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Measuring the Meta Efficiency and Its Determinants on Efficiency in the Korean Coffee Shop Franchise

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Abstract: Previous applications of DEA (data envelopment analysis) models in the field of franchising have been scarce. In particular, measurement and analysis of the operational efficiency of coffee shop franchisors in the explosively growing coffee market in Korea is required. In this study, we categorize 29 Korean coffee shop franchisors into three groups according to their number of franchisees and employ the metafrontier analysis to measure the efficiency of coffee shop franchisors from 2015 to 2018. Based on the results of metafrontier DEA, this study identifies sources of inefficiency within individual coffee shop franchisors to provide insights for coffee franchise operators and investigates efficiency differences between *small-chain* and *medium-chain* coffee shop franchisors. Furthermore, the results of bootstrapped truncated regression provide that the external environmental factors affecting the efficiency of each individual group are totally different patterns depending on the franchise group. Based on the analysis results, this study suggests strategic initiatives tailored to individual coffee shop groups to enhance their operating efficiency and identifies the principal operational drivers of the environmental variables to achieve sustainable growth.

Keywords: coffee shop franchise; metafrontier; group frontier; technology gap ratio; bootstrapped truncated regression

1. Introduction

Due to the skyrocketing coffee consumption in Korea, coffee shop chains are one of the fastest-growing service industries in Korea. Recently, Korea has grown to become the world's sixth-largest coffee consuming country, following Europe and the United States. Global coffee brands such as *Starbucks*, *Costa Coffee*, and *Blue Bottle*, as well as domestic brands such as *EDIYA* and *YOGERPRESSO*, are especially in competition with each other to attain a competitive advantage in the Korean coffee market by continuously innovating their operations. Moreover, Korean coffee shop brands such as *EDIYA* and *A Twosome Place* have grown into mega coffee shop franchisors with more than 1000 outlets (franchisees) in Korea [1,2].

In the explosively growing coffee market in Korea, measurement and analysis of the relative operation efficiency of coffee shop franchisors are required to strengthen the franchisors' core capabilities and to manage coffee shop franchisees successfully [3]. Therefore, this study measures the relative efficiency of 29 coffee shop franchisors in Korea from 2015 to 2018 based on the premise that the franchisors' brand can maintain sustainable growth by managing their franchisees effectively and efficiently. This efficiency index can provide strategic initiatives in establishing an operational plan for coffee shop franchisors and offer more efficient internal resource allocation and coordination to achieve their operational objectives [4–6].

Meanwhile, a set of coffee shop franchisors has technological homogeneity in that they deliver various types of coffee and beverages to customers visiting coffee shop franchises, but it also has

heterogeneities in production technology due to size differences between *mega-chain* and *small-chain* coffee shops, which ultimately induce the franchisor to have differentiated operating patterns and alternatives for the franchisee [2,7–9]. For instance, the *EDIYA* coffee shop brand with 2142 chains and the *Coffine Gurunaru* brand with 50 chains in 2018 have homogenous characteristics as coffee shop franchisors, however, their operation strategies for the franchises differ depending on the number of franchisees. Thus, if coffee shop franchisors with both homogenous and heterogeneous characteristics are analyzed together within the same production set, this can lead to inaccuracies and analytical errors in efficiency analysis [8,9]. In comparing a franchisor's efficiency among individual groups with different strategic characteristics, the efficiency of heterogeneous groups should be measured separately, depending on their operational alternatives and business model [9,10]. This procedure mainly offers efficient operating resource allocation policies and strategic benchmarking initiatives to compare franchisors' operation efficiency with industry best practices.

In this study, we categorize Korean coffee shop franchisors into three groups according to their number of franchisees (N), such as *large coffee shop chains* ($N \geq 300$), *medium coffee shop chains* ($100 \leq N < 300$), and *small coffee shop chains* ($N < 100$). Based on these classifications, we employed a metafrontier analysis that allows each group to have its own group frontier to compare the efficiency levels of other groups operating under different technical conditions. That is, the metafrontier production function is defined as a common boundary that envelops the group frontiers (GF) [7–9]. Additionally, this metafrontier methodology offers a technology gap ratio (TGR), which is expressed as the distance between the group frontier and the metafrontier [11,12]. Based on the results of the metafrontier analysis, this study investigated the efficiency difference among coffee shop franchisors' groups in Korea based on the Kruskal-Wallis test. Thus, this study suggested strategic initiatives tailored to individual coffee shop groups to enhance their operating efficiency and sustainable growth of coffee shop franchisors. Moreover, we identified the principal operational drivers of the environmental variables to increase the coffee shop franchisors' efficiency in Korea by double bootstrapping truncated regression suggested by Simar and Wilson [13,14]. Identifying how external determinants impact operational efficiency is essential for coffee franchisors to identify performance improvement strategies. The specific research questions addressed in this study are as follows:

- Research Question 1: What are the main reasons for the observed inefficiency (e.g., pure technical inefficiency or scale inefficiency) in coffee shop franchisors in Korea?
- Research Question 2: Is there any difference in efficiency among coffee shop franchisors' groups in Korea?
- Research Question 3: What are the principal determinants affecting operational efficiency, from the perspective of coffee shop franchisors' group respectively?

The remainder of this paper is structured as follows: The theoretical background of previous studies on franchise efficiency is reviewed in the next section. Section 3 describes the methodologies used in our study. Section 4 defines the research model and input/output variables necessary for DEA (data envelopment analysis) and explores the characteristics of the decision-making units (DMUs). Section 5 presents the empirical metafrontier results, namely, the analysis of annual meta efficiency (ME), group efficiency (GE), and TGR of Korean coffee shop franchisors. Section 6 investigates the main driver of environmental factors to increase ME. Lastly, Section 7 discusses these results and presents the study's conclusions, limitations, and research opportunities.

2. Literature Review of Franchise Efficiency

In franchise efficiency literature [2,15–21], a few studies have applied non-parametric DEA to measure the franchise efficiency of an individual decision-making unit (DMU), as seen in Table 1. The DEA model uses all observed franchising networks to assess the relative efficiency of each observed chain, comparing its productive results to those of all the sample chains. Table 1 tabulates previous

studies on franchise efficiency, which are based on the employed methodology, DMUs' characteristics, and different inputs/outputs variables.

Table 1. Literature Review of Franchise Efficiency.

Authors	Method	DMUs	Input Variables	Output Variables
Barros and Perrigot [15]	Output-oriented DEA (BCC)	150 US franchising networks ranked in the Entrepreneur's 25 Annual Franchise 500®	Average total investment, Duration of agreement, Cash liquidity requirements, Employees	Franchising fee, Royalty, Change in franchised units
Botti et al. [16]	Input-oriented DEA (CCR, BCC)	16 Hotel chains in France	Costs, Territory Coverage, Chain Duration.	Sales
Kim et al. [2]	Input-oriented DEA (CCR)	6 Coffee franchisors in Korea from 2010 to 2014	Product cost, Labor cost, Costs for interior design	Sales profit
Martin et al. [18]	Super-efficiency with Input-oriented BCC	143 franchises in the trade and other services sector in Spain	Tangible fixed assets, Intangible assets, Total volume of own resources, Total liabilities, Labor costs	Sales and returns before interest and tax
Medal-Bartual et al. [19]	Meta-Frontier DEA	73 franchise enterprises (5 groups) in Spain	Total assets, Total volume of own resources, Total liabilities, Labor costs	Sales, Returns
Reynolds [21]	DEA (CCR, BCC)	38 Restaurant chains of same-brand franchises in US	Hours worked, Average wage, Number of competitors, Seating capacity	Daily sales, Tip percentage
Piot-Lepetit et al. [20]	Meta-Frontier DEA	43 chains (24 retailing and 19 services) in French franchises	Capital, Labor costs, Functioning costs	Total sales
Roh and Choi [17]	Input-oriented DEA (CCR, BCC)	550 chain restaurants operating within the Pacific Rim	Environmental/Location, Physical resources, Human resources, Management efficiency	Sales, Net income

Barros and Perrigot [15] explored the franchising network performance, and more specifically, the relative franchising network efficiency of the US franchising sector, using a population of 150 franchising networks whose data are published in the Entrepreneur's 25 Annual Franchise 500® (www.entrepreneur.com/franchises/500. Botti et al. [16] analyzed efficiency with DEA models of franchises versus other organizational forms on French hotel chains to discusses the hypothesis that there is a relationship between the organizational form of the chain and its efficiency score. The results of study demonstrated that plural form networks are, on average, more efficient than strictly franchised and wholly owned chains. In a similar perspective, Roh and Choi [17] empirically compare and contrast the efficiency of multiple brands within the same franchise in the Pacific Rim utilizing DEA methodology. In addition, Martin et al. [18] measured the super-efficiency of 143 franchises in the trade and other services sector in Spain and characterized the best companies, confirming the relationship between efficiency and profit. This study suggested that, whilst the number of establishments is irrelevant in achieving greater efficiency, many of the most efficient enterprises have high returns. More recently, Kim et al. [2] analyzes the efficiency in the operation of the top six coffee franchisors in Korea with the aim to find out what the consumers think is important in the selection of coffee franchises and what factors meet their demands.

In franchise efficiency literature using metafrontier DEA, Medal-Bartual et al. [19] adopted a non-concave metafrontier DEA approach to enable a comparison between different groups, and takes into account any heterogeneity between the franchise firms of several sectors. This study compared the techno-economic efficiency of small franchise firms from the five main economic sectors in Spain.

Additionally, Piot-Lepetit et al. [20] analyze the impact of the industry in which the franchisor operates its business on its chain efficiency by comparing 43 chains' efficiency between and across industries (retail versus services) using a meta-DEA and a context-dependent DEA. In this study, they developed a level-by-level benchmarking path with the context-dependent DEA approach to provide realistic short-term and long-term objectives to inefficient chains.

3. Methodology

3.1. Analysis Technique (1): Metafrontier DEA Model

Traditional DEA models consider the units selected for analysis as a homogenous group, thus, it is supposed that all the considered DMUs use the same technology and are completely homogenous organizations [18]. Comparisons of technological efficiencies among groups cannot be performed using conventional DEA because the technical efficiency of a particular company is difficult to compare with that of others operating with other technologies [9,10]. However, franchising activity includes numerous and diverse sectors and groups, such as travel agencies, hotels, restaurants, and fashion outlets. This fact makes us to suppose that there can be differences between the efficiency of franchise firms depending on their belonging sector or their franchise group managed by individual franchisors [18]. To account for this heterogeneity problem, there are several approaches that take account of different production technologies. In particular, Battese et al. [7], Battese and Rao [22], and O'Donnell et al. [23] consider the fact that technology could differ across regions and develop the stochastic metafrontier approach. A metafrontier approach is able to measure efficiencies of DMUs associated with distinctive and heterogeneous technologies. This involves a metafrontier estimation, which represents the envelope of all stochastic production frontiers for all groups or regions, as seen in Figure 1. The limits for groups such as T^1, T^2, and T^3 can be differences in country geography, regional production environment, or the economic development of each area or region [23,24]. The difference between these two values is the technology gap, measuring the distance gap between the group frontier and the metafrontier in Figure 1 [24].
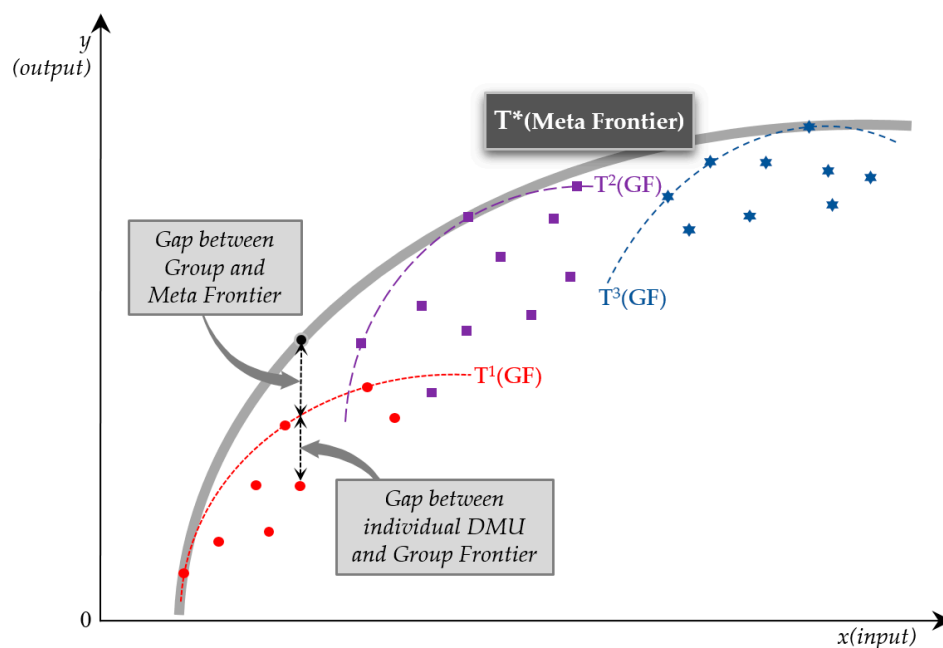

Figure 1. Research model for metafrontier in the Korean coffee shop franchise.

This study uses the stochastic frontier analysis (SFA) to measure the effectiveness of coffee shop franchise brands in Korea and a metafrontier production function that involves the production function

of all groups to compare the efficiency levels of three other groups (*large-*, *medium-*, and *small-chain*) of franchise brands operating under different technical conditions. For more details on this metafrontier approach, see Assaf [8], Battese and Rao [22], and O'Donnell et al. [23].

Technical efficiency for the *i*-th coffee shop franchisor indexed for a particular group *k* frontier can then be computed estimating a stochastic production frontier for each group as follows:

$$y_{i(k)} = e^{x_{i(k)}\beta_k + v_{i(k)} - u_{i(k)}} \tag{1}$$

where $x_{i(k)}$ is now a column vector of inputs for the *i*-th coffee shop franchisor associated with the *k* group. β_k is the estimated (unknown) parameter for the *k*-th group. $v_{i(k)}$ is the statistical random error, which is assumed to be independent and identically distributed with mean zero and variance σ_V^2 $[v_{i(k)} \sim N(0, \sigma_V^2)]$. The technical inefficiency term $u_{i(k)}$ is non-negative unobservable random error and assumed to be half normal distributed with variance $\sigma_{u(k)}^2 \left[u_{i(k)} \sim N\left(\mu_{i(k)}, \sigma_{u(k)}^2\right) \right]$ [22,23]. The technical efficiency indicator for coffee shop franchisor *i*-th for the *k*-th group is given by the ratio of the actual output to the output at the frontier such as in (2).

$$TE_{i(k)} = \frac{y_i}{e^{x_{i(k)}\beta_k + v_{i(k)}}} = e^{-u_{i(k)}} \tag{2}$$

O'Donnell et al. [23] defined a deterministic metafrontier as Equation (3), where y_i^* denotes the metafrontier output and β^* is a vector of metafrontier parameters which satisfies the condition (4). The metafrontier production function model from Battese et al. [22] is defined as follows:

$$y_i^* = f(x_{1i}, x_{2i}, \cdots x_{Ni}; \beta^*) \cdot e^{v_{i(k)}} = e^{x_{i(k)}\beta^* + v_{i(k)}} \tag{3}$$

$$s.t.\ x_{i(k)}\beta^* \geq x_{i(k)}\beta \tag{4}$$

From Equations (3) and (4), the graph of the metafrontier production function is located above the graph of the production frontier function of each group for all periods. To simplify, Equation (1) can be transformed as (5):

$$\begin{aligned} TE_i^* &= \frac{y_{i(k)}}{y_i^*} = \frac{y_{i(k)}}{y_{i(k)}^*} \times \frac{y_{i(k)}^*}{y_i^*} \\ &= e^{-u_{i(k)}} \times \frac{e^{x_{i(k)}\beta_k}}{e^{x_{i(k)}\beta^*}} \times e^{x_{i(k)}\beta^* + v_{i(k)}} \end{aligned} \tag{5}$$

In Equation (5) shown above, the second part is the ratio of the *K* group frontier production function to the metafrontier production function, which is expressed as either the TGR or the meta-technology ratio (MTR), measuring the distance between the group frontier and the metafrontier. O'Donnell et al. [16] indicated that a higher TGR implied that the gap between the group frontier and the metafrontier was shrinking. In effect, the MTR takes a value between 0 and 1, where 1 indicates no gap between the DMU in a particular region and the metafrontier.

$$TGR_{i(k)} = \frac{e^{x_{i(k)}\beta_k}}{e^{x_{i(k)}\beta^*}} \tag{6}$$

The TE_i^*, representing the technical efficiency of the metafrontier function, is decomposed as the product of $TE_{i(k)}$ and $TGR_{i(k)}$, and can be expressed as follows:

$$TE_i^* = TE_{i(k)} \times TGR_{i(k)} \tag{7}$$

Above all, the metafrontier approach is able to measure the efficiencies of DMUs associated with distinctive technologies and estimate the technical efficiency, TGR, and metafrontier efficiency of each group [8,22–24].

3.2. Analysis Technique (2): Simar and Wilson's Bootstrap-Truncated Regression

Non-parametric approaches such as DEA are primarily concerned with estimating a production-possibility frontier and measuring the distance of observed input-output combinations to this frontier. However, shedding light on what determines the magnitude of this distance is out of the narrow scope of non-parametric approaches. When analyzing what determines the efficiency of production, regressing efficiency scores estimated by DEA on explanatory variables has much intuitive appeal. To overcome this limitation of non-parametric approaches, Simar and Wilson [13,14] proposed the semi-parametric bootstrap to provide bias-corrected technical efficiency scores in DEA. They construct an underlying data generating process that is consistent with a two-stage estimation procedure, which implies a truncated rather than censored regression model. Moreover, they develop a parametric bootstrap procedure that is consistent with the assumed data generating process to yield estimated standard errors and confidence intervals that do not suffer from bias due to estimated efficiency scores being correlated [25].

Simar and Wilson [13,14] considered a well-defined, coherent statistical model in which a second-stage regression is meaningful, in the sense that the form of the second-stage regression equation is determined by the structure of the model in the first stage where the initial DEA estimates are obtained. In an attempt to rationalize studies where second-stage regressions have been estimated but no statistical model has been specified, Simar and Wilson [13,14] introduced assumptions that led to a truncated regression in the second stage which can be estimated consistently using the maximum likelihood (ML) method. This study employs Simar and Wilson's bootstrap algorithm as suggested by Badunenko and Tauchmann [25] and Barros and Assaf [26]. The main assumption is that the original efficiency score is given by $\hat{\theta}_i = \psi(\beta', z_i) + \varepsilon_i \geq 1$ and can be translated into the following regression specification:

$$\hat{\theta}_i = \beta' z_i + \varepsilon_i \geq 1 \tag{8}$$

where $\psi.$ is a smooth continuous function, z_i is a vector of the environmental variables, β' is a vector of parameters estimated by maximum likelihood, and $\varepsilon_i \sim N(0, \sigma_\varepsilon^2)$ is a continuous *i.i.d* random variable independent of z_i.

The steps of the algorithm are presented below:

Step 1: Estimate the efficiency score $\theta_i (i = 1, \ldots, N)$ using DEA.

Step 2: Fitting $\hat{\theta}_i = \beta' z_i + \varepsilon_i \geq 1$ truncated regression using the maximum likelihood (ML) method to obtain estimates $\hat{\beta}$ of β and an estimate $\hat{\sigma}_\varepsilon$ of σ_ε.

- Efficient DMUs $j\left(\hat{\theta}_j = 1, j = 1, \ldots, M\right)$ excluded

- $\hat{\theta}_i^{in} \in (0, 1]$. (input-orient): right-truncation at 1

- $\hat{\theta}_i^{out} \in [0, \infty)$ (output-orient): left-truncation at 1

Step 3: Repeat steps 3.1 to 3.3 B times ($b = 1, \ldots, B$) to obtain a set of bootstrap estimates.

3.1. For each $i = 1, \ldots, N$, draw $\varepsilon_i^b \sim N(0, \hat{\sigma}_\varepsilon^2)$ with left-truncation at $\left(1 - \hat{\beta}' z_i\right)$

3.2. For each $i = 1, \ldots, N$, compute $\theta_i^b = \hat{\beta}' z_i + \varepsilon_i^b$

3.3. Estimate $\hat{\beta}^b$ and $\hat{\sigma}_\varepsilon^b$ through the truncated regression model using the artificial efficiency scores θ_i^b as lhs-variable

Step 4: Construct standard errors for $\hat{\beta}$ and $\hat{\sigma}_\varepsilon$ (confidence intervals for β and σ_ε) from the simulated distribution of $\hat{\beta}^b$ and $\hat{\sigma}_\varepsilon^b$.

For the sake of brevity, we refer the reader to Simar and Wilson [13,14] and Barros and Assaf [26] for the details of the smoothed bootstrap-based DEA algorithm for computing efficiency.

4. Research Model and Data

In general, franchising is a business arrangement in which a business owner licenses the right to use another company's business system, name or names, logos, and trademarks [18–20,27,28]. Typically,

an individual or company pays an initial franchising fee to the company that owns the franchise, along with regular royalty payments for continued use of the system and intellectual property. There are two parties with different positions in a franchise business: franchisor (ownership) and franchisee (responsibilities) [18,19]. The difference between a franchisor and franchisee is similar to the licensee, licensor difference. The franchisor is the established business and the parent company that allows a third party (individual or business entity) to start and run a business using its trademarks, products and processes, usually for a fee. The franchisee is an individual or entity who purchases the right to operate a franchise business under the franchisor's name and system. That is, the franchisor owns the brand, the brand's trademarks, and sets the terms for licensing a franchisee to use the brand's name and its trademarks. The franchisee operates a business under the franchise's brand [17,18,20]. In this study, we investigated the efficiency of coffee shop franchisors that have a franchising arrangement with a number of franchisees in Korea.

Essentially, conventional DEA models rely primarily on the assumption that all DMUs have a set of DMUs sharing homogeneous technology. However, significant operating size disparities such as resource limitation, operational strategies, and management level in Korean coffee shop franchises provide a realistic basis for studying the franchisor's operation efficiency in the presence of heterogeneity, which can be implemented by conducting a metafrontier analysis [22,25]. In particular, Korean coffee shop franchisors can be classified into three groups according to their number of franchisees (N), such as *large coffee shop chains* ($N \geq 300$), *medium coffee shop chains* ($100 \leq N < 300$), and *small coffee shop chains* ($N < 100$). Although these coffee shop franchisees have the homogenous characteristics of providing coffee and beverage services to customers, the franchisor's operational policies appear to be somewhat heterogeneous, depending on the number of franchisees managed by individual franchisors [1,18–20,27,28].

To compare the contemporaneous meta efficiency (ME) of the 29 Korean coffee shop franchisors, financial and non-financial data were collected from the 'Korean Franchise Ranking' published by Startup & Business' newspaper (sbiznews.com) and the Fair Trade Commission (franchise.ftc.go.kr), a ministerial-level central administrative organization in Korea, from 2015–2018. Based on the previous literature review and data availability, we employ (I_1) Franchisor's Employee, (I_2) Franchisee's Average Sales, (I_3) Number of Franchisee as input, and (O_1) Franchisor's Financial Stabilization, (O_2) Franchisor's Total Sales, (O_3) Franchisor's Total Asset as output variables to measure ME.

The definition of input/output variables illustrated by '*Korean Franchise Ranking*' is as follows:

- Franchisor's Employee: The number of both full and part time employees of the franchise parent company, e.g., franchise supervisor and franchise development manager.
- Franchisee's Average Sales: The annual gross sales amount per franchisee during a given period.
- Number of Franchisee: The total number of franchised outlets under the franchisor's brand and system.
- Franchisor's Financial Stabilization: This financial indicator includes the current ratio, capital adequacy ratio, debt to equity ratio, and cash flow ratio of franchise parent company.
- Franchisor's Total Assets: The sum of total current and intangible assets, long term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets.
- Franchisor's Total Sales: An annual gross sales amount per franchisor, including (a) franchisees' sales-based royalties, (b) initial franchise fee revenue, and (c) revenue allocated to goods and services distinct from the franchise's right.

Additionally, a set of external environment variables used in the bootstrapped truncated regression are as follows: (E_1) Total Franchise Fee, (E_2) Franchise Turnover/Failure Rates, (E_3) Advertisement and Promotions, (E_4) Growth Rate of Franchisor, (E_5) Franchisor's Management Control, (E_6) Franchise History, and (E_7) ROE (Return on Equity) of Franchisor, as seen in Figure 2 and Table 2.

Table 2. Input-output variables in the Korean coffee shop franchise from 2015 to 2018.

Variables		Input Variables			Output Variables		
		Number of Franchisee	Franchisee's Average Sales	Franchisor's Employee	Financial Stabilization	Franchisor's Total Sales	Franchisor's Total Asset
2018	Max.	2142	386,275	762	90	184,124,914	105,342,107
	Min.	31	61,939	6	33	348,056	139,526
	Ave.	243.9	168,357.7	66.1	59.2	18,433,532.4	12,564,188.0
	S.D.	407.2	81,288.2	145.0	13.6	41,434,327.8	26,179,605.0
2017	Max.	1865	374,116	662	90	153,544,611	105,165,315
	Min.	32	66,709	6	33	148,791	81,916
	Ave.	232.2	166,669.9	65.9	59.2	17,929,997.4	12,850,812.3
	S.D.	367.4	82,125.3	132.6	13.6	37,103,534.2	28,218,335.8
2016	Max.	1577	355,839	439	90	135,521,376	110,276,297
	Min.	35	41,969	4	33	148,026	50,183
	Ave.	215.7	179,149.6	62.8	59.2	18,554,830.3	12,695,795.8
	S.D.	330.0	88,638.3	106.3	13.6	35,369,830.6	28,379,970.6
2015	Max.	1240	375,685	486	77	128,958,973	163,399,948
	Min.	30	11,156	1	33	326,890	129,210
	Ave.	208.9	184,492.1	72.7	56.9	20,214,419.2	13,866,208.0
	S.D.	294.4	104,262.8	114.3	11.8	35,024,661.5	34,915,928.3

In general, most coffee shop franchisors strive to trigger a franchisee's sales volumes through the franchisor's continuous management control of the franchisee, ultimately promoting the franchisor's total sales and maintaining the franchisor's sustainable growth [17–20,27,28]. Thus, this study used output-oriented DEA to estimate and compare the contemporaneous efficiency score of Korean coffee shop franchisors from 2015 to 2018. In an output-oriented DEA model, an inefficient unit is made efficient through the proportional increase of its outputs, while the inputs' proportions remain unchanged.

Table 2 summarizes descriptive statistics related to the changes in inputs/outputs from 2015 to 2018 used in the metafrontier DEA. Additionally, this study used the MaxDEA 6.9 (maxdea.com) and STATA 14 software packages to measure the metafrontier DEA estimations and second-stage truncated bootstrapped regression suggested by Simar and Wilson [13,14].
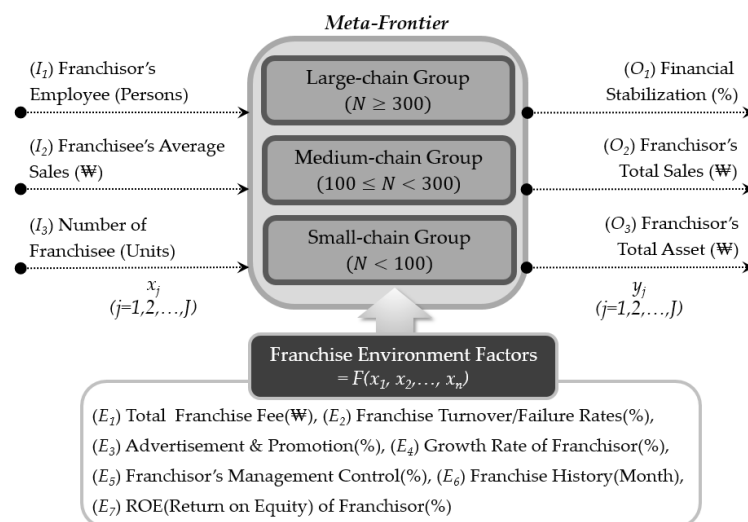
Figure 2. Research model for metafrontier in the Korean coffee shop franchise.

5. Empirical Metafrontier Results

In this study, we measured the ME, GE, and TGR of coffee shop franchisors in Korea on the premise that franchisors carried out different types of operations and differentiated resource utilization according to the number of franchisees. By using a metafrontier production function, this study compared the efficiency levels of other groups operating under different technical conditions. Based on the results of the metafrontier analysis, this study suggests strategic operation initiatives by decomposing whether the change in efficiency of the individual DMU is caused by changes in the technology level of the individual DMU or changes in the efficiency within the group.

Table 3 and Figure 3 show the metafrontier (MF), group frontier (GF), and TGR scores of coffee shop franchisors in Korea from 2015 to 2018. First, average MF for large coffee shop chain franchisors (0.8875) is ranked first, followed by small coffee shop chains (0.8342) and medium coffee shop chains (0.8028), under the constant returns-to-scale (CRS) assumption. Meanwhile, on the basis of the variable returns-to-scale (VRS), large-chain franchisors (0.9384) have the highest ME, followed by medium-chain franchisors (0.8985) and small-chain franchisors (0.8921).

Table 3. Metafrontier score comparison among the Korean coffee shop franchise from 2015 to 2018.

Group	Year	Number of DMUs	CRS-Based			VRS-Based		
			Average MF (TE)	Average GF	Average TGR	Average MF (PTE)	Average GF	Average TGR
Large coffee shop chains (N ≥ 300)	2018	6	0.9171	0.9625	0.9526	0.9376	0.9735	0.9626
	2017	6	0.9213	0.9286	0.9927	0.9440	0.9469	0.9957
	2016	5	0.8815	0.9570	0.9138	0.9357	1.0000	0.9357
	2015	5	0.8174	0.9430	0.8509	0.9354	1.0000	0.9354
	Average		*0.8875*	*0.9476*	*0.9316*	*0.9384*	*0.9783*	*0.9593*
Medium coffee shop chains (100 ≤ N < 300)	2018	9	0.8489	0.9927	0.8551	0.9170	1.0000	0.9170
	2017	9	0.8732	0.9945	0.8778	0.9282	1.0000	0.9282
	2016	7	0.7332	0.9512	0.7669	0.8434	0.9823	0.8597
	2015	5	0.6906	0.9273	0.7273	0.8888	0.9801	0.9054
	Average		*0.8028*	*0.9727*	*0.8200*	*0.8985*	*0.9926*	*0.9051*
Small coffee shop chains (N < 100)	2018	14	0.8557	0.8805	0.9750	0.8831	0.9139	0.9657
	2017	14	0.8364	0.8757	0.9580	0.9018	0.9423	0.9562
	2016	17	0.8646	0.9100	0.9518	0.8948	0.9412	0.9518
	2015	15	0.7774	0.8770	0.8925	0.8886	0.9634	0.9236
	Average		*0.8342*	*0.8869*	*0.9438*	*0.8921*	*0.9406*	*0.9490*

Second, on the basis of group efficiency (GE), the rank of average GF scores is in the following order: medium-chain franchisors (CRS-based average GF: 0.9727, VRS-based average GF: 0.9926), large-chain franchisors (CRS-based average GF: 0.9476, VRS-based average GF: 0.99783), and small-chain franchisors (CRS-based average GF: 0.8869, VRS-based average GF: 0.406).

Third, the TGR refers to the distance between the group frontier and the metafrontier, which is also the ratio of the optimal group frontier to the optimal metafrontier for the DMU in question. The closer the ratio is to 1, the closer the optimal group frontier is to the optimal meta-frontier for the DMU concerned. As seen in Table 3 and Figure 3, in terms of the TGR of Korean coffee shop franchisors, the medium-chain franchise group (CRS-based average TGR: 0.8200, VRS-based average TGR: 0.9051) is ranked lower in the TGR, which is farthest away from the metafrontier. Therefore, the medium-chain franchise group requires strategic alternatives to reduce the distance from the group frontier to the metafrontier. Looking at the yearly change of the TGR in Figure 3, the lowest TGR score is in 2015; regardless of the size of franchisors, however, this score exhibits an upward trend.
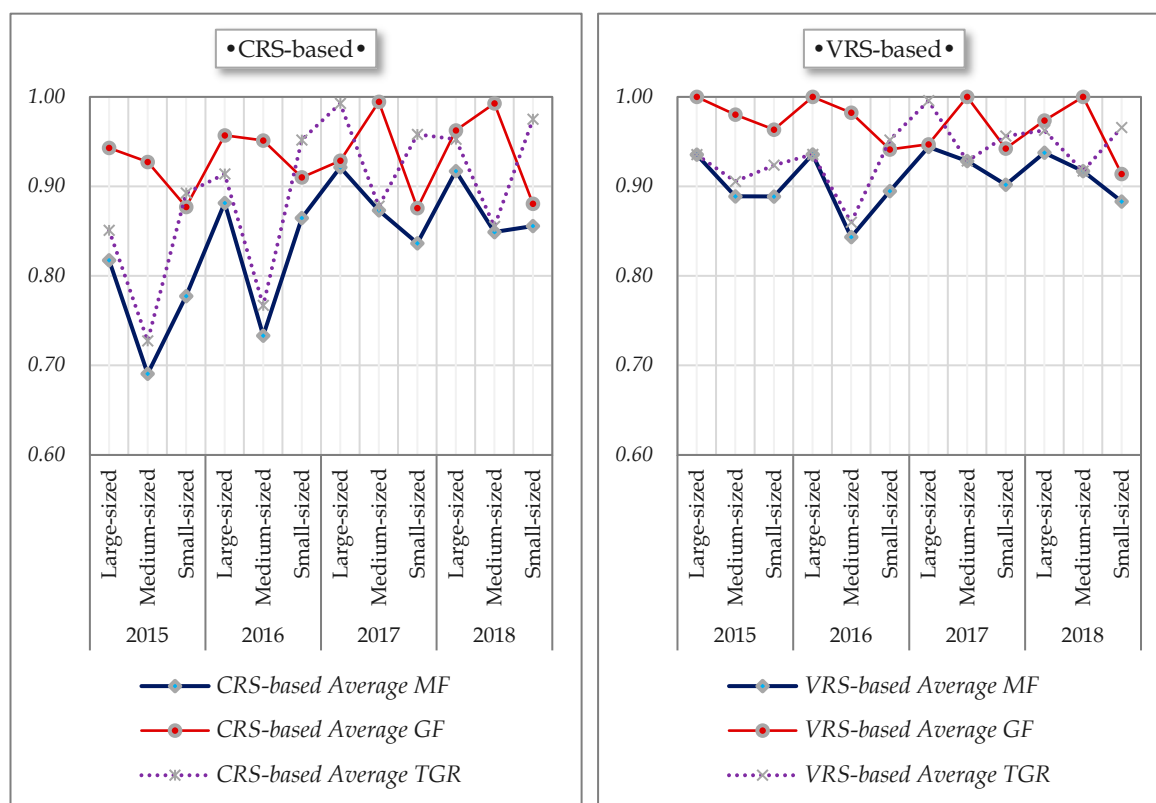
(a) CRS-based Meta Efficiency   (b) VRS-based Meta Efficiency

Figure 3. Average metafrontier (CRS-based and VRS-based) score comparisons from 2015 to 2018.

Meanwhile, this study conducted the Kruskal–Wallis H test to compare the GE of the Korean coffee brands depending on the size of franchisors. The results revealed that, χ^2(*test statistics*) = 7.876(CRS) and 7.002(VRS), *Asymp. Sig* = 0.019(CRS) and 0.030(VRS) < 0.05, showing a statistically significant difference, and thus indicating that there is a difference in the medians among the large-, medium- and small-chain groups of Korean coffee brands. The mean rank is in the following order: (CRS-based) Medium, 65.12; Large, 63.43; Small 49.65 and (VRS-based) Medium, 63.03; Large, 61.27; Small 51.48.

In addition, a pairwise comparison was performed to conduct a post-hoc test on how each franchisor group is different. Table 4 shows the pairwise comparison results by franchisor group, which prove that there are significant differences between the Small-Medium group. However, the Small-Large and Large-Medium groups have no significant differences.

Table 4. Pairwise comparison using the Kruskal–Wallis test for GE scores among coffee franchise groups.

(I) Group–(J) Group	Model	Test Statistics	Std. Error	Std. Test Statistics	Sig.	Adj. sig.
Small-Large	CRS	13.782	6.936	1.987	0.047	0.141
	VRS	9.789	5.404	1.811	0.070	0.210
Small-Medium	CRS	15.467	6.223	2.485	0.013	0.039
	VRS	11.550	4.848	2.382	0.017	0.052
Large-Medium	CRS	−1.685	7.812	−0.216	0.829	1.000
	VRS	−1.761	6.086	−0.289	0.772	1.000

χ^2(CRS) = 7.876, Asymp. Sig.(CRS) = 0.019, χ^2(VRS) = 7.002, Asymp. Sig.(VRS) = 0.030; *Asymptotic significant (2-sided tests) are displayed. The significant level is 0.05.

This study measured the technical efficiency (TE: CRS-based), pure technical efficiency (PTE: VRS-based), and scale efficiency (SE) scores of 29 coffee shop franchisors in Korea, as seen in the Appendix A Table A1. In particular, coffee franchisor brands such as *Amasvin*, *EDIYA COFFEE*, and *HOLLYS COFFEE* have almost maintained a TE and PTE score of 1 from 2015 to 2018, whereas *Arista* (CRS-based: 0.5108, VRS-based: 0.6392) and *YOGERPRESSO* (CRS-based: 0.5918, VRS-based: 0.7031) have noticeably low efficiency scores.

In terms of efficiency of individual DMUs, the ratio of constant returns-to-scale is 36.6% out of 112 overall DMUs. Moreover, a close look at the main driver of inefficiency in coffee shop franchisors reveals that the inefficiency is relatively attributed to pure technical inefficiency ($PTE < SE$, 50.7%) rather than scale inefficiency ($PTE > SE$, 49.3%), which implies that coffee shop franchisors failed to allocate service resources efficiently and had poor input utilization (i.e., managerial inefficiency). Consequently, these DMUs with pure technical inefficiency need innovative operating policies and alternatives to improve managerial performance.

From an RTS (Return-to-Scale) perspective, 20.5% of DMUs were located in the increasing returns-to-scale regions (IRS), indicating that these DMUs in the IRS region need to expand their business size to dramatically improve efficiency. Conversely, 42.9% of DMUs were in the decreasing returns-to-scale regions (DRS) region. In general, a DRS occurs when the proportion of output ($\Delta Output$) is less than the desired increased input ($\Delta Input$). This is a managerial inefficiency mainly caused by a complexity of communication and the decision-making system within a business entity. Thus, DMUs in the DRS region can improve their efficiency levels by optimizing business size such as eliminating overcapacity and adjusting overlapping employee responsibilities.

6. Determinants of Meta Efficiency

While standard DEA is simple in estimating the relative efficiency among DMUs, it is limited in terms of identifying the relation between the efficiency score and its external determinants on efficiency. To examine how environmental variables exert a significant impact on Korean coffee shop franchisors' measured efficiency, we adopted the bootstrapped truncated regression suggested by Simar and Wilson [13,14]. The estimated specification for the regression is:

$$\hat{\theta}_i = \beta_0 + \beta_1 His_i + \beta_2 Fee_i + \beta_3 Adv_i + \beta_4 Con_i + \beta_5 GR_i + \beta_6 ROE_i + \beta_7 Fail_i + \varepsilon_i \tag{9}$$

where $\hat{\theta}_i$ is the bootstrapped bias-corrected efficiency score of the original metafrontier scores of individual coffee shop franchise brand i, which is a valid estimate for the parameters in the regression model [13,14]; β_0 is a constant term, $\beta_1, \ldots, \beta_n$ are coefficients of technical ME determinants in Korean coffee shop franchisor operating environments, and ε_i is the error term (statistical noise).

Following Badunenko and Tauchmann [25], we employ a STATA 14 program to obtain unbiased coefficients and confidence intervals with 2000 replications. A set of exogenous covariates affecting CRS- and VRS-based ME scores were developed for the second-stage regression analysis, which represents the operating environments of a coffee shop franchisor in Korea, i.e., Franchise History (His_i), Total Franchise Fee (Fee_i), Advertisement and Promotion (Adv_i), Franchisor's Management Control (Con_i), Growth Rate of Franchisor (GR_i), Return on Equity of Franchisor (ROE_i) and Franchise Turnover/Failure Rates ($Fail_i$) [29,30]. The estimated coefficients and significance levels are shown in Table 5.

The Wald test statistics [e.g., 27.89 (large-chain, CRS), 25.08 (medium-chain, CRS), 18.62 (small-chain, CRS) and 25.85 (large-chain, VRS), 17.47 (medium-chain, VRS), 18.77 (small-chain, VRS)] reject the null hypothesis that the parameters in the regression equation are jointly equal to zero. Additionally, all the sigma values, or the robust standard deviation in the truncated regression of the reciprocal of the DEA score on environmental variables, are statistically significant at the 0.01 level.

Considering the effects of seven explanatory variables on the ME of a large coffee shop franchisor group, Total Franchise Fee $\left(\beta_{Fee(CRS, 5\%)} = 1.42e-06, \beta_{Fee(VRS, 5\%)} = 1.06e-06 \right)$ and Growth Rate of

Franchisor $\left(\beta_{GR(CRS,1\%)} = 0.0122,\ \beta_{GR(VRS,1\%)} = 0.0076\right)$ have a positive and statistically significant effect on the ME of a large-chain franchisor group at each significance level, but other variables do not have a statistically significant relationship between the franchisor's operating environment and the ME of a large-chain franchisor group.

Table 5. Bootstrap-truncated regression: the effect of a franchisor's environmental attributes on the metafrontier scores based on CRS and VRS.

Environmental Variables	Group	DEAModel	Coef.	Std. Err.	z	P > |z|	95% Conf. Interval	
							Lower	Upper
Franchise History	Large	CRS	−0.0007513	0.0002888	−2.60	1.910	−0.001342	−0.0001711
		VRS	−0.0004757	0.0002228	−2.14	1.967	−0.0009385	−0.000044
	Medium	CRS	−0.0016337	0.0006642	−2.46	1.986	−0.0029627	−0.0003364
		VRS	−0.0000871	0.0003718	−0.23	1.185	−0.0008498	0.0006173
	Small	CRS	0.0001366	0.0003932	0.35	0.728	−0.000628	0009487
		VRS	0.0002527	0.00039	0.82	0.413	−0.000329	0.0008785
Total Franchise Fee	Large	CRS	1.42×10^{-6} **	6.36×10^{-7}	2.23	0.026	1.41×10^{-7}	2.64×10^{-6}
		VRS	1.06×10^{-6} **	4.72×10^{-7}	2.25	0.024	1.74×10^{-7}	2.01×10^{-6}
	Medium	CRS	8.45×10^{-7} **	3.82×10^{-7}	2.21	0.027	1.27×10^{-7}	1.58×10^{-6}
		VRS	8.23×10^{-8}	2.16×10^{-7}	0.38	0.703	-3.39×10^{-7}	5.01×10^{-7}
	Small	CRS	-4.29×10^{-7}	3.21×10^{-7}	−1.34	1.819	-1.06×10^{-6}	2.01×10^{-7}
		VRS	-3.74×10^{-7}	2.50×10^{-7}	−1.50	1.866	-8.69×10^{-7}	1.36×10^{-7}
Advertisement and Promotion	Large	CRS	−0.0056105	0.0032931	−1.70	1.912	−0.0119926	0.0007415
		VRS	0.000603	0.0023972	0.25	0.801	−0.0044809	0.0049637
	Medium	CRS	−0.0006873	0.002327	−0.30	1.232	−0.0052283	0.003944
		VRS	−0.0001032	0.0012966	−0.08	1.063	−0.0026222	0.0055246
	Small	CRS	0.0001534	0.0013262	0.12	0.908	−0.002395	0.0028667
		VRS	−0.0010026	0.0010319	−0.97	1.669	−0.003053	0.0010916
Franchisor's Management Control	Large	CRS	−0.0041475	0.0050665	−0.82	1.587	−0.144173	0.0057284
		VRS	−0.0065265	0.003595	−1.82	1.931	−0.135664	0.0007654
	Medium	CRS	−0.0026858	0.0033774	−0.80	1.574	−0.0093955	0.00442
		VRS	0.017022	0.018976	0.90	0.370	−0.0019856	0.0055246
	Small	CRS	0.0066637 ***	0.0019286	3.46	0.001	0.002962	0.01065
		VRS	0.0052372 ***	0.0015088	3.71	0.001	0.002385	0.0084489
Growth Rate of Franchisor	Large	CRS	0.012241 ***	0.003591	3.13	0.002	0.002031	0.0179889
		VRS	0.0075892 ***	0.0025883	2.93	0.003	0.0025691	0.0125574
	Medium	CRS	0.0027067	0.001715	1.58	0.115	−0007222	0.0060904
		VRS	0.0021091 **	0.0009534	2.21	0.027	0.0002291	0.0040213
	Small	CRS	−0.01137	0.0010904	−1.04	1.703	−0.003297	0.0010164
		VRS	−0.0002833	0.008658	−0.33	1.256	−0.00109	0.0013863
ROE (Return on Equity) of Franchisor	Large	CRS	−0.0027078	0.0012322	−2.20	1.972	−0.0051804	−0.0002331
		VRS	−0.0001116	0.0009262	−0.12	1.096	−0018614	0.0017514
	Medium	CRS	−0.0020445	0.0012655	−1.62	1.894	−0.004566	0.0004413
		VRS	−0.0000755	−0.0007073	−0.11	1.085	−0.0014458	0.0013482
	Small	CRS	0.002457 ***	0.0007697	2.92	0.004	0.0007864	0.0037528
		VRS	0.0011999 **	0.0005807	2.07	0.039	0.0000264	−0.000231

Table 5. *Cont.*

Environmental Variables	Group	DEAModel	Coef.	Std. Err.	z	P > |z|	95% Conf. Interval	
							Lower	Upper
Franchise Turnover/Failure Rates	Large	CRS	−0.0015297	0.0012248	−1.36	1.826	−0.0037678	0.0006353
		VRS	−0.001522	0.000819	−1.86	1.937	−0.0032555	0.0000983
	Medium	CRS	0.0008429	0.0022505	0.37	0.708	−0.0035888	0.0053132
		VRS	−0.0011857	0.0012496	−0.95	1.657	−0.0036485	0.0011901
	Small	CRS	−0.0027058	0.0010669	−2.54	1.989	−0.004854	−0.000660
		VRS	−0.0024405	0.0008414	−2.90	1.996	−0.004107	−0.000818
Constant	Large	CRS	0.9302242 ***	0.1778719	5.23	0.000	0.5839312	1.265962
		VRS	0.7122965 ***	0.128604	5.61	0.000	0.4745063	0.9782561
	Medium	CRS	0.8952816 ***	0.205504	4.36	0.000	0.4972496	0.288165
		VRS	0.7196367 ***	0.1182745	6.08	0.000	0.4927688	0.9576661
	Small	CRS	0.5107363 ***	0.1242524	4.11	0.000	0.2678025	0.7519387
		VRS	0.6900445 ***	0.953892	7.23	0.000	0.5024822	0.8717355
Sigma	Large	CRS	0.0863977 ***	0.0133299	6.48	0.000	0.0431533	0.0955025
		VRS	0.0620644 ***	0.0099559	6.23	0.000	0.0299715	0.0689021
	Medium	CRS	0.1071516 ***	0.0155064	6.91	0.000	0.0616554	0.1233969
		VRS	0.618008 ***	0.0083852	7.37	0.000	0.0372806	0.0693693
	Small	CRS	0.134486 ***	0.0150303	8.95	0.000	0.0974256	0.1574115
		VRS	0.1045414 ***	0.0115133	9.08	0.000	0.075395	0.1217068

Total Number of Bootstrap replications. = 2,000, Number of Observation = 29; CRS Wald χ^2 (L, 7) = 27.89, CRS Prob.> χ^2(L, 7) = 0.0002, VRS Wald χ^2(L, 7) = 25.85; CRS Prob.> χ^2(L, 7) = 0.0005, CRS Wald χ^2(M, 7) = 25.08, CRS Prob.> χ^2(M, 7) = 0.0007; VRS Wald χ^2(M, 7) = 17.47, CRS Prob.> χ^2(M, 7) = 0.0146, CRS Wald χ^2(S, 7) = 18.62; CRS Prob.> χ^2(S, 7) = 0.0095, VRS Wald χ^2(S, 7) = 18.77, CRS Prob.> χ^2(S, 7) = 0.0089. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

From the perspective of ME of a large coffee shop franchisor group, the incremental number of franchisees augments the franchisors' total sales by the non-refundable up-front fee for each new franchisee location and the ongoing sales-based royalties received over the term of the franchise agreement. This leads to stabilize a financial status of franchisors through the expansion of franchisors' total assets quantitatively and qualitatively. The higher financial growth of the franchisor not only expands the market size of the Korean coffee franchisors, but also further increases the number of preliminary franchisees, as seen in Figure 4 (R1/R2/R3 reinforcing loop). However, franchisees exceeding a certain limited number are beyond the controllability of a franchisor's management, and this gives rise to weaken the franchisors' control or supervision over franchisees (B1 balancing loop). Thus, franchisors require new strategic initiatives and alternatives to maintaining sustainable growth depending on changes in the number of franchisees.
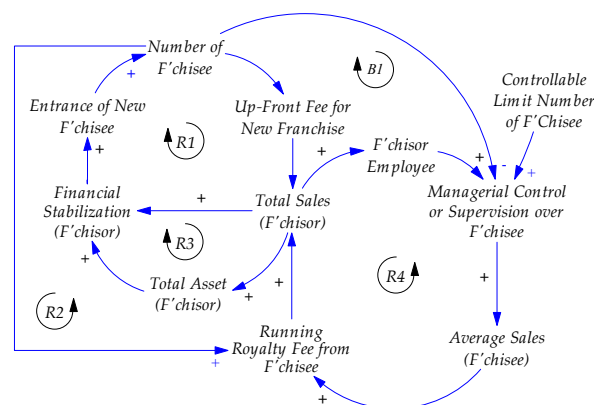

Figure 4. Causal Loop Diagram on the Profit Chain of the Korean Coffee Shop Franchise.

Meanwhile, the franchisor's operating environment variables with a significantly positive effect on the ME of a small-chain franchisor are *Franchisor's Management Control* $\left(\beta_{Con(CRS,1\%)} = 0.6667, \beta_{Con(VRS,1\%)} = 0.0052\right)$ and *ROE (Return on Equity) of Franchisor* $\left(\beta_{ROE(CRS,1\%)} = 0.0025, \beta_{ROE(VRS,5\%)} = 0.0012\right)$.

These results demonstrated that small-chain franchisor groups can increase ME with ongoing supervision over franchisees. That is, small-chain franchisor groups can enhance their efficiency by strengthening the more systematic training and education systems for manpower such as the franchisor's supervisor or franchise manager. This leads to increase average sales of franchisees, which ultimately contribute to enlarge total sales of franchisors, as seen in Figure 4 (R4 reinforcing loop). Thus, small-chain franchisors require strategic initiatives to strengthen their capabilities for the sustainable growth of a Korean coffee shop franchise.

From the perspective of the ME of a medium-chain franchisor group, the *Total Franchise Fee* $\left(\beta_{Fee(CRS,5\%)} = 8.45e - 07\right)$ has a significant positive effect on the CRS-based ME at the 0.05 significance level, while the *Growth Rate of Franchisor* $\left(\beta_{GR(VRS,5\%)} = 0.0021\right)$ has a positive effect on VRS-based ME.

7. Discussion and Conclusions

7.1. Implications for Theoretical and Operating Practice

Recently, franchising as an innovative business format, has been rapidly growing in the Korean food and beverage industry. Nonetheless, previous applications of DEA models in the field of franchising have been scarce. Therefore, this study employed the metafrontier analysis to measure the efficiency of Korean coffee shop franchisors from 2015 to 2018 and adopted a double bootstrap regression analysis suggested by Simar and Wilson [13,14] to reveal the impact of external determinants on ME.

The results presented herein suggest the following three theoretical and managerial implications:

First, this study contributes to the literature on efficiency in franchising. Specifically, it is focused on the sector of coffee shop franchisors which operate in the franchising system in Korea. Moreover, this study first employed a metafrontier DEA approach to compare the efficiency levels of three other groups of franchise brands operating under different technical conditions depending on franchise size difference. This fact is an original literature contribution and is critical because, up to now, there have not been any prior studies about efficiency in this sector of franchising.

Second, this study classified coffee shop franchisors in Korea into three groups according to the number of franchisees and accurately estimated the GE of different-sized coffee shop franchisors by analyzing various groups and ME values. Moreover, we investigated the comparison of GE among the Korean coffee shop brands using the Kruskal–Wallis test. The analysis results proved that there are significant differences between *small-chain* and *medium-chain* coffee shop franchisors. Consequently, franchisors require new strategic initiatives and alternatives depending on the characteristics of the individual group.

Third, this study outlines a way to improve ME with respect to operation management interfaces and coordination. That is, the previous literatures have analyzed the efficiency in various franchise fields; however, these studies cannot explore the critical operation factor affecting efficiency [2,3,6,15–21,27,28]. Therefore, this study investigated the principal drivers of the franchisors' environmental variables to increase the ME of the Korean coffee shop franchisors. In particular, the results of bootstrapped truncated regression provided that the external environmental factors affecting the efficiency of each individual group are totally different patterns depending on the franchise group (e.g., *large-*, *medium-*, and *small-chain* franchisees). In particular, the external operating environments affecting *large-chain* franchise groups are different from those of *small-chain*. The environmental factors affecting the efficiency of large-chain coffee shop franchisors are the *Total Franchise Fee* and *Growth Rate of Franchisor*, whereas the efficiency of the small-chain coffee shop franchisors are affected by the *Franchisor's Management Control* and *Return on Equity (ROE) of Franchisor*. For small-chain franchisors,

strengthening management and supervision over franchisees is a critical strategic factor to increase efficiency. However, for large-chain franchisors, a higher growth rate of franchisors triggers the transition from potential franchisee to actual franchisee, in that a preliminary franchisee wants to sign a franchising arrangement with the competitive franchisor.

This research highlights the following results:

- A majority of Korean coffee shop franchisors are located in the decreasing returns-to-scale regions. Thus, these franchisors should seek out sources of a managerial inefficiency and develop a sophisticated framework for achieving their optimal scale to improve their efficiency.
- There are significant group efficiency differences between *small-chain* and *medium-chain* groups of Korean coffee brands. The individual franchisor needs strategic initiatives tailored to the characteristics of the franchise group to enhance efficiency and achieve sustainable growth in a coffee shop franchise market in Korea.
- The principal operational drivers affecting meta efficiency differ depending on the preferred operational strategies and characteristics of each franchise group. Thus, a differentiated operating strategy of *large-*, *medium-*, and *small-chain* groups of coffee shop franchisors is required to maximize the individual coffee shop franchisor's efficiency.

Consequently, this study suggests that a franchisor requires new and innovative operation policies that are appropriate for each step of growth [31]. In addition, this research model can be applied to other service industries as well as the franchise industry. By measuring ME according to business scope, these results may help a franchise brand practitioner identify their franchisor brand position from the perspective of ME. In addition, this study provides strategic franchise initiatives to increase ME with more efficient internal resource allocation and coordination.

7.2. Limitations and Future Research

While providing important insights to both franchise management theory and practice, this study has two main kinds of limitations: those related to the data set and those related to the analysis periods. First, this study employs three input and output variables exclusively based on the financial data and does not address other confounding factors that have an important impact on the profitability of a coffee shop and customers' coffee shop brand choice: coffee price, convenience of location and parking, and atmosphere and styling. These additional variables are very important to precisely measure the efficiency of coffee shop franchisors. Nonetheless, we excluded certain information from our model such as coffee prices of an individual coffee shop franchisor due to the difficulty of data accessibility. Moreover, this study has a limitation that we failed to consider about franchise service quality in this study, despite its importance in the franchise industry. Therefore, further research must include franchise-related other factors as well as franchise service quality to confirm the adequacy of these results. Second, this study focused on the contemporaneous meta efficiency measurement based only on Korean coffee shop franchisors from 2015 to 2018. Hence, we need more longitudinal data accumulation to accurately measure ME and figure out the key drivers of efficiency fluctuation.

Appendix A

Table A1. Metafrontier Efficiency of the Korean Coffee Franchises from 2015 to 2018.

DMU	Year	CRS-Based			VRS-Based			SE	RTS	Major Cause of Inefficiency	
		MF(TE)	GF	TGR	MF(PTE)	GF	TGR			PTE	SE
Amasvin	2018	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2017	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2016	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2015					N/A					
	Average	*1.0000*	*1.0000*	*1.0000*	*1.0000*	*1.0000*	*1.0000*	*1.0000*			
Arista	2018	0.5279	0.5279	1.0000	0.5929	0.6353	0.9333	0.8904	DRS	✓	
	2017	0.4764	0.4764	1.0000	0.5930	0.6026	0.9840	0.8034	DRS	✓	
	2016	0.5641	0.5641	1.0000	0.6342	0.6377	0.9944	0.8895	DRS	✓	
	2015	0.4749	0.4749	1.0000	0.7368	0.7368	1.0000	0.6446	DRS		✓
	Average	*0.5108*	*0.5108*	*1.0000*	*0.6392*	*0.6531*	*0.9779*	*0.8070*			
Café Lu&B	2018	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2017	0.9825	1.0000	0.9825	1.0000	1.0000	1.0000	0.9825	IRS		✓
	2016	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2015					N/A					
	Average	*0.9942*	*1.0000*	*0.9942*	*1.0000*	*1.0000*	*1.0000*	*0.9942*			
Café Amote	2018	0.8258	0.8258	1.0000	1.0000	1.0000	1.0000	0.8258	IRS		✓
	2017	0.7283	0.7470	0.9750	1.0000	1.0000	1.0000	0.7283	IRS		✓
	2016	0.8110	0.8110	1.0000	1.0000	1.0000	1.0000	0.8110	IRS		✓
	2015	0.8025	0.8025	1.0000	1.0000	1.0000	1.0000	0.8025	IRS		✓
	Average	*0.7919*	*0.7966*	*0.9938*	*1.0000*	*1.0000*	*1.0000*	*0.7919*			
Café-bombom	2018	0.7225	1.0000	0.7225	0.9497	1.0000	0.9497	0.7608	DRS		✓
	2017	0.7281	1.0000	0.7281	0.8192	1.0000	0.8192	0.8888	DRS	✓	
	2016	0.7388	0.7583	0.9744	0.8331	0.8933	0.9326	0.8868	DRS	✓	
	2015					N/A					
	Average	*0.7298*	*0.9194*	*0.8083*	*0.8674*	*0.9644*	*0.9005*	*0.8454*			
Caffé Glen	2018	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2017	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2016	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2015	0.7742	0.7742	0.9999	1.0000	1.0000	1.0000	0.7742	DRS		✓
	Average	*0.9436*	*0.9436*	*1.0000*	*1.0000*	*1.0000*	*1.0000*	*0.9436*			
Caffe One+One	2018	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2017	0.9792	0.9900	0.9891	1.0000	1.0000	1.0000	0.9792	IRS		✓
	2016	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2015	0.6765	0.7719	0.8764	0.8779	0.9980	0.8797	0.7706	DRS		✓
	Average	*0.9139*	*0.9405*	*0.9664*	*0.9695*	*0.9995*	*0.9699*	*0.9375*			
CAFFE-BENE	2018	0.7995	0.9638	0.8295	0.8327	1.0000	0.8327	0.9601	DRS	✓	
	2017	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2016	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2015	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	Average	*0.9499*	*0.9910*	*0.9574*	*0.9582*	*1.0000*	*0.9582*	*0.9900*			

Table A1. *Cont.*

DMU	Year	CRS-Based			VRS-Based			SE	RTS	Major Cause of Inefficiency	
		MF(TE)	GF	TGR	MF(PTE)	GF	TGR			PTE	SE
Coffee Myungga	2018	0.9784	1.0000	0.9784	0.9827	1.0000	0.9827	0.9957	DRS	✓	
	2017	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2016	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2015	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	Average	*0.9946*	*1.0000*	*0.9946*	*0.9957*	*1.0000*	*0.9957*	*0.9989*			
Coffee-banhada	2018	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2017	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2016	0.9091	1.0000	0.9091	1.0000	1.0000	1.0000	0.9091	DRS		✓
	2015	0.7646	1.0000	0.7646	0.9464	1.0000	0.9464	0.8079	DRS		✓
	Average	*0.9184*	*1.0000*	*0.9184*	*0.9866*	*1.0000*	*0.9866*	*0.9292*			
COFFEE-BAY	2018	0.9154	1.0000	0.9154	1.0000	1.0000	1.0000	0.9154	DRS		✓
	2017	0.9560	1.0000	0.9560	1.0000	1.0000	1.0000	0.9560	DRS		✓
	2016	0.8188	1.0000	0.8188	1.0000	1.0000	1.0000	0.8188	DRS		✓
	2015	0.6680	1.0000	0.6680	1.0000	1.0000	1.0000	0.6680	DRS		✓
	Average	*0.8395*	*1.0000*	*0.8395*	*1.0000*	*1.0000*	*1.0000*	*0.8395*			
Coffee-mama	2018	0.8148	1.0000	0.8148	0.8299	1.0000	0.8299	0.9819	DRS	✓	
	2017	0.9202	1.0000	0.9202	0.9299	1.0000	0.9299	0.9896	IRS	✓	
	2016	0.6289	0.8656	0.7265	0.8080	0.8762	0.9222	0.7784	DRS		✓
	2015	0.4229	0.8903	0.4749	0.7527	0.9006	0.8358	0.5618	DRS		✓
	Average	*0.6967*	*0.9390*	*0.7341*	*0.8301*	*0.9442*	*0.8794*	*0.8279*			
Coffeenie	2018	0.7960	1.0000	0.7960	0.8394	1.0000	0.8394	0.9484	DRS	✓	
	2017	0.7788	1.0000	0.7788	0.7951	1.0000	0.7951	0.9795	DRS	✓	
	2016	0.6914	1.0000	0.6914	0.8320	1.0000	0.8320	0.8310	DRS		✓
	2015	0.6366	1.0000	0.6366	0.8738	1.0000	0.8738	0.7286	DRS		✓
	Average	*0.7257*	*1.0000*	*0.7257*	*0.8351*	*1.0000*	*0.8351*	*0.8719*			
Coffine Gurunaru	2018	0.6931	0.9966	0.6955	0.7084	1.0000	0.7084	0.9784	IRS	✓	
	2017	0.6011	1.0000	0.6011	0.6048	1.0000	0.6048	0.9939	DRS	✓	
	2016	0.6131	0.8609	0.7122	0.6208	0.9463	0.6561	0.9876	IRS	✓	
	2015	0.8792	1.0000	0.8792	0.8793	1.0000	0.8793	0.9999	IRS	✓	
	Average	*0.6966*	*0.9644*	*0.7220*	*0.7034*	*0.9866*	*0.7122*	*0.9899*			
Compose Coffee	2018	0.9300	1.0000	0.9300	1.0000	1.0000	1.0000	0.9300	DRS		✓
	2017	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2016	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2015				*N/A*						
	Average	*0.9767*	*1.0000*	*0.9767*	*1.0000*	*1.0000*	*1.0000*	*0.9767*			
Dal.komm Coffee	2018	0.8161	1.0000	0.8161	0.9010	1.0000	0.9010	0.9058	DRS	✓	
	2017	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2016	0.8009	1.0000	0.8009	0.8123	1.0000	0.8123	0.9860	IRS	✓	
	2015	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	Average	*0.9043*	*1.0000*	*0.9043*	*0.9283*	*1.0000*	*0.9283*	*0.9729*			
Davinci Coffee	2018	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2017	0.6577	0.6577	1.0000	1.0000	1.0000	1.0000	0.6577	IRS		✓
	2016	0.6549	0.6558	0.9986	0.6604	0.6604	1.0000	0.9917	IRS	✓	
	2015	0.4893	0.5579	0.8771	0.7018	0.7500	0.9357	0.6972	DRS		✓
	Average	*0.7005*	*0.7179*	*0.9689*	*0.8406*	*0.8526*	*0.9839*	*0.8367*			

Table A1. *Cont.*

DMU	Year	CRS-Based			VRS-Based			SE	RTS	Major Cause of Inefficiency	
		MF(TE)	GF	TGR	MF(PTE)	GF	TGR			PTE	SE
Deété espresso	2018	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2017	0.9079	1.0000	0.9079	1.0000	1.0000	1.0000	0.9079	IRS		✓
	2016	0.7886	1.0000	0.7886	0.8057	1.0000	0.8057	0.9787	DRS	✓	
	2015	0.6474	0.9595	0.6748	0.7525	0.9666	0.7786	0.8603	DRS	✓	
	Average	*0.8360*	*0.9899*	*0.8428*	*0.8896*	*0.9916*	*0.8961*	*0.9367*			
DROPTOP	2018	0.9034	1.0000	0.9034	1.0000	1.0000	1.0000	0.9034	DRS		✓
	2017	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2016	0.9248	1.0000	0.9248	0.9715	1.0000	0.9715	0.9519	DRS		✓
	2015	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	Average	*0.9570*	*1.0000*	*0.9570*	*0.9929*	*1.0000*	*0.9929*	*0.9638*			
EDIYA COFFEE	2018	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2017	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2016	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2015	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	Average	*1.0000*	*1.0000*	*1.0000*	*1.0000*	*1.0000*	*1.0000*	*1.0000*			
Havana Express	2018	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2017	0.9119	0.9187	0.9926	1.0000	1.0000	1.0000	0.9119	IRS		✓
	2016	0.9696	0.9747	0.9948	1.0000	1.0000	1.0000	0.9696	IRS		✓
	2015	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	Average	*0.9704*	*0.9733*	*0.9968*	*1.0000*	*1.0000*	*1.0000*	*0.9704*			
HOLLYS COFFEE	2018	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2017	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2016	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2015	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	Average	*1.0000*	*1.0000*	*1.0000*	*1.0000*	*1.0000*	*1.0000*	*1.0000*			
Joe's Sandwich& Coffee	2018	0.9247	0.9285	0.9959	0.9825	1.0000	0.9825	0.9412	DRS		✓
	2017	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2016	0.9860	1.0000	0.9860	1.0000	1.0000	1.0000	0.9860	IRS		✓
	2015	0.7120	0.8139	0.8748	0.8841	1.0000	0.8841	0.8054	DRS		✓
	Average	*0.9057*	*0.9356*	*0.9642*	*0.9666*	*1.0000*	*0.9666*	*0.9331*			
Selecto Coffee	2018	0.8741	1.0000	0.8741	0.8744	1.0000	0.8744	0.9997	IRS	✓	
	2017	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2016	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	2015	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	Average	*0.9685*	*1.0000*	*0.9685*	*0.9686*	*1.0000*	*0.9686*	*0.9999*			
Super Coffee	2018	0.9452	0.9645	0.9800	0.9595	0.9888	0.9704	0.9851	DRS	✓	
	2017	0.7319	0.8027	0.9118	0.7813	0.8791	0.8887	0.9368	DRS	✓	
	2016	0.8403	0.8448	0.9947	0.8463	0.8629	0.9808	0.9930	DRS	✓	
	2015	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		CRS	
	Average	*0.8794*	*0.9030*	*0.9716*	*0.8968*	*0.9327*	*0.9599*	*0.9787*			
The Kind Coffee	2018	0.4677	0.4677	1.0000	0.4981	0.5150	0.9672	0.9389	DRS	✓	
	2017	0.7270	1.0000	0.7270	0.9740	1.0000	0.9740	0.7464	IRS		✓
	2016	0.5766	0.9116	0.6325	0.6245	1.0000	0.6245	0.9233	IRS	✓	
	2015	0.8132	1.0000	0.8132	0.8494	1.0000	0.8494	0.9574	IRS	✓	
	Average	*0.6461*	*0.8448*	*0.7932*	*0.7365*	*0.8788*	*0.8538*	*0.8915*			

Table A1. *Cont.*

DMU	Year	CRS-Based			VRS-Based			SE	RTS	Major Cause of Inefficiency	
		MF(TE)	**GF**	**TGR**	**MF(PTE)**	**GF**	**TGR**			**PTE**	**SE**
Topresso	2018	0.7835	0.9340	0.8389	0.8585	1.0000	0.8585	0.9126	DRS	✓	
	2017	0.7967	0.9506	0.8382	0.8360	1.0000	0.8360	0.9531	DRS	✓	
	2016	0.6132	0.8814	0.6957	0.8622	1.0000	0.8622	0.7112	DRS		✓
	2015	0.3865	0.7461	0.5180	0.8658	1.0000	0.8658	0.4464	DRS		✓
	Average	*0.6450*	*0.8780*	*0.7227*	*0.8556*	*1.0000*	*0.8556*	*0.7558*			
YOGER-PRESSO	2018	0.7876	0.8114	0.9707	0.7927	0.8409	0.9427	0.9936	IRS	✓	
	2017	0.5717	0.5717	1.0000	0.6641	0.6816	0.9743	0.8609	DRS	✓	
	2016	0.5887	0.7848	0.7501	0.6783	1.0000	0.6783	0.8678	DRS	✓	
	2015	0.4192	0.7148	0.5864	0.6772	1.0000	0.6772	0.6190	DRS		✓
	Average	*0.5918*	*0.7207*	*0.8268*	*0.7031*	*0.8806*	*0.8181*	*0.8353*			
Zoo Coffee	2018	0.6166	0.6166	1.0000	0.6392	0.6550	0.9760	0.9645	DRS	✓	
	2017	0.6410	0.6675	0.9602	0.6460	0.7106	0.9090	0.9923	DRS	✓	
	2016	0.7189	1.0000	0.7189	0.8038	1.0000	0.8038	0.8943	IRS	✓	
	2015	0.6345	1.0000	0.6345	0.6528	1.0000	0.6528	0.9719	DRS	✓	
	Average	*0.6527*	*0.8210*	*0.8284*	*0.6855*	*0.8414*	*0.8354*	*0.9557*			

References

1. Cha, J.B.; Jo, M.N. The Effect of the Corporate Social Responsibility of Franchise Coffee Shops on Corporate Image and Behavioral Intention. *Sustainability* **2019**, *11*, 6849. [CrossRef]
2. Kim, C.; Lee, S.; Kim, S.W. Surviving in the Red Ocean: Measuring Factors for Business Excellence among Coffee Franchises in Korea. *Total Qual. Manag. Bus. Excell.* **2016**, *27*, 761–774. [CrossRef]
3. Joo, S.J.; Stoeberl, P.A.; Fitzer, K. Measuring and Benchmarking the Performance of Coffee Stores for Retail Operations. *Benchmarking Int. J.* **2009**, *16*, 741–753. [CrossRef]
4. Calderon-Monge, E.; Pastor-Sanz, I.; Huerta-Zavala, P. Economic Sustainability in Franchising: A Model to Predict Franchisor Success or Failure. *Sustainability* **2017**, *9*, 1419. [CrossRef]
5. Sveum, M.; Sykuta, M. The Effect of Franchising on Establishment Performance in the U.S. Restaurant Industry. *Cornell Hosp. Q.* **2019**, *60*, 104–115. [CrossRef]
6. Uli, L.D.; Martín, F.V.; Catalunña, F.J.R. Analysis of Efficiency of Own and Franchised Units in the Spanish Franchise System. *Eur. Res. Manag. Bus. Econ.* **2017**, *23*, 165–172.
7. Battesse, G.E.; Rao, D.S.P.; O'Donnell, C.J. A Metafrontier Production Function for Estimation of Technical Efficiencies and Technology Gaps for Firms Operating Under Different Technologies. *J. Prod. Anal.* **2004**, *21*, 91–103. [CrossRef]
8. Assaf, A.G. Accounting for Size in Efficiency Comparisons of Airports. *J. Air Transp. Manag.* **2009**, *15*, 256–258. [CrossRef]
9. Kim, H.; Lee, D.; Ryu, M.H. An Optimal Strategic Business Model for Small Businesses Using Online Platforms. *Sustainability* **2018**, *10*, 579. [CrossRef]
10. Wang, Q.; Zhou, P.; Zhao, Z.; Shen, N. Energy Efficiency and Energy Saving Potential in China: A Directional Meta-Frontier DEA Approach. *Sustainability* **2014**, *6*, 5476–5492. [CrossRef]
11. Assaf, A.G.; Barros, C.P.; Josiassen, A. Hotel efficiency: A Bootstrapped Metafrontier Approach. *Int. J. Hosp. Manag.* **2012**, *31*, 621–629. [CrossRef]
12. Tsai, W.H.; Lee, H.L.; Yang, C.H.; Huang, C.C. Input-Output Analysis for Sustainability by Using DEA Method: A Comparison Study between European and Asian Countries. *Sustainability* **2016**, *8*, 1230. [CrossRef]
13. Simar, L.; Wilson, P.W. A General Methodology for Bootstrapping in Non-Parametric Frontier Models. *J. Appl. Stat.* **2000**, *27*, 779–802. [CrossRef]
14. Simar, L.; Wilson, P.W. Estimation and Inference in Two-Stage, Semi-Parametric Models of Production Processes. *J. Econ.* **2007**, *136*, 31–64. [CrossRef]

15.　Barros, C.P.; Perrigot, R. Franchised Network Efficiency: A DEA Application to US Networks. In *Economics and Management of Networks*; Cliquet, G., Tuunanen, M., Hendrikse, G., Windsperger, J., Eds.; Contributions to Management Science; Physica-Verlag HD: Heidelberg, Germany, 2007.

16.　Botti, L.; Briec, W.; Cliquet, G. Plural forms versus franchise and company-owned systems: A DEA approach of hotel chain performance. *Omega* **2009**, *37*, 566–578. [CrossRef]

17.　Roh, E.Y.; Choi, K. Efficiency Comparison of Multiple Brands within the Same Franchise: Data Envelopment Analysis Approach. *Int. J. Hosp. Manag.* **2010**, *29*, 92–98. [CrossRef]

18.　Martin, C.J.G.; Medal-Bartual, A.; Peris-Ortiz, M. Analysis of Efficiency and Profitability of Franchise Services. *Serv. Ind. J.* **2014**, *34*, 796–810. [CrossRef]

19.　Medal-Bartual, A.; Garcia-Martina, C.-J.; Sala-Garrido, R. Efficiency Analysis of Small Franchise Enterprises through a DEA Metafrontier Model. *Serv. Ind. J.* **2012**, *32*, 2421–2434. [CrossRef]

20.　Piot-Lepetit, I.; Perrigot, R.; Cliquet, G. Impact of the Industry on Franchise Chain Efficiency: A Meta-DEA and Context-Dependent DEA Approach. *J. Oper. Res. Soc.* **2014**, *65*, 1692–1699. [CrossRef]

21.　Reynolds, D. An Exploratory Investigation of Multiunit Restaurant Productivity Assessment Using Data Envelopment Analysis. *J. Travel Tour. Mark.* **2004**, *16*, 19–26. [CrossRef]

22.　Battese, G.E.; Rao, D.S.P. Technology Gap, Efficiency and a Stochastic Metafrontier Function. *Int. J. Bus. Econ.* **2002**, *1*, 1–7.

23.　O'Donnell, C.J.; Rao, D.S.P.; Battese, G.E. Metafrontier Frameworks for the Study of Firm-Level Efficiencies and Technology Ratios. *Empir. Econ.* **2008**, *34*, 231–255. [CrossRef]

24.　Lee, Y.L.; Kuo, S.H.; Jiang, M.Y.; Li, Y. Evaluating the Performances of Taiwan's International Tourist Hotels: Applying the Directional Distance Function and Meta-Frontier Approach. *Sustainability* **2019**, *11*, 5773. [CrossRef]

25.　Badunenko, O.; Tauchmann, H. Simar and Wilson Two-Stage Efficiency Analysis for Stata. *Stata J.* **2019**, *19*, 950–988. [CrossRef]

26.　Barros, C.P.; Assaf, A.G. Bootstrapped Efficiency Measures of Oil Blocks in Angola. *Energy Policy* **2009**, *37*, 4098–4103. [CrossRef]

27.　Piot-Lepetit, I.; Perrigot, R.; Cliquet, G. Organizational Form and Efficiency of Franchise Chains. *Int. J. Retail Distrib. Manag.* **2014**, *42*, 671–684. [CrossRef]

28.　Perrigot, R.; Piot-Lepetit, I.; Cliquet, G. Plural Form and Franchise Chains Efficiency: A DEA Meta-Frontier Approach Applied to French Chains. In *Economics Working Paper Archive (University of Rennes 1 & University of Caen)*; Center for Research in Economics and Management (CREM): Caen, France, 2012.

29.　Castrogiovanni, G.J.; Justice, R.T.; Julian, S.D. Franchise Failure Rates: An Assessment of Magnitude and Influencing Factors. *J. Small Bus. Manag.* **1993**, *31*, 105–114.

30.　Holmberg, S.; Morgan, K.B. Franchise Turnover and Failure: New Research and Perspectives. *J. Bus. Ventur.* **2003**, *18*, 403–418. [CrossRef]

31.　Choi, K. Multi-Period Efficiency and Productivity Changes in US Domestic Airlines. *J. Air Transp. Manag.* **2017**, *59*, 18–25. [CrossRef]