.e. $H < \chi^2$ tabled value for 2 degrees of freedom and 0.05 level of significance. Since $H < \chi^2$, we fail to reject H_0 and conclude that we have no evidence to show that the organizational forms are different in terms of efficiency scores. In other words, there is no reason to believe that organizational forms differ in their ratings from a statistical perspective.

5. Conclusion

The transformation of retail and service chains toward plural form chains is not recent if we consider a historical evolution of these chains during the last 30 years, especially in hotel industry in France [6]. But researchers have brought very little attention to that phenomenon till the 90s and have continued to deal with it in a very traditional way, i.e. by opposing franchise systems and company-owned arrangements. Then, few studies have illuminated either the complexity of plural form organizations or their management challenges.

In the first part of the paper, we have exposed the evolution of researchers' state of mind: from a mechanistic approach (rational choice of control mechanism for a given site) to a more contingent approach, i.e. from the way of thinking which considers franchising and ownership as substitutable organizational forms to theories which analyze the utilization of both arrangements in the same chain.

Moreover, we have described the main theoretical attempts to explain the superiority of plural forms. While there are many theoretical reasons why plural form seems to be a rational organizational choice for chains, little empirical researches suggest anything about the productive efficiency level of this organizational form. Traditional works use quantitative data only to show the superiority of franchise units on non-franchised ones [71,72]. Then, in the second part of the paper, we have analyzed French hotel chains with a data envelopment analysis method and we have shown that in this case plural form networks are in average more efficient than strictly franchised and wholly owned chains. So, it seems that in the French hotel sector, there is a relationship between the organizational form of the chain and its efficiency score.

To be sure about this assumption, we have implemented the Kruskal–Wallis test [11,68]. This test is used to examine whether one group of DEA inefficiency scores is different (more efficient) from another group. The Kruskal–Wallis test result contradicts the existence of an organizational form effect. Thus, the relationship between the organizational form of the chain and its efficiency score requires further evaluation. Future researches could test it on larger and different samples of chains or use other methods like the one employed by Grosskopf et al. [73] or the one applied by Ross and Droge [74].

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