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Plural Form and Franchise Chains Efficency: A Dea Meta-Frontier Approach applied to French Chains

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Abstract

This paper deals with the performance of franchise chains related to their percentage of company-owned outlets (PCO). This research uses a Data Envelopment Analysis (DEA) to assess franchise chains' efficiency, and a meta-frontier approach to analyze chains' efficiency between and across sectors. The sample includes 43 chains of the service and retail sectors, located in the French market. Data are available over the 2005-2007 period allowing a longitudinal analysis. The main findings show that the meta-frontier is built up on retail chains rather than on service chains, and that there is a relationship between the PCO and the chain efficiency. Finally, there is no significant difference between the observed PCOs and the optimal PCOs which means that franchisors in our sample have already reached a PCO that is close to the PCO that optimizes the chain efficiency.

Keywords

Franchising, Plural Form, Percentage of company-owned outlets (PCO), Efficiency, Data Envelopment Analysis, Meta Frontier

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Introduction

Even if some scholars have insisted on the need for research on performance in the franchising industry (Combs, Ketchen, Shook, and Short 2011; Combs, Michael, and Castrogiovanni 2004; Watson, Stanworth, Healeas, Purdy, and Stanworth 2005), this topic is not so widespread in the academic literature. This lack of studies is mainly due to difficulties in collecting financial data, at both levels: the chain one and the outlet one. A few papers have dealt with the assessment of franchisors' performance and on how chain organization can influence this performance.

Recent papers focused on a specific sector, the hotel one, and used the Data Envelopment Analysis (DEA) methodology (Botti, Briec, and Cliquet 2009; Perrigot, Cliquet, and Piot-Lepetit 2009). These authors tried to compare the level of efficiency of chains with different organizational forms (predominantly franchised chains, predominantly company-owned chains or plural form chains). Their findings showed that a plural form organization, where franchised outlets and company-owned outlets do coexist within the same chain, increases chain efficiency.

Other papers based on econometric methodologies determined the optimal percentage of franchised outlets within the chain. For instance, Hsu and Jang (2009) found a non-linear relationship between the percentage of franchised outlets and the franchise chain performance. Based on a sample of publicly-held restaurants' chains, over a period of ten years, they pointed out that the optimal percentage of franchised outlets is equal to 44 percent

for an optimization of return to assets while it is equal to 46 percent for an optimization of return on equity. Moreover, El Akremi, Perrigot, and Piot-Lepetit (2011) confirmed the existence of such a non-linear relationship between the percentage of franchised outlets and the chain efficiency. Based on a cross-sectional sample of 189 U.S. franchise chains in the service and retail sectors, they found a significant and positive impact of the percentage of franchised outlets on the chain performance up to an optimal rate of 62.2 percent.

The main shortcomings of previous studies using a DEA approach are, firstly, the implementation of a cross-sectional analysis. Secondly, they focus on only one sector (the hotel one). Thirdly, their conclusions regarding the impact of the plural form on chain efficiency are not in the same direction: significant relationship (Perrigot, Cliquet, and Piot-Lepetit 2009) *versus* no significant relationship (Botti, Briec, and Cliquet 2009). At the opposite, studies based on econometric techniques aiming to define the relationship between the percentage of franchised outlets and chain performance, provides figures on an average optimal rate without taking into consideration the sector specificities (services *versus* retailing) or the initial chain configurations (historical franchising management practices of the chain).

Thus, this paper proposes an analysis of chain performance and optimal percentage of franchised outlets that overcome some weaknesses of previous studies. Firstly, we use a Data Envelopment Analysis (DEA) approach to assess franchise chains' efficiency. Built upon the works of Farrell (1957) and Charnes, Cooper, and Rhodes (1978), DEA is a non-parametric methodology used to assess relative efficiencies of a set of comparable Decision Making Units (DMUs), here the franchise chains, by some specific mathematical programming models. This methodology has been rarely applied for exploring franchise chains' efficiency.

Secondly, we use a meta-frontier approach for analyzing franchise chains' efficiency between and across sectors (O' Donnell, Prasada Rao, and Battese 2008). This methodology allows us to compare the efficiencies of chains that may be classified into different sectors: services *versus* retailing. Chains in different sectors face different production environments. They make their production decisions within different sets of feasible inputs-output combinations. Such differences imply that an accurate measure of efficiency should be assessed based on separate frontiers. As there is often an interest in measuring chain efficiency across sectors, a common meta-frontier is defined as an envelope of the sector-specific frontiers. Efficiencies measured relatively to the meta-frontier can be then decomposed into two components: a component that measures the distance to the common frontier and a component that measures the distance between the sector-specific frontier and the envelop frontier or meta-frontier.

These efficiency estimates provide two types of useful information. The first one is an assessment of chain management efficiency relative to other chains operating in the same sector. It is an external benchmarking of chains. The second information is an estimation of the gap between sector frontiers and the meta-frontier. It explains variations in efficiencies due to differences in the production environment. It allows a comparison of chains' efficiency across sectors and provides a benchmarking of franchise chains as a whole, regardless their sector specificities.

Finally, this research goes beyond previous studies that estimated an average optimal percentage of franchised outlets by developing a DEA model that allows for an individual estimation of the optimal percentage of franchised outlets for each chain in each sector and across sectors. Contrary to previous research which has analyzed the efficiency of plural form chains ex-post, the DEA modeling process, in this paper, takes into account the percentage of

company-owned outlets (PCO) given its contribution to the chain efficiency. A first DEA model considers PCO as a fixed input. The chain's efficiency is assessed at the observed value of the PCO. A second DEA model jointly optimizes the PCO and measures the efficiency of each franchise chain. It therefore becomes possible to point out the gap between the observed PCO and the optimal PCO of each chain. It then allows franchisors to increase their chain efficiency by changing the current PCO within their chain. Following Shane's suggestion (1998), the resulting PCO optimizes the franchisor's efficiency relatively to its sector-specific environment and to the franchising industry as a whole.

The empirical study deals with a sample of 43 French franchise chains over the period 2005-2007 (129 observations). The advantages of this data set are twofold. Firstly, as recommended by Dant (2008), this research looks beyond North American contexts for a better understanding of the franchising phenomenon. Secondly, as recommended by Mitsuhashi, Shane and Sine (2008), the analyses are based on a longitudinal approach.

The paper is organized as follows. In Section 2, we briefly review the franchising literature on plural form and performance. Section 3 presents the methodology whereas Section 4 describes data and variables' selection. Respectively, we expose and discuss the results in Sections 5 and 6. Section 7 concludes.

Literature Review

Franchising and Plural Form

The advantages associated to the plural form, that is the coexistence of franchised outlets and company-owned outlets within a same chain, have mainly concerned managerial challenges in the franchising literature so far. Bradach (1997) investigated plural form through an in-depth exploratory study of five U.S. fast food chains. His findings revealed that

plural form within a franchise chain seeks to meet four managerial challenges: spatial expansion by adding new outlets; brand protection by maintaining concept uniformity; local reactivity to threats or opportunities; and service and/or product concept evolution for a constant adaptation to changes.

Bradach (1998) described several processes emerging within a plural form chain that assist the franchisor in overcoming these four challenges: an additive process during the chain development as the franchisor exhibits its know-how through company-owned outlets and thus attracts new franchisees; a socialization process whereby franchisor's personnel become a potential source of new franchisees; a mutual learning process which serves to facilitate the generation, testing, selection, and implementation of new ideas.

Some authors pointed out other advantages of the plural form in terms of managerial issues. Dant and Kaufmann (2003) found that the strategic insight and control afforded by the plural form arrangement were richly valuable for franchisors regardless of their preference for a particular kind of outlet ownership. Furthermore, Ehrmann and Spranger (2004) identified four major groups of drivers for plural form dealing with cost, growth, quality and risk.

Franchising and Efficiency Measurement

Efficiency is a key issue in the franchising industry despite little guidance from the literature for improving it at the chain level. Many authors have tackled the efficiency issue at the outlet level, for instance comparing the efficiency of franchised outlets with non-franchised outlets. Anderson, Fok, Zumpano, and Elder (1998), comparing the efficiency of 184 unaffiliated real estate brokerage firms with 92 affiliated ones, concluded that both franchised and non-franchised firms were operating relatively inefficiently. Yoo, Donthu, and Pilling (1998) showed the superiority of franchised outlets compared with non-franchised ones in the refreshment place industry by using a DEA methodology.

The empirical studies on outlets' efficiency have been often carried out in the hotel industry (Anderson, Fok, and Scott 2000; Hwang and Chang 2003; Johns, Howcroft, and Drake 1997; Morey and Dittman 1995; Tsaur 2000). Barros (2004), Barros and Alves (2004) and Barros and Mascarenhas (2005), for instance, analyzed the hotels' efficiency of a Portuguese public-owned hotel chains by using a stochastic cost frontier and a DEA model. Kosova, Lafontaine, and Perrigot (2008) compared the performance of more than one thousand franchised and company-owned hotels in terms of occupancy rate and revenue per available room. The main conclusion from these research papers underlines the relevance of internal benchmarking within a same chain. It provides the franchisors with managerial recommendations useful to point out their best outlets and improve the results of the less efficient ones.

External benchmarking is of interest for franchisors as well. It allows them to compare the efficiency of several chains and to examine the variables influencing this efficiency. Botti, Briec, and Cliquet (2009) implemented the DEA methodology for analyzing the efficiency of plural form chains in the French hotel industry. Their findings were not statistically significant and they could not demonstrate the superiority of plural form chains over franchised or company-owned chains. At the opposite, Perrigot, Cliquet, and Piot-Lepetit (2009), focusing on another sample of French hotel chains and using different variables in the DEA model, concluded that plural form chains were more efficient than predominantly franchised or company-owned chains.

Barthélemy (2008) studied the performance of French franchise chains, in relationship with their brand name, their PCO and their business practices tacitness. He found that the relationship between brand value and chain performance was stronger when the PCO was high. Thus, it appears that plural form has an impact on the franchise chain performance.

Nevertheless, most of studies found in the literature have significant shortcomings that encourage further research, among which the present study: limitation of the sample size (often less than 20 chains), analysis of a specific industry (mainly, the hotel industry) or use of cross-sectional data. The following developments try to overcome these limitations.

Methodology

Efficiency Measurement and Data Envelopment Analysis

Based on Farrell's work (1957), Charnes, Cooper, and Rhodes (1978) developed the Data Envelopment Analysis (DEA) model. This model uses all observed Decision Making Units (DMUs) to assess the efficiency of each observed DMU and compares it to the productive input-output bundle of each DMU. A DMU is efficient if neither any other observed DMU nor combination of observed DMUs can provide a better productive bundle. Otherwise, the efficiency measure provides the amount of inputs to be reduced without changing the current level of outputs.

We assume that there are *K* DMUs, that are franchise chains, that convert *N* inputs into *M* outputs. Furthermore, we assume that DMU_k consumes $x_{nk} \geq 0$ of inputs *n* to produce $y_{mk} \geq 0$ of outputs *m*, and that each DMU has at least one positive input and one positive output (Färe, Grosskopf, and Lovell 1994). The PCO is first introduced in the DEA model as a non-discretionary – or fixed – input that is beyond the control of the DMU's manager, that is the franchisor. Banker and Morey (1986) illustrated the impact of different kinds of inputs on the efficiency of restaurants belonging to a chain. According to them, it is important to consider separately inputs beyond the control of the restaurant manager and inputs not beyond their control. In other words, researchers have to distinguish discretionary and non-discretionary inputs when assessing DMU's managerial efficiency. The adjustment

of discretionary inputs is then possible while non-discretionary inputs remain constant. The corresponding DEA model is:

$$
\begin{aligned}
&\min_{\theta^o,\lambda_k^o} \quad \theta^o \\
&s.t. \sum_{k=1}^{K} x_{nk}\lambda_k^o \le \theta^o x_{no} \qquad n = 1,\ldots,N_D \\
&\quad \sum_{k=1}^{K} x_{nk}\lambda_k^o \le x_{no} \qquad n = N_D+1,\ldots,N \\
&\quad \sum_{k=1}^{K} y_{mk}\lambda_k^o \ge y_{mo} \qquad m = 1,\ldots,M \\
&\quad \lambda_k^o \ge 0,\ \lambda_k^o \ \ free \qquad k = 1,\ldots,K
\end{aligned}
\tag{1}
$$

This model is an input-oriented DEA model. It attempts to proportionally reduce DMU_o's inputs as much as possible while not decreasing its current level of outputs and non-discretionary inputs. The optimal solution θ^{o*} yields an efficient score for a particular DMU_o. The process works repeatedly for each DMU. DMU_os for which $\theta^{o*} < 1$ are inefficient, while DMU_os for which $\theta^{o*} = 1$ are efficient. In model (1), the set of N inputs has been divided into a subset of N_D discretionary variables and N_{ND} non-discretionary variables. As the input level x_{no} for $n=N_D+1,\ldots,N$ is not subject to managerial control, it is not minimized by the radial efficiency score θ^o. At the opposite, the input level x_{no} for $n=1,\ldots,N_D$ can be reduced in order to improve DMU's efficiency. In our study, we assume that the PCO is not beyond the direct control of the franchisor because this decision maker cannot easily adjust it in a short-term perspective (within a one-year period). It is a medium-term or long-term adjustment process linked to strategic perspectives for the chain development.

Optimization of the PCO within the chain and DEA Efficiency Measurement

One of the main drawbacks associated to the previous DEA model concerns the adjustment of the PCO within the chain. An implicit assumption founds model (1): the

current PCO is the optimal one. In a short-term perspective, this percentage can be difficult to adjust. However, model (1) is not able to deliver any information regarding the PCO "optimality". For assessing the optimal PCO of each DMU of the sample, that is each franchise chain, it is necessary to allow for a free optimization of this variable during the measurement of the chain's efficiency. The following modification of the DEA model (1) may offer this possibility:

$$
\begin{aligned}
&\min_{\theta^o,\lambda_k^o,x_n^o} \quad \theta^o \\
&s.t. \sum_{k=1}^{K} x_{nk}\lambda_k^o \le \theta x_{no} \qquad n = 1,\ldots,N_{NF} \\
&\quad \sum_{k=1}^{K} x_k\lambda_k^o \le x_n^o \qquad x_n^o \ \ free, n = N_{NF}+1,\ldots,N \qquad (2) \\
&\quad \sum_{k=1}^{K} y_{mk}\lambda_k^o \ge y_{mo} \qquad m = 1,\ldots,M \\
&\quad \lambda_k^o \ge 0,\ \lambda_k^o \ \ free \qquad k = 1,\ldots,K
\end{aligned}
$$

In model (2), the set of *N* inputs is still divided into two subsets. The first subset contains the N_{NF} variables radically reduced for measuring DMU_o's efficiency, that is not freely optimized by the DEA model. The second subset includes the $(N\text{-}N_{NF})$ inputs that evolve freely, that is an optimal value for these inputs is estimated by model (2).

DEA Sector-Specific and Meta-Frontiers

First of all, all the observed franchise chains may not have access to the same production technology. Rather, different chains or categories of chains may face different production technologies. A variety of geographical, institutional, legal factors or other factors may give rise to such a situation. Building a single production frontier based on all the data points would, in such cases, result in an inappropriate best-practice technology. A way to measure the impact of production technological heterogeneity across sectors (services *versus*

retailing) is to building a specific frontier for each sector alongside meta-frontier that applies to chains from the two sectors.

In order to build different production possibility sets for different groups, we first group observed input-output bundles according to some criteria, for example the industry: retailing *versus* services, into *H* numbers of distinct and exhaustive groups, g^{th} group containing K_g DMUs: $K = \sum_{g=1}^{H} K_g$. Then, we define the index set of observations $k = 1,...,K$ and we partition it into non-overlapping subsets $K_g = \{k : \text{firm } k \text{ belongs to group } g;\ g = 1,...,H\}$.

We suppose that the observed input-output bundle of DMU_o in group g is (x_o^g, y_o^g). The following DEA model solved for each DMU k in the g^{th} group ($g = 1,...,H$) then provides a measure of the within-group or within-sector efficiency of DMU_o:

$$\begin{aligned} &\min_{\theta^{og},\lambda_k^{og}} \quad \theta^{og} \\ &s.t. \sum_{k=1}^{K_g} x_{nk}\lambda_k^{og} \le \theta^{og} x_{no}^g \qquad n = 1,...,N \\ &\quad \sum_{k=1}^{K_g} y_{mk}\lambda_k^{og} \ge y_{mo}^g \qquad m = 1,...,M \\ &\quad \lambda_k^{og} \ge 0,\ \lambda_k^{og} \ \ free \qquad k = 1,...,K_g \end{aligned} \tag{3}$$

Next, we consider the technical efficiency of the same DMU *k* from group *g* relative to a common production frontier to all groups, called meta-frontier. The meta-frontier is the outer-envelop of all the group frontiers, that is the production frontier of all DMUs in the sample whatever their origin group or sector. The meta-efficiency of the franchise chain *o* from group *g* is measured by using the following DEA model:

$$
\begin{aligned}
&\min_{\theta^{oG},\lambda_k^{og}} \quad \theta^{oG} \\
&s.t. \sum_{g=1}^{H}\sum_{k=1}^{K_g} x_{nk}\lambda_k^{og} \le \theta^{oG} x_{no}^{g} \qquad n = 1,\ldots,N \\
&\quad \sum_{g=1}^{H}\sum_{k=1}^{K_g} y_{mk}\lambda_k^{og} \ge y_{mo}^{g} \qquad m = 1,\ldots,M \\
&\quad \lambda_k^{og} \ge 0,\ \lambda_k^{og} \ \ free \qquad k = 1,\ldots,K_g;\ g = 1,\ldots,H
\end{aligned}
\tag{4}
$$

In view of the fact that the meta-production possibility set contains every group production possibility sets, it is obvious that $\theta^{og} \ge \theta^{oG}$ for every DMU *k* and group *g*. In other words, DMU$_o$ cannot be less efficient when assessed against the meta-frontier than when assessed against its group frontier.

When, for any DMU *k* in group *g*, the group efficiency and the meta-efficiency measures are close, we may argue that the group frontier is close to the meta-frontier and no real difference exists between the group and the envelop-frontiers. At the opposite, if both frontiers are far away from each other, it means that a portion of the efficiency assessed relatively to the meta-frontier can be attributed to specificities regarding the production environment or technology of the group of DMUs. For each DMU$_o$, the following meta-technology ratio (MTR) can define an overall measure of proximity between the group frontier and the meta-frontier:

$$
MTR_o^g = \frac{\theta^{oG}}{\theta^{og}} \tag{5}
$$

MTR_o^g is less than or equal to one. It increases if the group frontier shifts towards the meta-frontier, ceteris paribus, and is bounded above by unity which would occur if and only if the group frontier coincides with the meta-frontier.

Data and variables selection

The empirical study deals with the franchising industry in France. Franchising in France is particularly well developed, with 1,477 chains, 58,351 franchised outlets, and 47.88 billion euros generated in these franchised chains (French Franchise Federation 2011). We used two complementary data sources to gather data on the efficiency of French franchise chains. On the one hand, the annual directories published by the *French Franchise Federation* and entitled *Toute la Franchise, les Textes, les Chiffres, les Réseaux* provide detailed information for about a hundred of franchised chain that are members of the Federation, information such as the PCO, the chain size, the chain age, the financial conditions associated to the franchising contract, the sector. These directories have been used in previous research on franchising in France (Barthélemy 2008; Dant, Perrigot, and Cliquet 2008; El Akremi, Mignonac, and Perrigot 2011) and are considered as a reliable data source. We used three consecutive publications, those of 2006, 2007 and 2008, corresponding to 2005, 2006 and 2007 data.

On the other hand, the *DIANE* database offers financial information such as capital, labor, costs for various kinds of firms, not only in the franchising industry. This database is a product of *Bureau Van Dijk Electronic Publishing*. It has been used in previous research dealing with various French firms (Durand, Bruyaka, and Mangematin 2008; Francis, Richard, and Vanstraelen 2009; Sentis 2009), and with French franchised chains as well (Barthélemy 2008). *DIANE* is considered as a reliable data source. We gathered data for the years 2005, 2006 and 2007.

Our sample consists of 43 franchised chains, those present in the three consecutive directories and for which we had corresponding information through the *DIANE* access. This

balanced panel data of 43 franchise chains for the period 2005-2007 then corresponds to a total of 129 observations.

An important step in the DEA modeling is the identification of the inputs and the outputs used to build up production possibility sets. It is a difficult and decisive step within the efficiency assessment process. The literature review, the data availability and the managers' subjective opinions play an important role in this selection. A wide variety of variables can influence the efficiency of franchise chains. As we compare different franchise chains from two different sectors, services *versus* retailing, selected information depends on the management of the franchise chain and the business activity. We selected one output and three inputs to define the DEA production technology as well as one strategic input, the PCO.

The output is the total amount of sales of franchise chains. The inputs are (1) the capital, both the current investment of the franchisor and the current charge involved by previous investments, (2) the variable costs of the year that gives an assessment of variable charges involved by the management of the chain, and (3) labor cost that is defined by labor charge of the year. For these variables, the euros values for 2006 and 2007 have been deflated according to the French General Production (for the output) and Consumption Price Index (for the inputs) (base 100 in 2005) so that the variations observed for these variables are related to quantities actually consumed or produced and not inflation or price change.

Our objective relying on the analysis of the relationship between the PCO and the chain's efficiency, we introduced an additional input in the DEA model (1), the PCO, as a non-discretionary or fixed input, and in the DEA model (2) as a free variable to be optimized simultaneously with the measurement of efficiency. Table 1 provides descriptive statistics regarding these different inputs and output.

Insert Table 1

Among the 43 chains under investigation, 19 franchise chains (44 percent) are in the service sector (services for persons, services for companies, services for cars, hotels and restaurants...), that are 57 observations over the three-year period, while the 24 remaining chains (56 percent) are in the retail sector (food retail stores, person equipment: clothes, shoes, home equipment...), that are 72 observations over the 2005-2007 period. Table 1 shows a decrease in the average total amount of sales over time for chains in the service sector while retail chains show an increasing tendency in terms of total amount of sales. Regarding inputs, capital decreases between 2005 and 2007, in both service and retail chains. At the opposite, variable costs increase. Finally, labor cost decreases in the service sector while it increases in the retail sector.

Regarding the PCO, values are similar from year to year. There are, on average, 32 percent of company-owned outlets within the franchise chains. This PCO is inferior, but comparable, to the percentage highlighted by Dant, Perrigot, and Cliquet (2008) for the French market when they explored the plural form phenomenon in US, French and Brazilian franchise chains. However, these figures mask important differences among franchise chains. Some of the chains are fully franchised. The PCO of service chains is equal to 30 percent in 2005, and decreases to 25 percent in 2006 and 26 percent in 2007. The PCO of retail chains is higher and varies between 33 percent in 2005 and 37 percent in 2006-2007. These figures slightly increase over the three-year period.

Results

Efficiency Measurement of French Franchise Chains

Table 2 provides efficiency scores with a comparison between the two DEA models. The first model is defined in (1) and corresponds to the measurement of efficiency with the PCO as a non-discretionary or fixed variable. All inputs are decreased by the same scalar θ^o,

except the PCO. When this score is stated at unity, it means that the franchise chain is fully efficient in the sense defined by Farrell (1957) at the observed value of its PCO. It is therefore impossible to find any other franchise chain with a similar PCO, in the sample under investigation that produces the same amount of output with lesser inputs. When the score ranges from 0 to 1, it means that the franchise chain is technically inefficient by comparison to other chains with a similar PCO in the sample. It is possible to find other efficient franchise chains, or a linear combination of efficient franchise chains, in the sample, that produce the same amount of output as the inefficient chains but with a smaller amount of inputs and the same PCO.

The second DEA model, defined in (2), is an extension of the previous model where the input PCO is freely optimized during the efficiency estimation process. This introduces a degree of flexibility since the PCO can either be increased, decreased or maintained constant, depending on the direction needed to improve the efficiency of the franchise chain under investigation. Furthermore, each efficiency evaluation depends on each sector-specific (services *versus* retailing) production frontier, as presented in (3) and on the meta-frontier, that is the overall production frontier (service and retail chains) defined in (4). A Kruskal-Wallis test, that is a non-parametric test, evaluates the statistical significance of differences in terms of efficiency assessed relatively to both the group- and the meta- frontiers. It provides an analysis of the ranks of efficiency scores and a chi-square statistic for testing the null assumption that the location of the ranks is the same.

Insert Table 2

With both DEA models, efficiency scores for retail chains related to the retail frontier and the meta-frontier are not statistically different. On the contrary, service chains have efficiency scores that are statistically different between both the services- and meta-frontiers.

Thus, retail chains are those that built up the meta-frontier and influence the evaluation of all chains, specifically chains from the other sector, that is the service sector.

For retail chains, efficiency scores provided by the first DEA model (fixed PCO) are between 49.7 percent and 55.8 percent when assessed relatively to its sector-specific frontier. While efficiency scores seem lower relatively to the meta-frontier with values between 46.5 percent and 53.6 percent, these values are not statistically different from those assessed relatively to the retail-frontier. With the extended model (DEA model 2 with PCO optimization), efficiency scores are lower, with values between 42 percent and 48 percent relatively to both the retail- and meta-frontiers. Highest efficiency scores are found in 2005 and lowest ones in 2007. Efficiency slightly decreases from 2005 to 2007. However, a Kruskal-Wallis test does not indicate any statistical significant differences over years. For the DEA model with a fixed PCO, values are $\chi^2 = 1.897$ with a *P-value*$_{5\%}$=0.387 relatively to the retail-frontier and $\chi^2 = 1.965$ with a *P-value*$_{5\%}$=0.374 relatively to the meta-frontier. For the DEA model with an optimized PCO, values are $\chi^2 = 5.442$ with a *P-value*$_{5\%}$=0.66 and $\chi^2 = 2.062$ with a *P-value*$_{5\%}$=0.357, respectively.

For service chains, they have higher efficiency scores relatively to the sector-specific frontier. Values are between 60.5 percent and 70.9 percent when the PCO is fixed, and between 55.9 percent and 63.7 percent when the PCO is optimized. However, these values fall below 50 percent when using a meta-frontier to assess efficiency of the same chains. As the meta-frontier is built up on chains from the retail sector rather than chains from the service sector, service chains are misevaluated when using an overall frontier whatever the DEA modeling implemented. Over the 2005-2007 period, the impact of using the meta-frontier rather than the service-frontier, on efficiency measurement results on average in a decrease from 66.1 percent to 45.8 percent with the first DEA model (fixed PCO) and from 60.9

percent to 34.8 percent with the second DEA model (optimized PCO). More precisely, the decrease is of 30 percent and 42.8 percent, respectively. For retail chains, the impact is only a decrease of 4 percent and 0.4 percent, respectively.

Furthermore, even if a Kruskal-Wallis test does not indicate any statistical significant difference among scores from 2005 and 2007 (DEA model with fixed PCO: $\chi^2 = 2.299$ with a *P-value*$_{5\%}$=0.317 relatively to the services-frontier and $\chi^2 = 5.991$ with a *P-value*$_{5\%}$=0.369 relatively to the meta-frontier; DEA model with optimized PCO: $\chi^2 = 2.037$ with a *P-value*$_{5\%}$=0.361 relatively to the services-frontier and $\chi^2 = 2.33$ with a *P-value*$_{5\%}$=0.312 relatively to the meta-frontier), the highest average efficiency score happens in 2006. Thus, the evolution of efficiency scores in the service sector is different from that observed in the retail sector. For service chains, efficiency increases from 2005 to 2006, and then decreases in 2007 whereas retail chains see their efficiency decreasing during the overall three-year period.

Table 3 provides the estimated values for the meta-technology ratio (MTR) defined in (5). It allows a direct comparison of efficiency scores assessed relatively to the sector-specific frontier and the meta-frontier. Results confirm that retail chains have similar efficiency scores when assessed relatively to both frontiers. MTR values are close to unity. On the contrary, MTR values for service chains are between 66 percent and 68 percent when PCO is fixed and between 57.6 percent and 60 percent when PCO is optimized. Thus, the services-specific frontier and the meta-frontier are not close one to each other.

Insert Table 3

Optimal PCO of French Franchise Chains

Table 4 presents the estimated PCOs and compares them to the observed PCOs in our sample of franchise chains. For service chains, the observed PCOs are between 24.7 percent and 29.8 percent. Optimal values assessed relatively to the service frontier are higher, with values between 35.6 percent and 44.7 percent, showing that increasing the average PCO in this service sector can improve chain efficiency. Highest optimized PCOs are found in 2006 corresponding to the year with highest efficiency scores (see Table 2). Values assessed relatively to the meta-frontier are close to those assessed relatively to the service-frontier. Meta-frontier optimal PCO are higher in 2005 and 2007 while they are lower in 2006. However, observed differences between both frontiers are not statistically significant according to the results of Kruskal-Wallis tests.

Insert Table 4

For retail chains, observed PCOs are between 33 percent and 37 percent while optimized PCO are between 45 percent and 50 percent relatively to the retail frontier, and between 42 percent and 47 percent relatively to the meta-frontier. PCOs are lower with the meta-frontier than with the retail frontier. They are increasing over time while efficiency scores provided in Table 2 are decreasing. However, differences in PCOs are not statistically significant. This latter result points out the fact that even if the DEA modeling provides optimal PCOs for each franchise chain, observed PCOs are not so far away from their optimal position as shown in Table 5, that displays some results for five chains in both sectors: services and retailing. Optimal values for PCOs are specific to each franchise chain. Average values provided in Table 4 mask important ranges of values.

Insert Table 5

Discussion

This paper contributes to the literature on franchising and efficiency that is still under-explored, even if authors such as Combs, Michael, and Castrogiovanni (2004), Watson, Stanworth, Healeas, Purdy, and Stanworth (2005) and Combs, Ketchen, Shook, and Short (2011) have nevertheless underlined the need for research focusing on this specific topic.

The first contribution of this paper concerns the impact of the organizational form of the franchise chain on its performance, and more specifically the impact of the PCO on franchise chain's efficiency. The literature has highlighted many advantages of the plural form in terms chain management, and more precisely in terms of chain development, concept uniformity, local reaction to threats or opportunities, and concept adaptation to changes (Bradach 1998) and also in terms of costs, growth, quality and risk management (Ehrmann and Spranger 2004). Only few authors have explored the advantages of the plural form in terms of chain efficiency (for example, Botti, Briec, and Cliquet 2009; Perrigot, Cliquet, and Piot-Lepetit 2009).

The present paper presents two DEA models with the PCO of each chain used as an input. The first model analyzes the efficiency of the franchise chains based on operational variables and a strategic fixed input that is the observed PCO. The second model is an extension of the first one and allows for estimating the optimal PCO that maximizes the chain's efficiency. Recent studies (El Akremi, Perrigot, and Piot-Lepetit 2011; Hsu and Jang 2009) have confirmed the existence of an optimal PCO that maximizes the chain performance. These former studies provide an average optimal value for all chains in their sample.

Here, the extended DEA model allows for optimization of the PCO at the chain level. An optimal value is estimated for each chain in the sample. On average, optimal PCOs are

higher than the observed ones. Thus, franchisors should increase their PCO in order to maximize the efficiency of their chains. However, results show a wide range of situations among chains. Chains in the service sector have an average optimized PCOs always lower than those in the retail sector. This difference tends to decrease when evaluations stem from the meta-frontier because, as shown in the results section, this envelop frontier is built up primary on the retail chains. However, observed and optimal PCOs in our sample have shown no statistical significant difference. It means that franchisors in our sample already have a PCO within their chain that is not too far from their optimal PCO. As a consequence, they only need to proceed to some slight adjustments in terms of PCO in order to improve their efficiency.

The second contribution relies on methodological aspects. First, it provides an application of the DEA methodology to the franchising industry by using a sector-specific frontier (services *versus* retailing) and a meta-frontier. This methodology leads to go beyond previous studies by analyzing both sector-specific chains' efficiency and by assessing their efficiency within the overall franchising industry. The main finding is that the meta-frontier is built up on chains from the retail sector. Thus, the efficiency measurement based on this envelop frontier provides a measurement for chains from the service sector that is biased. Their efficiencies are highly reduced when the meta-frontier is used.

Another methodological contribution relies on the use of longitudinal and French data. On the one hand, as explained by Mitsuhashi, Shane and Sine (2008), the longitudinal approach is more relevant than usual cross-sectional approaches. It allows an exploration of the evolution of chains' efficiency and PCO over years. On the other hand, the selection of a sample of French franchise chains corresponds to a call for more research outside the U.S. market. Indeed, most empirical studies in franchising have dealt with the U.S. market

entailing a predominant mono-cultural view towards franchising research (Combs, Ketchen, Shook, and Short 2011; Dant 2008).

Limitations of this research are mainly twofold and can encourage franchising scholars to conduct further research. First, the sample under investigation includes only 43 franchise chains. These were the only franchise chains, members of the French Franchise Federation, for which we had enough data on the 2005-2007 period to run the DEA models. It would be of interest to reinforce the validity of our results by using a larger sample of French franchise chains and a longer time-period. Secondly, the empirical study, even if it concerns a non-North American country, deals only with one country whereas authors such as Dant (2008) suggested focusing on cross-cultural comparisons. A track for future research would therefore consist in exploring the efficiency of franchise chains in several countries such as France, the U.S. or Brazil that already showed some significant differences in terms of the plural form phenomenon and the PCO (Dant, Perrigot, and Cliquet 2008).

Conclusion

This paper deals with plural form and efficiency of franchise chains. Literature about plural form is rich but only a few researchers have examined the relationship between the PCO and chain efficiency. More specifically, this paper provides a methodology for assessing the optimal PCO for each franchise chain that maximizes its efficiency. Efficiency is measured by using the DEA methodology. This paper develops two models. The first one considers the PCO as a non-discretionary or fixed input for constraining chain's efficiency measurement to locus where similar PCO are used. The second DEA model enables decision makers, that are franchisors, to optimize the PCO within their chain at the same time as the chain's efficiency is assessed. Franchisors can then increase, decrease or maintain constant their PCO when searching for the improvement of their franchise chains' efficiency.

Furthermore, the efficiency assessment is implemented relatively to both a sector-specific frontier and meta-frontier.

The main findings, based on a sample of French franchise chains over the period 2005-2007, first show that the meta-frontier is built up on retail chains rather than on service chains. Thus, the use of this envelop frontier for assessing efficiency of franchise chains provides an under-evaluated efficiency of the service chains. Secondly, the comparison of the results stemming from both DEA models implemented in this paper confirms that there is a link between the PCO and the chain efficiency. Finally, non-parametric statistical tests do not support the existence of significant differences between the observed PCOs and the optimal PCOs. Thus, franchisors in our sample have already reached a PCO close to the PCO that optimizes the chain efficiency.

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Table 1. Descriptive Statistics

	2007		*2006*		*2005*	
	Mean	*Std-dev*	*Mean*	*Std-dev*	*Mean*	*Std-dev*
META-DATA: Service and Retail Chains (#43)						
Output (k€)						
Total sales	175,052	581,261	175,723	559,549	173,759	549,412
Inputs (k€)						
Capital	9,182	21,565	8,868	20,529	8,248	18,587
Labor cost	28,771	62,880	30,581	65,074	29,510	62,091
Consumption	54,568	124,142	58,207	133,466	63,085	144,395
Fixed vs. optimized input (%)						
PCO	0.32	0.30	0.32	0.29	0.32	0.29
DATA on SERVICE CHAINS (#19)						
Output (k€)						
Total sales	121,625	210,318	72,376	140,724	73,833	143,574
Inputs (k€)						
Capital	5,767	14,179	5,644	15,658	4,912	13,678
Labor cost	26,063	71,659	20,584	40,786	20,401	38,677
Consumption	41,957	112,730	35,162	92,829	39,595	107,667
Fixed vs. optimized input (%)						
PCO	0.30	0.32	0.25	0.29	0.26	0.30
DATA on RETAIL CHAINS (#24)						
Output (k€)						
Total sales	217,349	760,347	257,539	735,141	252,867	721,318
Inputs (k€)						
Capital	13,497	27,804	11,420	23,713	10,889	21,632
Labor cost	32,192	51,403	38,496	79,265	36,721	75,806
Consumption	70,498	138,714	76,452	158,109	81,680	167,883
Fixed vs. optimized input (%)						
PCO	0.33	0.28	0.37	0.29	0.37	0.28

Table 2. DEA Efficiency Scores

	2005		*2006*		*2007*		*2005-2007*	
	Mean	*Std-dev*	*Mean*	*Std-dev*	*Mean*	*Std-dev*	*Mean*	*Std-dev*
DEA Model (1) with Fixed PCO								
Service sector								
θ^g	0.6049	0.2576	0.7089	0.2280	0.6693	0.2125	0.6610	0.2333
θ^G	0.4257	0.2705	0.5008	0.2837	0.4494	0.2428	0.4586	0.2633
K-W test	$\chi^2 = 8.291$	*Pval=0.004*	$\chi^2 = 4.718$	*Pval=0.030*	$\chi^2 = 9.582$	*Pval=0.002*	$\chi^2 = 25.245$	*Pval<0.0001*
Retail sector								
θ^g	0.5579	0.2683	0.5206	0.2822	0.4973	0.3025	0.5253	0.2817
θ^G	0.5364	0.2699	0.5097	0.2861	0.4655	0.2858	0.5039	0.2783
K-W test	$\chi^2 = 0.236$	*Pval=0.627*	$\chi^2 = 0.146$	*Pval=0.703*	$\chi^2 = 0.267$	*Pval=0.606*	$\chi^2 = 4.249$	*Pval=0.514*
DEA Model (2) with Optimized PCO								
Service sector								
θ^g	0.5594	0.2408	0.6368	0.213	0.6300	0.2170	0.6087	0.2219
θ^G	0.3242	0.1526	0.3626	0.1308	0.3568	0.1761	0.3480	0.1525
K-W test	$\chi^2 = 15.670$	*Pval<0.0001*	$\chi^2 = 14.515$	*Pval<0.0001*	$\chi^2 = 16.234$	*Pval<0.0001*	$\chi^2 = 48.164$	*Pval<0.0001*
Retail sector								
θ^g	0.4858	0.2307	0.4582	0.2376	0.4289	0.2523	0.4576	0.2381
θ^G	0.4832	0.2324	0.4550	0.2124	0.4262	0.2537	0.4548	0.2397
K-W test	$\chi^2 = 1.175$	*Pval=0.278*	$\chi^2 = 0.066$	*Pval=0.797*	$\chi^2 = 0.024$	*Pval*=0.877	$\chi^2 = 7.690$	*Pval*=0.158

Notes: θ^g: Estimated chain efficiency when using the sector-specific frontier; θ^G: Estimated chain efficiency when using the sector-meta-frontier;

K-W test: Kruskall-Wallis non-parametric test. If the P-value is less than 0.05 then the null assumption that scores are from the same population is rejected. Scores are different.

Table 3. Meta-Technology Ratio: $MTR^g = \theta^G / \theta^g$

	2005		*2006*		*2007*		*2005-2007*	
	Mean	*Std-dev*	*Mean*	*Std-dev*	*Mean*	*Std-dev*	*Mean*	*Std-dev*
DEA Model (1) with Fixed PCO								
Service sector	0.6875	0.2021	0.6844	0.2268	0.6605	02129	0.6769	0.2107
Retail sector	0.9569	0.0733	0.9724	0.0502	0.9524	0.1186	0.9606	0.0848
DEA Model (2) with Optimized PCO								
Service sector	0.6015	0.1668	0.5959	0.1850	0.5760	0.1736	0.5911	0.1724
Retail sector	0.9923	0.0196	0.9899	0.0185	0.9910	0.0181	0.9911	0.0185

Table 4. Observed and Optimized PCO

	2005		*2006*		*2007*		*2005-2007*	
	Mean	*Std-dev*	*Mean*	*Std-dev*	*Mean*	*Std-dev*	*Mean*	*Std-dev*
Service sector								
Observed	0.2980	0.3167	0.2469	0.2864	0.2634	0.2981	0.2695	0.2960
Sector-Frontier	0.3560	0.3875	0.4470	0.4533	0.3710	0.4493	0.3913	0.4252
Meta-Frontier	0.3871	0.3840	0.4136	0.3491	0.4002	0.3585	0.4003	0.3577
K-W test	$\chi^2 = 0.684$	*Pval=0.710*	$\chi^2 = 2.714$	*Pval=0.257*	$\chi^2 = 1.790$	*Pval=0.409*	$\chi^2 = 5.362$	*Pval=0.718*
Retail sector								
Observed	0.3329	0.2843	0.3739	0.2915	0.3727	0.2798	0.3205	0.2867
Sector-Frontier	0.4579	0.3421	0.5035	0.3874	0.5027	0.4069	0.4603	0.3987
Meta-Frontier	0.4251	0.3335	0.4603	0.3931	0.4762	0.3964	0.4520	0.3658
K-W test	$\chi^2 = 2.801$	*Pval=0.246*	$\chi^2 = 1.685$	*Pval=0.431*	$\chi^2 = 1.508$	*Pval=0.471*	$\chi^2 = 6.260$	*Pval=0.618*

Note: *K-W test*: Kruskall-Wallis non-parametric test. If the P-value is less than 0.05 then the null assumption that scores are from the same population is rejected. Scores are different.

Table 5. Results for five Chains in the Service and Retail Sectors

	2005					2006					2007				
#obs	θ^G	θ^g	*PFobs*	*PFmeta*	*PFsector*	θ^G	θ^g	*PFobs*	*PFmeta*	*PFsector*	θ^G	θ^g	*PFobs*	*PFmeta*	*PFsector*
Service sector															
1	0.370	1	0	0.20	0	0.373	1	0	0.26	0	0.361	0.967	0	0.28	0
2	0.356	0.501	0.12	0.08	0.01	0.363	0.565	0.16	0.08	0.03	0.329	0.544	0.17	0.09	0.04
3	0.343	0.945	0.62	0.55	1	0.356	0.965	0.62	0.72	1	0.373	0.997	0.63	0.86	1
4	0.290	0.454	0.14	0.08	0.03	0.281	0.589	0.13	0.02	0.06	0.247	0.615	0.16	0.007	0.07
5	0.222	0.455	0.11	0.02	0.25	0.195	0.486	0.11	0.02	0.31	0.182	0.441	0.10	0.02	0.29
Retail sector															
1	1	1	0.82	0.82	0.82	0.974	0.974	0.70	1	1	0.969	0.970	0.70	1	1
2	0.338	0.338	0.56	0.25	0.25	0.330	0.330	0.56	0.26	0.26	0.307	0.307	0.54	0.31	0.31
3	0.350	0.350	0.15	0.65	0.65	0.346	0.346	0.13	0.65	0.65	0.359	0.359	0.11	0.68	0.68
4	0.337	0.337	0.04	0.006	0.07	0.212	0.213	0.03	0.007	0.01	0.206	0.207	0.04	0.006	0.02
5	0.250	0.272	0.23	0.001	0.20	0.306	0.306	0.26	0.08	0.24	0.259	0.259	0.24	0.07	0.17

Notes: θ^g: Estimated chain efficiency when using the sector-specific frontier; θ^G: Estimated chain efficiency when using the sector-meta-frontier; *PFobs*: Observed percentage of company-owned in the chain; *PFmeta:* Optimized percentage of company-owned based on the meta-frontier; *PFsector:* Optimized percentage of company-owned based on the sector-specific-frontier.