DETERMINANTS OF A FIRM'S EFFICIENCY AND PROFITABILITY: EVIDENCE FROM THE FOOD AND BEVERAGE INDUSTRY IN THE UNITED STATES

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Abstract

The performance of a company is usually dependent on numerous external and internal factors. In this master's thesis the focus was centered around the influence of the company's size and its age on the financial performance of a corporation. More specifically, food and beverage restaurant franchises were examined for their efficiency and profitability potential. The United States was appointed as geographical focus of this research, considering the importance of the franchise sector which is expected to outperform the growth of the national GDP this year again, generating about USD 710 billion output in 2017 and contributing to the job creation with approximately 7.888.500 employments. Out of the 744.437 franchise establishments in the United States, about 30% belong to the food and beverage restaurant sector. The analysis conducted was originally undertaken for 56 food and beverage franchises quoted on the American stock exchange, during the course of which four different research questions were studied: What is the effect of age on company efficiency? What is the effect of age on company profitability? What is the effect of size on company efficiency? What is the effect of size on company profitability? Through the help of the data envelopment analysis method, the study has revealed the most efficient franchises, which include amongst others Dominos's Pizza, the Bravo Brio Restaurant Group, Dunkin Brands Group, McDonalds and Bojangles Chicken. The most profitable companies comprise of Yum Brands!, Freshii, Papa John's International, McDonalds and Popeys' Louisiana Kitchen. The subsequent linear regression analysis has been undertaken to analyze the relationship between age / size and the newly obtained relative efficiency scores and profitability percentage. The results revealed a significant positive relationship between the size of the company and profitability. A non-significant but positive relationship was concluded on in the case of efficiency and company size as well as efficiency and firm age. The correlation between age and profitability was on the other hand non-significantly negative. It is thus clear that these results call for future research on the topic.

Keywords: Firm size, Profitability, Efficiency, Super-efficiency, Food & Beverage Franchise

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List of Abbreviations

ANOVA	Analysis of variance table
BCC	Banker, Chames and Cooper
BOD	Bord of Directors
D-TEST	Durbin-Watson Test
DEA	Data envelopment analysis
DF	Degrees of Freedom
DMU	Decision making units
F&B	Food and beverage
FBI	Franchise Business Index
GUIs	Graphical user interfaces
IFA	International Franchise Association
KFC	Kentucky Fried Chicken
LBD	Learning by doing
NASDAQ	National Association of Securities Dealers Automated Quotations
NYSE	New York Stock Exchange
PPMC	Pearson Product Moment Correlation
QSR	Quick Service Restaurants
SEC	U.S. Securities Exchange Commission
SME	Small and medium size enterprises
SS	Excel Spreadsheet

Executive Summary

In 2016 there were about 732.842 franchise businesses in the United States, out of which 33% belong to the food and beverages sector alone. Having outperformed the United States GDP growth for numerous consecutive years, the franchise industry generated an output of USD 674 billion in 2016, which is projected to increase in the year 2017 by 5,3% to USD 710 billion. The GDP of the franchise sector is expected to grow in the same year to USD 426 billion from USD 405 billion the year before, which corresponds to approx. 3,0% of nominal private GDP. Last year 7.636.000 jobs were generated by franchise businesses, a number which is expected to increase by 3,3% by the end of 2017. Considering these numbers, it is surprising how little research was undertaken to understand the complexity of this sector.

This master's thesis aims to contribute to this understanding by researching the impact of a company's profitability and efficiency on two of the most important indicators when considering the financial health of a firm, namely efficiency and profitability. Subject to this research are the American franchise businesses in the food and beverage sector, quoted on the United States stock exchange in the year 2015. The sample size of 56 companies was in the focus of a two-step methodology. First, an efficiency analysis with the data envelopment analysis method (DEA) was completed in combination with the calculation of profitability related functions to determine the return on equity. This has allowed concluding on the fact that about 39% of the food and beverage companies subject to this research have reached full efficiency when being compared amongst each other. Most efficient firms include McDonalds, Dunkin Brands Group and Domino's Pizza. The profitability of analyzed companies amount to 16% on average, with a minimum value of -397% and a corrected maximum ratio of 270%. Among the most profitable outlets are by Yum Brands!, Papa John's International, Popeys' Louisiana Kitchen, Freshii and McDonalds.

The two variables mentioned above - efficiency and profitability - were then used in the second part of this study as dependent variables to perform a linear regression analysis to conclude on the results of this study, namely the association between the firm's size and age with efficiency and profitability. The results of this study have revealed a slight positive relationship between the efficiency and the size of the company as the correlation coefficient R amounts to 0,051, while the regression coefficient to 0,013. The relationship between the efficiency and age of the company shows similar results, with a slightly positive correlation of 18,7% and a regression coefficient of 0,002. It is clear that despite these non-significant results, three of the oldest companies in this master's thesis, McDonalds, Krispy Kreme Doughnuts and Yum Brands! rank among the most efficient companies. The only linear regression analysis that concluded on a negative relationship was the one performed between profitability and age with a regression coefficient of negative 0,001.

Nevertheless, the above results failed to provide significant results as the significance level p did exceed the required 0,05%. The only statistically significant results could be obtained in the case of the regression analysis between size and profitability of the company as the regression coefficient of 0,313 and the R value of 0,518 demonstrate it well. These results correspond with academic literature by Akinlo (2011), Sritharan (2015), Papadogonas (2007), Majumdar (1997), Akinyomi et al. (2013) and Doğan (2013).

The relationship of the remaining variables seems to remain subject to future empirical research, while the current research appears to deliver controversial result

1. Introduction

This master's thesis aims to first better understand a complex and powerful sector of the American economy where the concept of the food and beverage franchises was born. The following chapter starts with a few introductory remarks around the franchise concept as such to facilitate the understanding of the topic. This will be followed by outlining the current condition in the global franchise sector. The chapter continues by offering a broad overview on the current situation in the food industry in the United States, which will be followed by describing the food and beverage sector and finally by concluding with the more focused local industry view to better define the topic of the study and to facilitate the understanding of the research objectives in the subsequent chapter.

1.1. Presentation of the problem

Franchising is the oldest and most traditional form of organic growth (Cho, 2005, p. 112). Numerous studies exist that analyze the franchise model as a useful tool for minimizing business risk, others examine the efficiency and profitability of the model while some others assess transaction and agency costs that occur. Given the large number of studies undertaken for the franchising industry in various sectors, it is surprising how little attention was devoted to developing models that aim to understand the influence of the firm's lifecycle and its size on long-term success and discrepancy in performance. This paper aims to contribute to filling this gap through performing a study on this topic for the food and beverage industry in the United States. Given the fact that this area in general has great importance to the US economy as it currently represents about 3% of the entire US GDP (IHS Markit Economics, 2017, p. 2), this paper has the objective to analyze public food & beverage franchises (F&B) for their efficiency and profitability potential. Size and age will be introduced as determinants of the analyzed companies' success by aiming to conclude on a positive or negative correlation between the above-mentioned variables. Previous studies have shown contradicting results on the same topic as some have concluded on a significant positive relationship (Bahl & Gork; 1993; Akinyomi & Olagunju, 2013; Akinlo, 2011;

Coad, Segarra & Teruel, 2007; Hall & Weiss, 1967; Doğan, 2013; Hui, Jenatabadi, Jasimah, Radu, & Kasim, 2013; Nunes & Serrasqueiro, 2008) while some others resulted in a significant negative correlation (Majumdar, 1997; Fiegenbaum & Karnani, 1991) as well as non-significant relationships (Papadogonas, 2007; Dahmash, 2015).

The generally accepted assumption for aging companies is the theory of learning by doing, which suggests a positive age effect when correlated to the efficiency and profitability of the company. Age also has a positive impact on the firm's ability to better match the resources to opportunities, to leverage on a well-established network of partnerships and a larger knowledge base, as well as a proven know how - all of which lead to favorable conditions of the company (Garnsey, 1998, pp. 552-553). This theory is criticized by other scholars, highlighting the problem termed "liability of adolescence and obsolescence", implying internal inefficiency and inability to adapt to change due to the old age of the company (Hannan, 1998, p. 129).

When considering the causality between size and company performance, crucial determinants, such as economies of scale, separation of management and ownership, adaptability to market conditions and the diversification effect seem to be in favor for a positive relationship (Nunes & Serrasqueiro, 2008). The opposite argument is highlighted by the problem called "dinosaur dynamics" as the resistance to change is more characteristic for larger companies than it is for smaller ones. Hence, despite controversial results, the theory of structural inertia suggests that with the increasing size of a company, the snowball effect of the growing presence of bureaucracy and inflexibility of the structure lead to a presumably negative effect of size on company performance (Hannan & Freeman, 1984, p. 162).

As the introductory remarks above clearly demonstrate the discrepancy in opinions with regards to the relationship between age, size, profitability and efficiency of a company, the ultimate goal of this paper is to offer a clear link between these

variables and to contribute to clarifying these mixed results. In order to achieve this goal, following research questions were articulated:

RQ 1: What is the effect of age on company efficiency?
RQ 2: What is the effect of age on company profitability?
RQ 3: What is the effect of size on company efficiency?
RQ 4: What is the effect of size on company profitability?

1.2. Analysis of the current situation

1.2.1. Franchise history & definition

The first franchise dates back to the trendsetter Isaac Singer who wanted to speed up the circulation of his sawing machines in the 1850s. Companies that first followed Singer were car dealerships, gas service stations and soft drink distributors. The first boom of franchise companies was observed in the 1930s and dates back to the first modern burger franchise created by Howard Deering Johnson and Reginald Sprague. These franchise pioneers were then followed by numerous copycats, such as the well known Kentucky Fried Chicken (KFC), Dunkin Donuts, Burger King, McDonalds and many more. Since its appearance, fast food is the largest American export item and is also the fastest growing retailing sector worldwide (Dant, Grünhagen, & Windsperger, 2011, p. 253). Franchising is hence without doubt one of the most powerful tools for an ambitious entrepreneur.

The franchising relationship was best defined by the International Franchise Association (IFA), according to which franchising is merely a licensing agreement between two parties that allows for fast expansion through the use of the established brand name of the franchisor. In this contractual relationship, the franchisor provides the trade name that enables the franchisee to not only operate using that brand name but to also benefit from a comprehensive operating system, know-hows, product specifications, operating standards and support (International Franchise Association, 2017). This contractual agreement allows for the franchisee to sell the product or service subject to the agreement under the franchisor's brand,

which is limited to the region and time frame specified in the contract (Elango & Fried, 1997, p. 69).

There are two main types of franchise models that only differ in payment modality and the complexity of the relationship between two enterprises. Business-format franchising occurs when the franchisee has the right to sell products or services under the name of the franchisor in exchange of fees and royalties, such as the model used by Dunkin Donuts or McDonalds. This is the most widespread type of franchise as it offers the franchisee to use the entire concept provided by the franchisor. In this case, the franchisee agrees to strictly follow the operations manual provided by the franchisor and to pay franchise fees and / or royalties. Product / trademark franchising exists when the franchisors grants the right to market the products manufactured by the franchisor. In this case, the franchisee receives a preferred status for dealing with the given goods in exchange for an agreed percentage on gross sales. This model applies to car dealerships (e.g. GM dealership) or the sales of soft drinks or snacks (e.g. PepsiCo) (Dant, Grünhagen, & Windsperger, 2011, p. 253). The term is not to be confused with monopoly franchising that implies exclusive rights to selling a certain product, usually granted by local authorities (Elango & Fried, 1997, p. 69). The latter is not identified as a separate category within the franchise definition and hence will not be further elaborated on. A third franchise model that is less widespread is termed conversion franchising. In this model, franchisors simply buy existing units and convert or rebrand these under their own trademark (Hoffman & Preble, 2003, p. 188).

1.2.2. Franchise vs. ownership

The most debated question in franchising is whether companies should aim for a franchise model when expanding or if they should rather do so through company owned units (Elango & Fried, 1997, p. 70). It has been widely accepted by numerous studies that entrepreneurs striving for an efficient and profitable organization, the franchise system should be taken into consideration instead of an ownership system. As pointed out by Shelton in 1967 after having examined 22 different cases between franchised vs. company owned outlets, in 19 of these cases the franchised outlets were more profitable than company owned restaurants. The profit margin reached almost 10% in the case of the franchised companies, while the same indicator was just below 2% for company owned units (Shelton, 1967, p. 1252). Although scholars do not completely agree whether franchising or owning is a better form for an enterprise, the arguments against company ownership outlined below seem to overshadow the concept and benefit the franchise system.

One point against company ownership is that it does not allow for a fast growth as opposed to franchised outlets. Through the fees and royalties paid by the franchisees, company level expansion is accelerated. Secondly, as the owners of the franchised companies also serve as managers, these aim to maximize output created by the outlets. Hence, the franchisor can be sure that managers will reach the best profits possible in a certain situation, which would not necessarily apply in the case of ownership companies. In the latter situation, managers of the outlet are merely employees with no interest in the financial behavior of the company, as their salaries are not incentivized (Combs & Ketchen, 1992, p. 197). Another argument for franchise-operated outlets is the fact that company owned outlets tend to pay higher wages to their employees than it is the case for franchised outlets. Thus, labor costs for franchised outlets do tend to be lower (Krueger, 1990). Furthermore, it seems that employee supervision is managed more efficiently in the case of franchised outlets as pointed out by Kruger (1990, p. 7). In his study on the same topic, 45% of employees have answered positively on the question

weather their managers provide appropriate supervision to them. The same question was only answered by 33% of the employees in the case of company owned outlets positively (Krueger, 1990, p. 7). It has also been concluded that for a franchised outlet the chances for an employee of escaping his tasks or not dutifully fulfilling these is lower when compared to a company-owned outlet. As monitoring of the employees is facilitated by the franchisor, the chance of theft or fulfilling unapproved duties during working hours is lower which thus serves as an advantage for franchised outlets (Krueger, 1990, p. 11). It has also been concluded that due to better resource utilization of franchises, these are better able to select employees with higher predicted productivity and lower turnover rates. As recruiting and training new employees is rather costly, high productivity and low turnover are keys to minimize labor costs. In order for company owned stores to compensate for these shortcomings, they might be prone to pay higher compensation to employees, a fact which is connected to higher costs of course (Krueger, 1990, p. 13). After having examined 7.000 workers in 273 fast food restaurants, the study by Krueger (1990, p. 16) highlighted this aspect by showing that on average the assistants' and shift's managers hourly wage was by 10% higher at company owned outlets than it was the case for franchised outlets. A similar tendency was observed among the crew workers as well, whose wage in a company owned outlet was about 1% higher than the ones working in a franchised outlet.

On the other hand, there are some negative aspects to the franchising concept as well. As the franchisor is limited in its freedom to choose a business partner and thus cannot engage in partnerships, all the risk is centralized in his hand and consequently, franchisees might require a higher return due to higher perceived risk, leading to reducing the profit for the franchisor. The other problem of a franchised outlet is the so-called "free-riding" phenomena. If the franchisee is located in an area with low proportion on repeat customers they do not have to ensure consistently high quality. Thus the franchisee might offer poor standards reflecting in a negative way on the franchisor. This problem evokes another related issue with regards to potentially failing to fulfill the franchisee's obligation for

continuous product improvement, required advertising and technological advances, evoking distaste for the franchise concept (Krueger, 1990, p. 8).

1.2.3. Reasons to franchise

The franchise model offers numerous advantages specifically for small and young entrepreneurs. Many new companies may not have enough internal resources to fuel rapid growth needed to maintain a healthy company. Franchising agreements speed up this growth through economies of scale (Combs & Ketchen, 2003, p. 445) and eliminate the need to raise scarce financial resources (Martin R. E., 1988, p. 954) in the early stage of the business. However, once franchisors become more liquid they can start buying back franchised units from franchisees, which serves as another advantage due to the flexibility of the model. Franchises thus often follow this path. This trend was first described by Oxenfelt & Kelly as the “lifecycle model” (Oxenfeldt, Mired R.; Kelly, Anthony O., 1968, p. 69). Later Carney and Gedajlovich have refined this concept by proposing minor adjustments, which since then became widely known as the “resource scarcity” theory (1991, p. 608). Additionally, when in need of further financial resources, the franchise concept offers diversification for the investors as they not only invest in a single outlet but into an entire chain (Combs & Ketchen, 1992, p. 196).

A second reason for franchising is highlighted by the agency theory introduced by Brickley (1987, p. 402). According to this model, managers work better in case of a variable compensation typical for franchise companies, it necessitates lower initial costs and due to the consistency offered, franchised outlets do imply a higher number of repeat customers. This means that managers of single unit or company owned outlets will aim to fulfill their own interest rather than keeping the one of the owner in consideration due to the predominantly self-interest character of managers (Hoover, Combs, & Ketchen Jr., 2003, p. 9). The latter was further reinforced by Thomas, O’Hara and Musgrave (1990, p. 54) demonstrating its continued relevance. As Fred Turner, former President & CEO of McDonalds has pointed out: “Running a McDonalds is a three-hundred-sixty-three-days-a-year business with an owner operator, with his personal interests and incentives, can

inherently do a better business than a chain manager" (Krueger, 1990, p. 6). In addition to these advantages, the franchise model also allows for the franchisor to shift geographic risk to the local franchisee without additional effort. The latter is aware of the local circumstances and is also familiar with all specificities in a given country allowing hence the franchisor to minimize risks implied by global expansion (Martin R. E., 1988, p. 955). And lastly, franchises do not only offer great benefits to the two contractual parties, but also to third parties. Researchers argue that franchise has the power to shape society by improving economic efficiency. Franchises constantly strive to develop long lasting relationships with their suppliers offering thus a strong chance for survival even in harder economic times (Elango & Fried, 1997, p. 70).

1.2.4. Franchise worldwide

Although Franchise is an American invention, it seems to have spread all over the world by now. It has been very helpful in boosting economies in numerous non-American countries, creating additional jobs and making the American brands accessible worldwide. Nowadays there are franchises available in about 300 different sectors, such as food and beverage, healthcare, hotels, financial and IT services and many more. With regards to the company distribution per sector, the below figure shows the allocation of the franchise companies within each sector on a global scale, where it is clearly visible that the fast food is dominating the franchise sector with 19% of the top ranking franchises belonging to this category. The fast food segment is followed by cleaning, restaurants, food and drink and automotive. The below figure also shows that 8 of the globally top 10 ranked franchises were formed in the United States and that half of these companies belong to the fast food industry further highlighting its importance. The largest franchisor worldwide is 7-Eleven with 55.801 outlets followed by Subway with 43.154 stores and by McDonalds with 36.258 restaurants. The figure also shows that 76% of the largest franchises originate in the United States, 6% in France, 4% in Canada and the same percentage in the UK followed by Germany, Sweden and Japan with 2%, 1% and 1% respectively. The most important franchises outside of the United States is Spar in the convenience store industry, Bata representing the

footwear sector, Benetton and the LFC Club belonging to the educational segment (Raconteur, 2016).

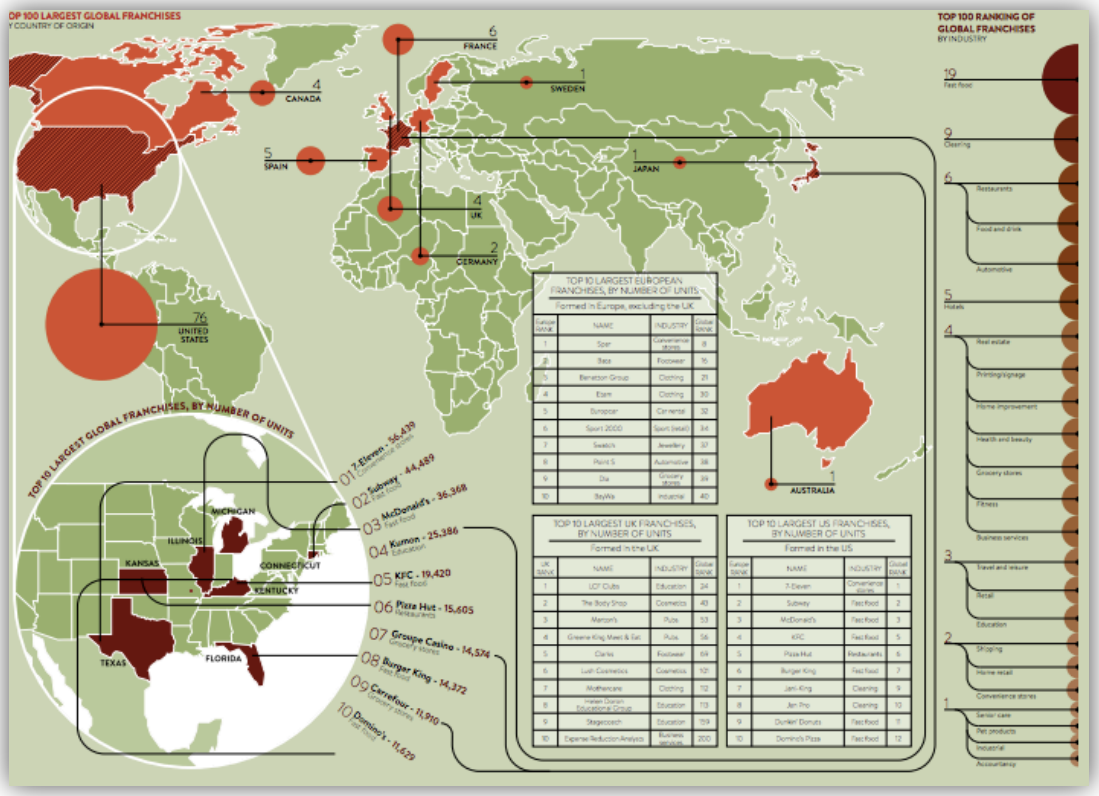

Figure 1: Global franchises

Source: Raconteur Media Ltd.

The worldwide trend for franchisees is to typically operate small and medium size enterprises (SMEs) with a maximum of 30 employees. Globally there are about 1.300 different companies listed under the umbrella of the International Franchise Association (IFA) with about 12.000 members (International Trade Administration, 2016, pp. 5-8). The franchise industry generates about USD 2 trillion revenues every year worldwide (Creative Colors International, 2017) and about 38 % of the largest US headquartered franchises are located in the rest of the world, signifying the importance of the franchise industry worldwide. Generally, it can be concluded that the 200 largest U.S. franchise companies have added four international outlets for one domestic outlet from 2012 – 2015. As can be seen on figure 2 below, it is clear that McDonalds has already about 50% more locations internationally than it has domestically, while the same statistic for 7-Eleven is at about 6 times as many,

and KFC has about four times as many international outlets compared to the domestic ones (International Trade Administration, 2016, pp. 5-8).

The below figure demonstrates the employment distribution per sector highlighting the importance of the food and beverage industry, which in 2016 has generated more than 50% of global franchise employment. This industry is followed by the services sector being accountable for about 1/3 of total employment, while lodging contributes to the same figure by 8%, the real estate & automotive concludes the statistic with only 6% (IHS Markit Economics, 2016).

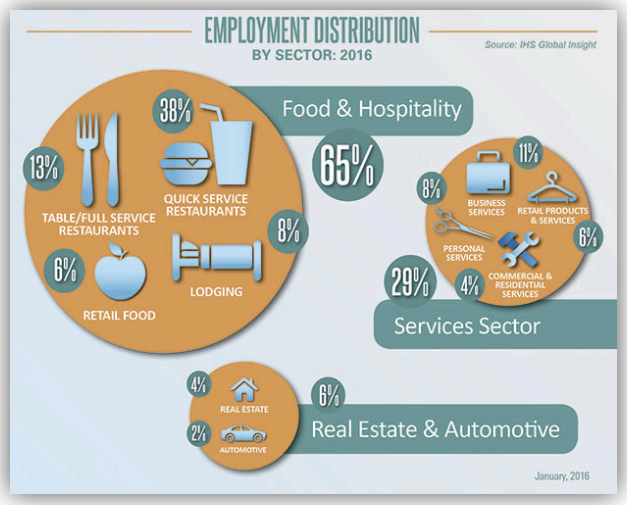

Figure 2: Employment distribution by sector

Source: IHS Markit Economics, 2016

The general ranking for the most important franchise markets has been established based on various key factors. These include a transparent regulatory framework, the capacity for talent development in a given country, stability of the currency, IT and transportation infrastructure, potential market size determining demand together with the middle class who posses the required disposable income and the industry input. Based on the above, the Unites States has been recognized as the global leader for franchise companies being the home to the most famous brands worldwide (International Trade Administration, 2016, pp. 5-7), followed by the most important output market Canada, where franchise companies contribute with approximately 10% to the GDP. The most important sector for the Canadian

franchise market is the retail sales sector, where about 45% of sales are generated by franchisees. Canada is followed by Australia, where the density of franchising outlets is worldwide the highest with about 1.100 outlets in the country, mainly present in the retail, lodging and food services industry. A strong specificity of this country is the domination by local franchisees as about 95% of all outlets are domestic. The third most important franchise market outside of the U.S. is China, where there are about 4.500 outlets having generated about 5 million jobs and total sales of about USD 66 billion. Almost 40% of all franchise operations in China are attributed to F&B and retail outlets (International Trade Administration, 2016, pp. 15-22). Following markets will be shown on the figure below, summarizing the 10 most important markets for franchising following the USA:

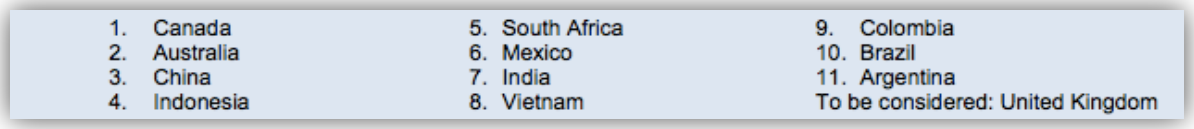

Figure 3: Projected franchise markets

Source: International Trade Administration, 2016, p. 6

On the other hand, there are numerous challenges for a franchise company before becoming an international venture. The first problem is posed by strict and tedious governmental regulations, which leads to long registration processes, sometimes even taking a few years. A further problem arises from the fact that occasionally American companies are required to create joint ventures with local companies to leverage on the local expertise, which in some cases has proven to be counterproductive as this does not always lead to successful partnerships. Thirdly, local products sometimes do not meet standards as required by the franchisor, which in some cases can prove to be an unbreakable hurdle. Another problem can arise from the devaluation of the local currency for which American franchises have to be properly hedged against. And lastly the evaluation of qualified investors might turn out to be challenge in these foreign markets (International Trade Administration, 2016, p. 9).

1.2.5. Franchise in the United States

The franchise sector in the United States has outperformed the country's GDP in terms of growth for the year 2016 and is expected to continue this tendency. In 2016 there were 732.842 franchise businesses, which represents a 1,7% increase compared to 2015. For the year 2017 an increase of 1,6% is forecasted that will result in a total of 744.437 outlets as specified by the United States Census Bureau, compiled by the leading economic analysis & forecast company, IHS Markit. In 2016 about 7.636.000 people were employed by a franchise company, which produced an output of USD 674 billion and a GDP contribution of USD 405 billion, which represents about 3,0% of total private US GDP. Employment by franchise companies is also on the rising side; in 2016 it showed an increase of 3,5% compared to the previous year. In 2016, output per employee is also increasing on average, amounting to USD 88.306 per worker, which represents an increase of 2,2% compared to the year 2015 (IHS Markit Economics, 2017, p. 23). The below table summarizes the growth from 2014 until 2017 per year for the most important data as outlined above. It is clearly visible that the forecasted growth will be a little under the one observed in 2016 in all four categories, which is only due to minor fluctuations. As shown on figure 4, the number of franchise establishments is constantly growing since 2014 by just under 2,0% per year. This upward trend is mainly due to favorable interest rates, positive regulatory framework and the proposed tax cuts planned for 2018 (IHS Markit Economics, 2017, p. 7). Employment is also on the growing side with an average of about 3,0% p.a. The output and GDP contribution is closely related to the increasing number of establishments and as these are growing more than double as fast per year on average as the number of establishments, the significance of the franchise business is also on the growing side (IHS Markit Economics, 2017, p. 2). The output reflects the increase in consumer spending which is currently at about 2,5% – 3.0% and is also boosted by the increased real disposable income which in 2017 has shown an increase of 2,7% and thus a higher household net worth (IHS Markit Economics, 2017, p. 7).

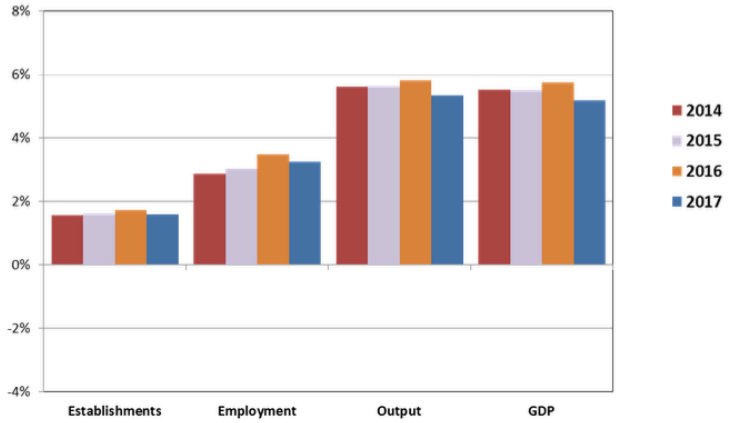

Figure 4: Franchise business growth by year, 2014-2017

Source: IHS Markit Economics, US Census

All the above components contribute to a constantly rising Franchise Business Index (FBI), which describes the franchise activity on a monthly basis. The index compiles information with regards to employment in the franchise industry, unemployment, number of self-employed members and numerous other critical factors related to the general business environment in which a franchise operates. Figure 5 demonstrates the growth of the FBI, showing that it has been on the growing side in the past months, by an approximate growth of an average of 0,4% per month. For the year 2016 the index has increased by about 2,7%, which is mainly due to retail sales and favorable macroeconomic conditions, such as the low rates for receiving a credit (IHS Markit Economics, 2017, pp. 3-4).

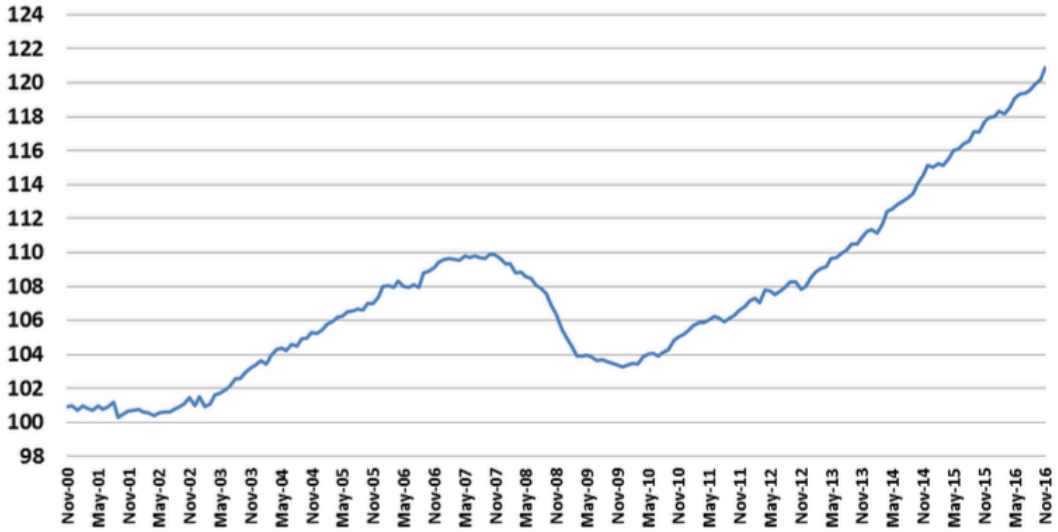

Figure 5: Franchise Business Index

Source: IHS Markit Economics, 2017

The below figure shows the distribution of franchise establishments in the United States by industry in 2015 (Franchise Direct, 2015). Clearly, food related outlets are in the forefront similarly to the global trend, followed by personal services representing about 15% total franchise establishments. The third place was taken by retail products and services, immediately followed by real estate and business services.

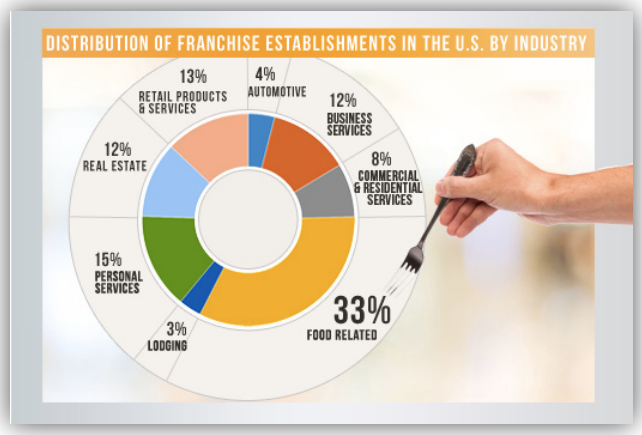

Figure 6: Distribution of franchise establishments in the U.S. by industry

Source: Franchise Direct, 2015

The below table shows the most important franchise companies industry-wide in the United States. It is clear from the below that McDonald's is domestically the most important franchisor, followed by 7-Eleven on second place and KFC ranking as third. The important position of the food and beverage (industry: restaurant) is clearly visible, 6 out of the top 10 franchise companies, more than half belong to this category. Among the top 10 franchisors, 2 retail companies have been listed, 1 lodging company and 1 present in the automotive industry. The international presence shown under the column "total location" is further highlighted, as mentioned above (International Trade Administration, 2016, p. 8).

		Company	Industry	Sales	U.S. Locations	Total Locations
1		McDonald's *Oak Brook, IL*	Restaurant	$87.78 B	14,344	36,258
2		7-Eleven *Dallas, TX*	Retail	$84.50 B	7,836	55,801
3		KFC *Louisville, KY*	Restaurant	$23.40 B	4,391	19,420
4		Subway *Milford, CT*	Restaurant	$18.20 B	26,958	43,154
5		Burger King *Oakville, ON*	Restaurant	$17.01 B	7,126	14,372
6		Ace Hardware *Oak Brook, IL*	Retail	$14.29 B	4,251	4,794
7		Hertz *Naples, NJ*	Automotive	$14.20 B	5,760	11,230
8		Pizza Hut *Plano, TX*	Restaurant	$12.20 B	7,908	15,605
9		Marriot Hotels & Resorts *Washington, DC*	Hotel/Travel	$9.60 B	347	578
10		Wendy's *Dublin, OH*	Restaurant	$9.30 B	5,750	6,515

Figure 7: Leading U.S. franchise firms

Source: International Trade Administration, 2016, p. 8

1.2.6. Franchise in the food and beverage industry

Franchising in the fast food industry works very similar to the generally accepted principles of franchise: the parent company gives the franchisor the permission to operate a standardized F&B outlet while pertaining to certain generally accepted rules and regulations for a “fixed fee and monthly royalties on gross sales (typically 8%)” (Krueger, 1990, p. 4). The total costs usually range between USD 400.000 – USD 600.000. The total pre-tax income is usually dependent on the type of franchise chosen. The below figure summarizes the pre-tax income based on the type of the concept after having looked at 3.396 franchises. From the below it is clear that the top three types of fast food are currently Mexican, full service restaurants and Burgers (Franchise Business Review, 2016, p. 12).

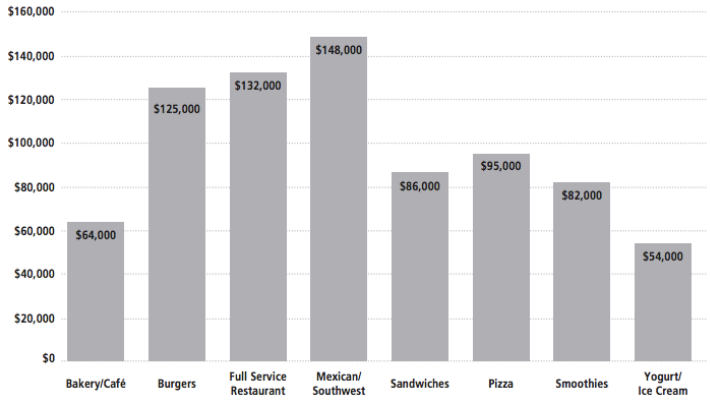

Figure 8: Average pre-tax income by concept type

Source: Franchise Business Review, 2016, p. 12

It is typical for the F&B franchises that the franchisee plays an active role in day-to-day operations, as it is for example the case of McDonalds, where every new franchisee has to go through a major training program lasting about 9 – 18 month to ensure the quality and consistency of all franchises worldwide (McDonalds, 2017). The franchisees usually have to undergo an online application process, where they can also choose their preferred location, which the franchisor has the right to veto. After the expiration of the regular franchise duration of 20 years, the franchise contract is renewed, sold or given back to the franchisee (Krueger, 1990, p. 4).

Four main trends were identified for the future of the fast food industry. Firstly, it seems that the demand for breakfast will be on the growing side until 2019, adding about 5% on demand. Secondly, more and more budget conscious customers favor meal-deals, a growingly strong trend that McDonalds, Burger Kings and Wendy's have already successfully accommodated. Thirdly, the growing demand for customized fast food products seems to be on the growing side the most for the case of pizza. Sales of the custom-made Italian specialty are growing by 22% on average per annum. The phenomenon "snacking" is about to cause a large boom among fast food suppliers as in 2015 about 18% of the products sold were related to a lighter and smaller snack alternative to fast food. Together with this new feel and trend for fast food restaurants, many franchisees seem to adapt fresher, more

international and cooler designs to appeal to younger customers and to broaden their horizon effectively (Sena, 2017).

1.2.7. Food & beverage restaurant franchise in the United States

One of the fastest growing industry segments within franchise is still the food and beverage sector. The three main food related franchises – full service restaurants, quick service restaurants (identical to the term fast food) and retail food – make up about 33% of all franchise outlets in the United States (Franchise Direct, 2017). There will be 190.494 quick service restaurants (QSR) in 2017, according to the forecast, up about 1,9% compared to the previous year. Table / full service restaurants also take the second place in terms of establishment growth with a 1.9% compared to 2016. The third member of the food related franchise, retail food is only expected to grow their number of outlets by 1,3%. The below table shows a comparison among the ten main franchising sectors when compared to quick service and full service restaurants. It is clear that the largest growing industry in terms of establishment growth, personal services, has outperformed both quick service restaurants and full service restaurants. However, when considering the output of these same fast food restaurants these are forecasted to increase by 6,7% in 2017, somewhat higher than the increase for personal services at 6,1%. The full service restaurants have the fastest growing forecast in terms of output at 6,8%. In terms of increase in employment, fast food restaurants have grasped the first place with an increase in employment of 4,0%, closely followed by full service restaurants and by personal services taking the third place (IHS Markit Economics, 2017, p. 3).

	Establishments		Employment (thousands)		Output ($Billions)	
	Amount	*Percent Change Over Previous Year*	Amount	*Percent Change Over Previous Year*	Amount	*Percent Change Over Previous Year*
Automotive	37,603	*1.3%*	196	*2.6%*	41.2	*3.8%*
Business Services	106,772	*1.5%*	643	*2.4%*	96.4	*4.1%*
Commercial & Residential Services	65,072	*0.4%*	245	*0.4%*	42.6	*0.9%*
Lodging	28,029	*1.1%*	620	*1.3%*	71.1	*4.9%*
Personal Services	109,223	*2.3%*	484	*3.6%*	35.0	*6.1%*
Quick Service Restaurants	190,494	*1.9%*	3,610	*4.0%*	237.6	*6.7%*
Real Estate	62,424	*1.3%*	247	*1.6%*	49.9	*4.6%*
Retail Food	52,891	*1.2%*	470	*2.7%*	37.9	*4.1%*
Retail Products & Services	60,453	*1.7%*	346	*3.2%*	30.7	*5.5%*
Table/Full Service Restaurants	31,476	*1.9%*	1,025	*3.9%*	67.5	*6.8%*
TOTAL	744,437	*1.6%*	7,885	*3.3%*	709.9	*5.3%*

Figure 9: Franchise business economic outlook 2017

Source: IHS Markit Economics, US Census

The below figure shows a contrast for sales growth for quick service restaurants in comparison to their full service counterparts. Sales for quick service restaurants grew by 6,7% in the year 2016, at a somewhat slower pace than in the previous year, while the full service restaurants seem to have outperformed fast food outlets in terms of growth in 2014 – 2015 and 2017, but not in 2016. This growth is mainly attributed to higher wages and better employment conditions (IHS Markit Economics, 2017, p. 12).

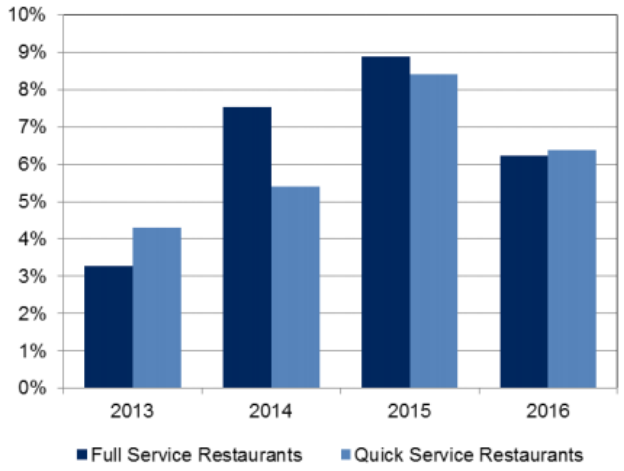

Figure 10: Industry-wide restaurant sales growth

Source: IHS Markit Economics, US Census

In terms of dollar amount output, QSR is expected to amount to USD 237,60 billion in 2017, about 33% of total franchise sector output, while full service restaurants to about only 10%. In terms of productivity, output per employee is however on the lowest side for fast food restaurants in comparison at only USD 65,81 per worker, which represents a modest increase of 2,8%, compared to the previous year. The same value is in the case of the full service restaurants at USD 65,85, which is only slightly higher (IHS Markit Economics, 2017, pp. 20-22).

Employment within the quick service restaurant sector has shown a growth of 4,2% in the year 2016 with a total of 3.609.503 persons employed. Thus 26% of all franchise establishments accounting for about 46% of total franchise industry employment, which is visualized on the figure below. The second spot is taken by full service restaurants generating about 13% of total franchise employment

followed by the personal services group accounting for only 6% of jobs created (IHS Markit Economics, 2017, p. 19).

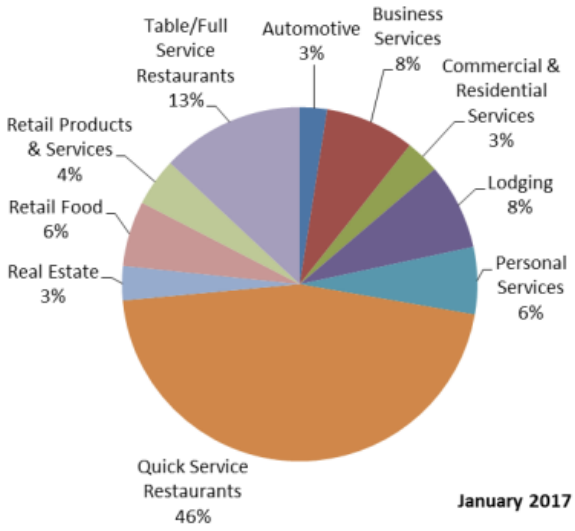

Figure 11 : Employment distribution by sector

Source: IHS Markit Economics, US Census

In terms of growth as distributed to the various states in the US, it can be concluded that the states located in the south or the west benefit the most from output and employment growth, which is mainly due to domestic migration initiated by above average housing affordability. This increased population is then the reason for increased outputs in the states with highest output growth rates, such as Utah, Arizona or Colorado. The main reason for growth in the states Nevada and Florida is attributed to tourism consistently generating strong demand for both food and lodging related franchises. The below table summarizes the growth per output state showing the largest growth in Nevada with 7,4%, followed closely by Utah, which is up 7,3% and by Florida with 6,6% (IHS Markit Economics, 2017, p. 24).

Top 10 States for Franchise Growth: 2017				
Employment	Growth		Output	Growth
Arizona	4.7%		Nevada	7.4%
Utah	4.6%		Utah	7.3%
Nevada	4.4%		Florida	6.6%
Florida	4.1%		Arizona	6.4%
Colorado	4.1%		Colorado	6.3%
South Carolina	4.0%		Virginia	6.1%
North Carolina	3.8%		Texas	6.1%
Georgia	3.8%		South Dakota	6.1%
Tennessee	3.8%		South Carolina	5.9%
Texas	3.6%		North Carolina	5.8%

Figure 12: Top 10 states for franchise growth 2017

Source: IHS Markit Economics, US Census

This master's thesis will be structured as follows: in the next chapter the structure of this paper and the research objectives will be described in detail. Then the paper will already introduce the empirical analysis in chapter 3. This is divided into the methodology section, which will introduce both research methods used in this paper, namely the data envelopment analysis and the linear regression model. This will be followed by presenting the research results in the same chapter and by interpreting these with regards to the four hypotheses tested. In chapter 4, the paper will conclude on the results obtained. Lastly, the paper will describe implementations, suggestions and limitations.

1.3. Research structure

During this master's thesis, the theory establishes the general framework for the research and highlights the relevance of the topic. It provides an overview of the subject and specifies the context for the subsequent research to prepare the reader for the empirical analysis. The empirical part of this paper will introduce the methodology and the type of data studied. The empirical analysis is divided into two different parts. In the first part, franchises will be analyzed for relative efficiency and profitability in terms of resource management. The study used as benchmark for the first part of this paper is the study by Garcia Martin, Medal-Bartual, & Ortiz from 2014 that studies the efficiency and profitability of Spanish franchise concepts through the widely accepted Data Envelopment Analysis Method (DEA), which will be described at a later stage (Garcia Martin, Medal Bartual, & Peris-Ortiz, 2014). To conclude on relative efficiency, input and output variables used for the analysis must be determined. During the analysis various models will be presented that aim to analyze relative and super-efficiency of franchise enterprises. The tool super-efficiency will be utilized to facilitate a clear ranking of F&B franchises. To measure profitability, the return on equity for each of the companies will be determined. This will be done using the classical formula for computing profitability with the aid of earnings before interest and tax and the total owner's equity. Companies will be ranked according to their ROE. In the second part of this thesis, the influence of size and age on efficiency and profitability will be concluded on. The study used as benchmark for the second part of this paper was written by Ilaboya & Ohiokha (2016) on "Firm Age, Size and Profitability Dynamics". In this part the results from earlier will be leveraged on to perform a linear regression analysis, using the logarithm of size and age as independent variables, while the logarithm of efficiency and profitability will be utilized as dependent variables.

1.3.1. Data used for the analysis

Companies analyzed were chosen based on the annual report of the American franchise association and through America's Number 1 Franchise Directory that includes a complete list of all franchises registered in the United States. Appendix 7.2. shows a complete list of F&B franchise concepts that are established on the American market. The list was taken over from the annually appearing Food & Beverage franchise directory of 2015 (Food & Beverage Franchise Directory, 2015). The chosen American franchises have already been narrowed down to only publicly quoted companies to ensure correctness of data. Due to this criteria an additional resource, the homepage "Invest Snips" was used, which summarizes all public companies within a certain sector (InvestSnips, 2017). The data chosen for this study originates from the annual reports submitted by all public companies in the United States. The Form 10K is the document through which companies are obliged to disclose all financial information related to a given fiscal year. Quarterly reports or current reports were not utilized. The main database to collect annual reports is the official homepage of the Exchange and Securities Commission in the United States, also referred to as SEC (U.S. Exchange and Securities Commission, 2017). All data used is from the latest financial year where complete reports exist, from 2015, unless mentioned otherwise. Thus all efficiency and profitability related figures were calculated by the researcher.

1.3.1.1. Efficiency

Efficiency is defined as an equation of following input variables: tangible fixed assets, intangible assets, total volume of own resources, total liabilities, labor costs and following output variables: total operating sales, total operating results. The variables will be described below in detail.

1.3.1.2. Profitability

Profitability will be determined through the return on equity (ROE), which will be calculated through the quotient of returns before interests and taxes and own resources.

1.3.1.3. Company age

Similarly to the study by Garcia Martin, Medal-Bartual, & Ortiz from 2014, age is measured through the difference between the current year and year of inauguration of the firm (Garcia Martin, Medal Bartual, & Peris-Ortiz, 2014).

1.3.1.4. Company size

Similarly to above, for the variable company size, the number of worldwide outlets will be used. The alternative method for measuring company size – the number of employees - was an inappropriate measurement as this data was either not available or only partially available.

1.4. Formulation of the objectives / research question

This paper aims to conclude whether the economies of scale and the current lifecycle of a company have an effect on its profitability and efficiency. The paper is structured into two coherent sections. In the first part of this paper, American F&B franchise companies will be ranked according to their relative efficiency when compared amongst each other. The same companies will be analyzed for their profitability potential to examine whether return on investment (ROE) and efficiency can be used as interchangeable terms. In the second part of the empirical analysis, the correlation between efficiency and profit to company age and size will be computed to prove the relationship between these variables. The ultimate goal of this master's thesis is to conclude whether the size of the company and its age prove to have an effect on its profitability and efficiency. To reach this goal, the study of Garcia Martin, Medal-Bartual, & Ortiz from 2014 will be taken as a benchmark, where "the relative efficiency of franchise services" is analyzed to conclude on the "relationship between efficiency and profit" (Garcia Martin, Medal Bartual, & Peris-Ortiz, 2014). The second study that will be utilized to conclude on the correlation between size and age in the second part of the study is the study performed by Ilaboya & Ohiokha (2016) on "Firm Age, Size and Profitability Dynamics". The research questions were articulated as a synthesis of the two articles and similarly to the study of Ilaboya & Ohiokha will be formulated along the four most important topics of this master's thesis. These are outlined in detail as follows.

1.4.1. Hypothesis 1 - Firm age & efficiency

There is one generally accepted principle with regards to the firm age: once a company gets older and evolves into a non-favorable direction due to its age, the owners or the board of directors (BOD) have the opportunity to restructure, learn & develop, invest into training their human capital, etc. Hence a company would rather mature and evolve into a positive direction rather than "age" due to the reasons above. Numerous scholars support the most prevailing theory around the relationship between firm age and efficiency, the learning by doing effect (LBD), which would also imply a positive relationship (Bhak & Gort, 1993, pp. 561-570). Nevertheless, findings have concluded on both positive and negative relationship between firm age and efficiency. For example Coad et al. (2007) have found in their research about Spanish manufacturing firms that company's performance declines with age as older firms experience a slower growth rate and hence a more moderate increase in revenues as well. The very same study has also found that in some cases performance improves with age due to "lower debt ratios and higher equity ratios", demonstrating the contradiction around this topic very well. Bahk et al. (1993) highlight in their study of 2.150 plants in the manufacturing sector a positive relationship between age and efficiency due to the famous learning by doing effect mentioned above. Jovanovic also argues in his paper that with time firms should go through an upward facing learning curve and that they should be able to find out what they are good at which would hence imply a positive relationship between these two variables (1982, pp. 649-653). Baker et al. also argue that companies who can adapt to change, new technologies and trends will be able to survive and others who do not, will die. Thus they note that with age, those companies who manage to reach a certain stage will be able to use their resources more efficiently through reallocation of corresponding resources (2002, p. 27). Due to the inconsistency in the results presented above, the research question aims the shed light on these discrepancies and will thus be articulated as follows:

RQ1: What is the effect of age on company efficiency? The null hypothesis describes a non-significant relationship between these two variables (RH1).

1.4.2. Hypothesis 2 - Firm age & profitability

The relationship of the two variables firm age and profitability has also been widely analyzed, some scholars could conclude on a significant relationship while some failed to do so, again resulting in a controversial view on this relationship. Papadogonas (2007, p. 1) has examined the effect between firm age and profitability in the Greek financial sector and has concluded on a non-significant relationship between these two variables. A study including 1.020 Indian firms by Majumdar (1997, p. 231) shows a negative relationship between age and profitability mainly resulting from the country-specific market-restricting policies in India. Thus Majumdar implies a general limitation to studying the relationship between age and performance stating that this might be due to country specific institutional factors and thus results from a certain study cannot be taken as a benchmark for the analysis of other countries (Majumdar, 1997, p. 240). The research undertaken by Loderer et al has analyzed 10.930 companies between 1978 and 2004. In their study they also conclude on a negative relationship between these two variables independently from the sector in which the company operates in or the actual time period subject to the study. The explanation for this phenomenon seems to be found in the rigidities and inflexible process structure induced by age once a firm matures. They also point out that older companies in their inability to adapt to changes result in having higher costs and lower growth rates. The latter is due to the fact that financial instruments are limited as thus companies struggle to reach a break-even point with every additional unit produced. This leads to the marginal product to decline, which directly corresponds to the growth rate (Loderer & Waelchli, 2010, pp. 4-5). Campa et al. also argue in their paper analyzing the diversification factor of companies between 1978 and 1996 for a negative relationship between age and profitability, mainly due to the fact that markets reach a maturation point as companies age and they might be forced to enter other markets that they are not necessarily qualified to do so or lack the resources, thus leading to this diversification effect occurring with age negatively influencing profitability (Campa & Kedia, 2002, p. 1731). Another argument for a negative relationship is to be found in the declining uncertainty of owners / investors as the company matures (James & Wier, 1990, p. 149). Thus owners

require a lower rate of return to be in line with the perceived risk, which also drives down the profitability of the company. The opposite side however argues for a positive relationship. Coad et al, after having examined firms in the Spanish manufacturing segment between 1998 and 2006 have documented that older companies benefit from the experience they have accumulated during long years of operations, which thus implies a positive impact of age on profitability (Coad, Segarra, & Teruel, 2007, p. 1). Jovanovic also suggests a natural selection implying that only companies who are profitable enough to reach an older stage will be able to survive and thus being forced to exit the market at a certain stage implies unprofitable companies being naturally removed (Jovanovic, 1982, p. 649). Given the uncertain empirical evidence concerning the relationship between age and profitability, the following research question is proposed to further elaborate on the topic:

RQ2: What is the effect of age on company profitability? The null hypothesis describes a non-significant relationship between these two variables (RH2).

1.4.3. Hypothesis 3 - Firm size & efficiency

The prevailing theory behind the correlation of firm size and efficiency is the “model of firm growth” presented by Jovanovic in 1982 (pp. 649-651), which has documented that the larger a company, the more efficient it becomes. The same scale economies effect was highlighted by Lundvall et al. (2000, p. 160) who have concluded on a significant positive relationship between firm size and efficiency after having examined 235 Kenyan manufacturing firms. The study undertaken by Hui et al. (2013, p. 171) on 168 manufacturing companies for the food industry in China, Taiwan and Malaysia aims to highlight this theory as well. In their research they conclude on a positive relationship between firm size and efficiency due to the prevailing collectivism effect in larger companies. The same causality is highlighted by Nunes & Serrasqueiro (2008, p. 195), who reason the outcome of their research somewhat differently. They attribute this relationship to the opportunity of diversification, the well-known scale effect and the capability to adapt and react to rapid changes on the market. They also argue that larger companies can react to the increasing competition in a better and faster manner, and that these tend to separate ownership and management which is not the case for smaller companies, which also seems to have a beneficial effect on efficiency. However, Fiegenbaum & Karnani (1991, p. 102) conclude on a negative relationship between firm size and efficiency: the smaller the company, the more efficient it is. Their study on 3.000 companies in 83 industries support this circumstance, mainly due to the fact that smaller companies are willing to give up a certain quantity on output if producing this does not prove to be efficient. This leads to higher cost efficiencies by allowing for flexibility in volume thus leading to better input / output ratios. As the theories suggest mixed results, the following research question has evolved to understand the relationship between size and efficiency of the firm:

RQ3: What is the effect of size on company efficiency? The null hypothesis describes a non-significant relationship between these two variables (RH3).

1.4.4. Hypothesis 4 - Firm size & profitability

Numerous studies have examined the relationship between firm size and profitability with rather contradictory results. These results can mainly be categorized into three general groups: empirical research with both positive and negative significant results as well as non-significant conclusions. Akinyomi et al. (2013, p. 1172) have conducted a study in the Nigerian manufacturing sector and have concluded on a positive significant relationship between these variables. Papadogonas (2007, p. 1) also argues for a positive relationship due to larger firms' ability to negotiate better terms leading to lower average rates and lower input costs and hence to higher profitability. Another study conducted among 1.020 Indian firms also supports this relationship by concluding on the fact that larger companies seem to be more profitable in India (Majumdar, 1997, p. 231). Doğan (2013, p. 54) has examined 200 Turkish companies active in the financial sector quoted on the Istanbul stock exchange and has concluded on the same positive relationship between firm size and profitability, which he explains through the economies of scale effect. Akinlo (2011, p. 706) has completed a research on the same topic and also has concluded within a period of 8 years - from 1999 to 2007 - that on long-term a positive causality exists. Sritharan (2015, p. 1) also highlights the important effect of scale economies when conducting his study for the Sri Lankan hotels and travel sector, which in addition to its natural effect also reduces transaction costs and the above-mentioned long-term debt ratio as well. Dahmas (2015, p. 58) has established in his study that the effect of size on profitability of a company is different when looking at different sectors. In his study conducted in Jordan for a fairly large sample of 1.538 companies in various sectors between the years 2005 and 2011, he concludes that the analysis pertinent to companies in the three different areas in particular, the industrial sector, the service sector and the financial sector show a significant positive causality. All other sectors examined only show insignificant coefficients. Caves & Porter (1977, p. 241) have highlighted a similar conclusion, stating that the relationship between size and profitability of a company might be different when analyzing different industries. Bradburd & Ross (1989, p. 259) also highlight controversial results, namely that small and large companies are more efficient when trying to fill the gaps in niche markets as

opposed to medium sized companies that “are stuck in the middle” and cannot gather sufficient market presence to capture market share. The inconsistent results shown above have led to formulating the following research question that aims to add some clarification to this topic:

RQ4: What is the effect of size on company profitability? The null hypothesis describes a non-significant relationship between these two variables (RH4).

2. Empirical Analysis

2.1. Methodology

2.1.1. The DEA Method

In order to conclude on relative efficiency and profitability of F&B franchises, the Data Envelopment Analysis (DEA) method was used. Mathematically, the "relative efficiency is the ratio of the weighted sum of outputs to the weighted sum of inputs" (Roh & Choi, 2010, p. 93). This original model, named after Charnes, Cooper and Rhodes (CCR) was later improved by Banker et al. (1984) and has been since then widely used. The same approach will be applied in this paper as well.

The original tool developed by Charnes et al. (1978) uses a linear programming method to determine relative efficiency and profitability of a group of enterprises, also called decision-making units (DMUs) within a given population. The term "relative" efficiency refers to the fact that an efficient DMU, initially compared to a certain set of data can also be determined as inefficient when comparing to another set of data. Hence, efficiency in this context can only be determined in relation to a certain set of data and never as absolute efficiency. The efficiency of each decision-making unit is determined by comparing "inputs and outputs with all other DMUs" (Garcia Martin, Medal Bartual, & Peris-Ortiz, 2014, p. 12). This implies that for each DMU the minimum input required generating a certain or the maximum output has to be calculated. Farrell describes an efficient entity as one that is able to choose an optimal set of inputs to achieve the highest output (Farrell, 1957, p. 259). It is important to note that in many empirical papers, efficiency has been used as a synonym for profitability, utilization, efficacy and numerous other performance related dimensions. Profitability that will be measured in this master's thesis is however different than efficiency as it is defined simply as the ratio of input to output over a certain period of time (Johnston & Jones, 2004, p. 202).

The DEA method has not only been applied in various sectors for different companies, but also aims to measure efficiency and profitability of franchise

enterprises. For example, Staub et al. has analyzed the efficiency development of Brazilian Banks (2010), Anderson et al. examined the efficiency of the hotel industry (2000), while Ashrafi et al. measure the same aspect in Singapore (2013). Further applications include the evaluation of 55 Taiwanese hotels (2005) for occupational and managerial efficiency, Pulina et al. investigate the correlation between efficiency and size in the Italian hospitality sector (2010) and Roh et al. compare multiple brand franchises (2010). Thus, this methodology has been widely used and accepted in many sectors and countries, however its application for the American food and beverage franchise market is broadly missing. The lack of empirical work undertaken in this area is mainly due to the fact that, measuring efficiency within the service sector is not as simple as doing the same in manufacturing (Johnston & Jones, 2004, p. 203). One issue that arises is that the customer is not only the buyer, but also "co-producer" of the service and hence influences the quality of the service delivered and overall profitability (Martin, Horne, & Chan, 2001, p. 137). The analysis becomes even more complex when trying to include the profitability of the buyer (Martin, Horne, & Chan, 2001, p. 141). Hence, profitability does not only depend on the provider, but also on the customer's perception on the actual experience, that may be influenced by intangibility and heterogeneity of the service provided (Martin, Horne, & Chan, 2001, p. 152).

2.1.1.1 Relative efficiency

The first step to using the DEA model necessitates the computation of the efficiency frontier by determining the relatively most efficient units. This serves as the basis for solving all data envelopment analysis problems. This frontier is defined by the best performance that the observed DMUs can achieve by utilizing a given number of inputs to achieve the highest outputs. Hence, a ratio between the total weighted inputs and total weighted outputs has to be created. The below figure demonstrates the visual depiction of this frontier. It is clear that DMUs A, B and C are efficient as they lie on the frontier, while all other DMUs show an inefficient performance. Hence, the reference set for unit D is made up of A and B, while B and C serve as reference for DMUs E and F. This depiction demonstrates well the relative efficiency of each unit and clearly highlights the DMUs against which a given inefficient unit has been compared. Should the benchmark units be

removed, the inefficient DMU could also become efficient. This demonstrates the importance of relative efficiency versus simple efficiency (El-Mahgary & Lahdelma, 1995, p. 702).

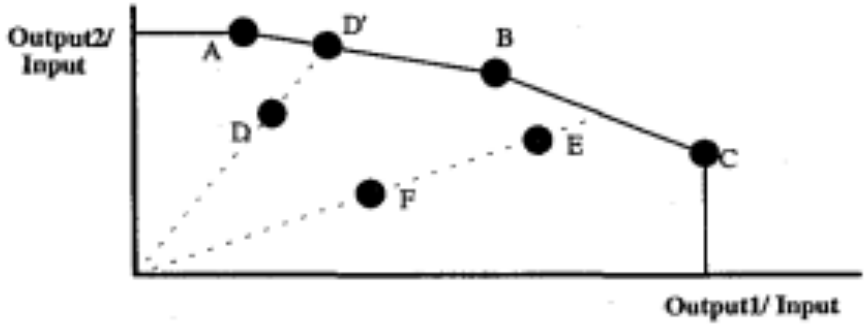

Figure 13: Efficiency frontier

Source: El-Mahgary & Lahdelma, 1995

Similarly to the study Sheng-Hshiung Tsaur (2001), the DEA model to calculate the efficiency score of each DMU will be used as follows. There are *n* DMUs to be evaluated with *m* number of inputs producing s amount of outputs. Hence, the efficiency will be determined by using the following model:

$$Max \ \ h_j \frac{\sum_{r=1}^{s} U_r \ Y_{rj}}{\sum_{i=1}^{m} V_i \ X_{ij}} \qquad \dots\dots\dots\dots\dots (1) \quad s.i.$$

$$\frac{\sum_{r=1}^{s} U_r \ Y_{rj}}{\sum_{i=1}^{m} V_i \ X_{ij}} \leq 1, \quad j = 1, \dots, n$$

$$U_r \geq \xi \geq 0, \ \ r = 1, \dots s$$

$$V_i \geq \xi \geq 0, \qquad i = 1, \dots, m$$

Equation 1: Efficiency score

Source: Sheng-Hshiung Tsaur, 2001

In this model, h_j stands for relative efficiency. U_r and V_i stand for the weights associated with the output Y_{rj} and the input X_{ij}. "Y_{rj} is the value of the r^{th} output from the j^{th} DMU and X_{ij} is the value of the i^{th} input used by the j^{th} DMU." As shown on the figure above, the objective of this problem is to optimize the weights in order to maximize relative efficiency h_j. The two constraints below show that the efficiency cannot be higher than 1, while 1 also stands for the frontier efficiency unit mentioned above. ε stands for an "arbitrarily small positive number" (Tsaur, 2011, p. 74).

The advantage of the BCC Model proposed by Banker at al (Banker, Charnes, & Cooper, 1984, p. 1078) is that it takes into consideration that units do not always operate at an optimal level. The CCR-DEA model assumes the constant return to scale, which means that the increase in inputs will result in a proportional change of outputs. Using the BCC-DEA model offers the advantage of the variable returns to scale, which explains the behavior of the change of outputs relative to the inputs. Hence, this implies that it allows for a proportionally higher change in outputs compared to inputs (IRS, increasing returns to scale) or a proportionally smaller change in outputs (DRS, decreasing return to scale) compared to the CCR model (Roh & Choi, 2010, p. 94).

To solve the DEA model and hence to conclude on the most efficient enterprises, numerous software has been used in the DEA literature. There are about 20 software solutions widely used for DEA problems, out of which 8 packages prove to be a viable option for a master's thesis. About half of these packages are available as commercial packages, while 50% is available at no charge, although certain limitations do apply. All models include the BCC / VRS model needed for this master's thesis, as this belongs to the fundamental features of each program. The models were evaluated based on key features, capabilities, platforms, user interface, reporting and related costs. When choosing the right software for this master's thesis, following criteria were respected in detail in addition to the above: non-commercial, allowing for input or output orientation, calculate super-efficiency scores, compatibility with a Microsoft Excel platform and Excel spreadsheet (SS), output file as excel spreadsheet, uses "elaborate graphical user interfaces" (GUIs) as opposed to "simple command-line controls" (Barr, 2004, p. 544). Hence, the EMS: Efficiency Management System will be used to compute all data in this master's thesis.

2.1.1.2 Super-efficiency

The term super-efficiency will be introduced to achieve the hierarchical ranking of the analyzed companies. Numerous other ranking methods have been developed in the DEA context. Adler et al. summarize the various options in an excellent manner, by noting that each method is useful given a certain type of data. Self and peer evolution is done through the cross-efficiency matrix which is another widely accepted tool for ranking. Benchmarking and multivariate statistical techniques are also used in the DEA literature. The fourth type of method is the ranking of inefficient units based on their proportionate measurements of inefficiency. Finally, the combination of qualitative information from decision makers and multiple criteria decision methodologies is also mentioned when discussing hierarchical rankings (Adler, Friedman, & Sinuany-Stern, 2002, p. 249). However, during this master's thesis – similarly to Garcia Martin, Medal Bartual, & Peris-Ortiz – the super-efficiency model will be selected due to the nature of the data, despite the fact that all other techniques have high value in the DEA methodology.

Super-efficiency allows any efficient DMU *k* to reach an efficiency score over 1 (or 100%) by removing the kth constraint from the following formula shown in below:

$$h_k = Max \sum_{r=1}^{s} u_r y_{rk}$$

Equation 2: Super-efficiency I.

Source: Garcia Martin, Medal Bartual, & Peris-Ortiz, 2014, p. 20

which is subject to

$$\sum_{i=1}^{m} v_i x_{ij} - \sum_{t=1}^{s} u_r y_{rj} - c_k \geq 0 \quad for\ j = 1, \dots n \quad j \neq k$$

$$\sum_{i=1}^{m} v_i x_{ik} = 1$$

$$u_r \geq \xi \qquad for\ r = 1, \dots s$$

$$v_i \geq \xi \qquad for\ i = 1, \dots m$$

Equation 3: Super-efficiency II.

Source: Garcia Martin, Medal Bartual, & Peris-Ortiz, 2014, p. 20

This model has been widely used by past academic literature, Banker et al. used super-efficiency when analyzing management control in hospitals (1989, p. 269), while Zhu used alternative super-efficiency models to perform a sensitivity analysis of given DMUs (2001, p. 443). Further examples include the ranking of efficient DMUs introduced by the Andersen and Petersen (1993, p. 1261) and the application of the super-efficiency methodology in combination with financial ratios in the Chinese banking industry (2011, p. 323).

2.1.2. Linear Regression

In the second part of the empirical analysis, the tool linear regression will be used. The introduction of the correlation coefficient and regression analysis can be traced back to an experiment on a sweet pea plant undertaken by Sir Francis Galton in the 19th century. This experiment has led to the definition of regression and the Pearson Product Moment Correlation (PPMC). Linear regression can be hence defined as finding the best fitting straight line through the criterion variable, denominated with "Y" which is anticipated based on the predictor variable, also called variable "X" (Stanton, 2011, p. 3). The basic formula to compute the regression line can be described as follows:

$$Y' = bX + A$$

Equation 4: Regression line

Source: Lane, 2013, p. 436

Y' is the estimated dependent score, b is the slope of the line or also called the regression coefficient, X is the independent variable, also called predictor variable and A is the intercept for Y, also called the constant. In this master's thesis, simple regression lines will be computed between the two predictor variables age and size and the criterion variables efficiency and profitability. This will be done by using the statistical software, SPSS. To compute the above-mentioned regression line, standard deviation and correlation has to be computed.

The slope (b) can be calculated with the following formula:

$$b = r * \frac{s_Y}{s_X}$$

Equation 5: Slope

Source: Lane, 2013, p. 437

where, r is the correlation coefficient between the variables X and Y, s_Y is the standard deviation of Y and s_X is the standard deviation of X.

The intercept (A) can be calculated as:

$$A = M_Y - b * M_X$$

Equation 6: Intercept

Source: Lane, 2013, p. 437

where M_Y is the mean of Y and M_X is the mean for X (Lane, 2013, pp. 436 - 437).

In order to complete a linear regression, a few criteria have to be tested for. The first test that will be completed below is the test for continuity, which implies that a variable can have any value in a given range, rather than being a discreet variable that can only have a certain set of options as a value (Lane, 2013, p. 283). Secondly, data has to be tested for a linear relationship between the variables, in which case the two variables - when plotted on a scatterplot - fall on the same line, implying a perfect relationship. As long as the divergence from the line is random and not systematic, a linear relationship can still be concluded on (Lane, 2013, p. 446). Thirdly, a test for significant outliers has to be performed, which implies the removal of any observation data that deviates from the entire sample. As the data used is not too large to oversee, the outliers will be removed manually before undertaking the regression analysis. Lastly test of normal distribution of the examined data will be performed. The distribution also called a “bell curve” or “Gaussian curve” has to always be symmetric around their mean and the area below the curve has to equal to 1,0. The density to calculate the normal distribution for any given value on the x-Axis is follows:

$$\frac{1}{\sqrt{2\pi\sigma^2}} e^{\frac{-(x-\mu)^2}{2\sigma^2}}$$

Equation 7: Density formula

Source: Lane, 2013, p. 238

where μ stands for the mean and σ for the standard deviation, implying that these two parameters determine the normal distribution (Lane, 2013, p. 238). All these tests will be undertaken below in the empirical part of this thesis.

In order to compute the linear regression, the Spearman rank-order correlation has to be undertaken, which is very similar to the Pearson correlation except that the data is converted into ranks. Spearman's ρ is computed by comparing the correlation between the actual data and the correlations that could be obtained if Y variable was rearranged and not compared according to the sequence of observations. Afterwards the number of possible arrangements for Y is computed by calculating N!, which is the possible number of paired arrangements between X and Y. Since this master's thesis necessitates a two-tailed test, the result has to be multiplied by 2 as the probability for both directions – larger or smaller – will be considered (Lane, 2013, p. 579).

To assure relevance of the linear regression, a few diagnostic tests will be completed. This first test is the serial correlation test, which will be concluded on by using the Durbin Watson Test or d-test. The aim of this test is to conclude on the independence of the residuals and hence to exclude an autocorrelation. The hypothesis tested for the Durbin Watson test is H_0: ρ = 0, thus no autocorrelation exists while H_1: ρ > 0 would imply the presence of an autocorrelation. There is an upper limit (d_u) and lower limit (d_L) for the d-test, which determine when the hypothesis can or cannot be rejected. D_L and d_u, is dependent on the sample size "n", number of regressors "k" as well as the significance level "α" all of which can be found in a corresponding table showing the critical values for this statistic. The criteria for hypothesis testing is that if $d < d_L$ then H_0 is rejected. If however $d > d_U$

then H_0 cannot be rejected. Numbers between the lower and upper limit for d result in an inconclusive test (Decarlo & Tryon, 1993).

The second test aims to conclude on heteroscedasticity, or in other words the variance of sub populations compared to the regression line. For a linear regression, the presence on homoscedasticity is needed, implying that the variance for all values of X is identical considering the regression line. To complete this test, the Breusch-Pagan test will be used. H_0 implies the absence of heteroscedasticity while H_1 describes the existence of heteroscedasticity among the variables. In order to have a reliable model for the linear regression, it is necessary to not to reject H_0 for homoscedastic residuals (Pedace, 2016).

2.2. Results of Empirical Analysis - Part I.

2.2.1. Efficiency analysis

The fast food industry in the United States is divided into full service restaurants, quick service restaurants and retail food. In this thesis only quick service and table restaurant franchises will be analyzed, which amounted to about 484.955 establishments with sales at USD 242,80 billion in the year of analysis, 2015 (IHS Markit Economics, 2017, pp. 17,19). In this study 56 establishments will be analyzed, which only represent about 0,02% of the entire F&B franchise population. The study used as benchmark for this master's thesis studies 0,006% of the entire sample size (there are 2,5 million companies in the trade & other services sector, out of which 143 were analyzed), hence the same practice will be undertaken for the current analysis (Garcia Martin, Medal Bartual, & Peris-Ortiz, 2014, p. 13). Companies studied represent a very important pool of enterprises due to their significance to the economy of the United States.

To measure relative efficiency of the franchise enterprises in the first part of this paper, input and output variables have been determined. Similarly to the 2014 study of Garcia Martin, Medal-Bartual, & Ortiz, five input variables will be determined, which ensure objectivity and representativeness of resources, as follows: tangible fixed assets, intangible assets, total volume of own resources, total liabilities and labor costs for the financial year of 2015 (Garcia Martin, Medal Bartual, & Peris-Ortiz, 2014, p. 14). Output variables will be sales and returns in the fiscal year 2015. In order to directly achieve a ranking of companies, the problem of equal ranks of totally efficient companies will be solved with the aid of super-efficiency as mentioned earlier. The term super-efficiency will be introduced to rank efficient franchises with a coefficient of 1. The advantage of using the super-efficiency extension of the DEA study is due to the fact that the inefficient reference set is excluded from the mathematical formula right away, which offers the possibility for efficient franchises to become super-efficient. Similarly to the study of Garcia Martin, Medal-Bartual, & Ortiz, the Banker, Chames and Cooper the BCC measure will be used (Garcia Martin, Medal Bartual, & Peris-Ortiz, 2014,

p. 17).

The variables used in this paper were chosen based on the study of Garcia Martin, Medal Bartual and Peris-Ortiz from 2014. Many of these input and output variables appear in studies where the DEA Method was used, such as the study by Fuchs in 2004 (Fuchs, 2004) or Pulina et al. (Pulina, Detotto, & Paba, 2010). All variables were chosen for the fiscal year of 2015, which implies a year-end in 2015 in cases where calendar year and fiscal year do not coincide. These variables are as follows:

Input variables:

a) Tangible fixed assets (X_1): this includes all current assets (e.g.: cash and cash equivalents, short term investments, net receivables, deferred tax assets, other assets etc.) and fixed assets with a useful life of over 1 year (e.g.: long term investment, property plant & equipment, equity method investments, etc.) as shown on the balance sheet of the company, measured in thousands of US dollars, from the year 2015.

b) Intangible assets (X_2): denotes all non-physical assets that include goodwill, trademarks, franchise rights, customer relationships, liquor licenses, etc., measured in thousands of US dollars, from the year 2015.

c) Total volume of own resources (X_3), which represents the total stockholder equity including common and preferred stocks, additional contributed capital, redeemable shares, and non-controlling interests, measured in thousands of US dollars, from the year 2015.

d) Total liabilities (X_4): including both current and long-term liabilities, measured in thousands of US dollars, from the year 2015.

e) Labor costs (X_5) that occurred for all employees in the financial year of 2015, measured in thousands of US dollars, from the year 2015. In a few cases, where 10-K reports did not offer this information specifically, “general and administrative” costs were used to provide the necessary information. When

measuring labor costs, the following companies did not break down “costs of goods sold” to show employee wages and benefits separately: Benihana, Freshii, DineEquity, Dunkin Brands, Domino’s Pizza, Nathan’s Famous, Ruth’s Hospitality Group, Rave Restaurant Group, Wingstop, and Morton’s Restaurant Group. Hence, an average of all other companies’ labor costs was computed, that summed up to 25,47%. As this is also in line with the literature, which suggests around 30% labor cost from total sales (Carty, 2017), the average percentage was taken as a benchmark.

Output variables:

a) Total operating sales (Y_1): all revenues generated by the daily business of the company without the deduction of any costs occurred, often denominated as “income from operations”, measured in thousands of US $ dollars, from the year 2015.

b) Total returns (Y_2): also referred to as earnings before interest and tax (EBIT) or total operating income, which is applicable to common shares and represents hence the return on investment for share holders, measured in thousands of US $ dollars, from the year 2015.

It is also important to note that in order to achieve reliable results, the number of DMUs has to exceed 3 times the sum of the number of inputs and outputs, hence in the current case a minimum of 24 DMUs should be tested (El-Mahgary & Lahdelma, 1995, p. 703). The below table shows the relative efficiency score of the studied enterprises and summarizes these results obtained from the DEA model.

DMU	Score
Ark Restaurants Corporation	1,00
Biglari Holdings	1,00
Bojangles Famous Chicken	1,00
Bravo Brio Restaurant Group	1,00
Brickhouse Tavern & Joe's Crab shack	1,00
Dave & Busters	1,00
Domino's Pizza	1,00
Dunkin Brands Group	1,00
Flanigan's Seefood Bar & Grill	1,00
Frisch's Big Boy	1,00
Jamba Juice	1,00
Krispy Kreme Doughnuts	1,00
McDonalds	1,00
Nathan's famous	1,00
Noble Roman's	1,00
Papa John's international	1,00
Popeys' Louisana Kitchen	1,00
Potbelly Corporation	1,00
Rave Restaurant Group	1,00
Red Robin Gourmet Burgers	1,00
Ruth's hospitality group	1,00
Wingstop	1,00
Texas Roadhouse	0,95
Cosi	0,95
Fiesta Restaurant Group	0,91
Yum Brands!	0,91
Buffalo Wild Wings	0,87
Ruby Tuesday	0,84

DMU	Score
Famous Dave's	0,81
Noodles & Company	0,81
Brinker International	0,80
Carrols Restaurant Group	0,79
Pollo Loco Holdings	0,79
Papa Murphy's	0,78
DineEquity	0,78
Hooters	0,77
Kona Grill	0,76
Panera Bread	0,72
Del Taco	0,71
Denny's	0,71
Luby's	0,70
Redland's & Stoney River Sth. Grill	0,70
Good Times Restaurants	0,70
Sonic Group	0,68
Logan's Roadhouse	0,67
Restaurant Brands Intl.	0,67
Zoes kitchen	0,60
Del Friso's Restaurant Group	0,57
Jack in the Box	0,55
Freshii	0,51
Bloomin Brands	0,50
Olive Garden	0,44
Wendys	0,43
The Habit Burger Grill	0,42
Diversified Restaurant Holdings	0,38
Fogo De Chao	0,36

Table 1: Efficiency scores

Source: Researcher's computation

Only 39% of the enterprises have reached the highest level of efficiency, which are thus totally efficient. These 22 most efficient franchises include for example Domino's Pizza, Dunkin Brands Group or McDonalds. A somewhat smaller number (about 16%) has reached efficiency levels between 0,95 and 0,8, the franchise concepts Cosi and Texas Roadhouse are the highest ranked in this group, just behind the totally efficient franchises with an efficiency score of 0,95. Inefficient companies falling below the threshold of 0,5 are 9% of the entire sample size. The least efficient franchise concepts include Diversified Restaurant Holdings and the Restaurant Group Fogo de Chao.

2.2.2. Super-efficiency analysis

To conclude on the most efficient company within the top performance from the above analysis, super-efficiency of companies will be analyzed. It has to be noted that to successfully conclude on the model for super-efficiency, both input and output variables have to fulfill the criteria of being non-negative.

Through the super-efficiency model, already efficient units can become super-efficient by “shrinking the production set” (Garcia Martin, Medal Bartual, & Peris-Ortiz, 2014, p. 19). This means that super-efficient units can achieve a score that is higher than 1, the maximum score in the previous analysis. However, inefficient units will remain at the same level. Before pursuing the analysis, it has to be pointed out that there are some weaknesses to this analysis, which Adler at al. (2002) have identified as follows. The first problem arises through the weight allocation to each DMU. The main aim is to dedicate a weight that allows to “show the specific DMU in as positive light as possible”, under the restriction that no other DMU, given the same weights, is more than 100% efficient” (Adler, Friedman, & Sinuany-Stern, 2002, p. 250). However, as all weights of all DMUs are equally used, the multiplier effect is lost (Adler, Friedman, & Sinuany-Stern, 2002, p. 253). The second problem is to be found among the specialized units, which due to the excellent utilization of one input variable in specific might distort the efficiency frontier. This might lead to an extreme value determining the DEA frontier, leading to unreliable results. The last problem is called the infeasibility issue, according to which not even the super-efficiency model can provide a comprehensive ranking of the DMUs as some results might prove to be in reality infeasible (Adler, Friedman, & Sinuany-Stern, 2002, p. 254).

Despite the above-mentioned weaknesses, this model will be used in combination with the BCC measure (DEA with input orientation) that has been first mentioned by Lovell and Rouse (2003). Without this BCC measure, super-efficiency cannot be computed due to the limitations in the original model.

The below table shows the ranking of the same 56 franchise outlets as analyzed earlier. It can be clearly seen that outlets which did not reach the efficiency score 1,00, have remained at the same efficiency level. DMUs which were however totally efficient (score ≥ 1) in the earlier analysis, have now become super-efficient. From the below table it is now possible to conclude on a ranking, which was not possible earlier. It can be seen that Bravo Brio Restaurant Group has achieved the first rank with an efficiency score of 3,55, followed by Biglari Holdings with a score of 2,40. The third place went to Rave Restaurant Group, closely followed by Papa John's International with scores amounting to 1,95 and 1,94 respectively.

DMU	Score	DMU	Score
Bravo Brio Restaurant Group	3,55	Famous Dave's	0,81
Biglari Holdings	2,40	Noodles & Company	0,81
Rave Restaurant Group	1,95	Brinker International	0,80
Papa John's international	1,94	Carrols Restaurant Group	0,79
Dunkin Brands Group	1,56	El Pollo Loco Holdings	0,79
Bojangles Famous Chicken	1,53	Papa Murphy's	0,78
Wingstop	1,46	DineEquity	0,78
Frisch's Big Boy	1,39	Hooters	0,77
Popeys' Louisana Kitchen	1,29	Kona Grill	0,76
Noble Roman's	1,22	Panera Bread	0,72
Dave & Busters	1,20	Del Taco	0,71
Potbelly Corporation	1,19	Denny's	0,71
Ruth's hospitality group	1,19	Luby's	0,70
Krispy Kreme Doughnuts	1,16	Redland's & Stoney River Sth. Grill	0,70
McDonalds	1,12	Good Times Restaurants	0,70
Red Robin Gourmet Burgers	1,12	Sonic Group	0,68
Flanigan's Seefood Bar & Grill	1,06	Logan's Roadhouse	0,67
Ark Restaurants Corporation	1,04	Restaurant Brands international	0,67
Brickhouse Tavern & Joe's Crab shack	1,04	Zoes kitchen	0,60
Domino's Pizza	1,00	Del Friso's Restaurant Group	0,57
Nathan's famous	1,00	Jack in the Box	0,55
Jamba Juice	1,00	Freshii	0,51
Texas Roadhouse	0,95	Bloomin Brands	0,50
Cosi	0,95	Olive Garden	0,44
Fiesta Restaurant Group	0,91	Wendys	0,43
Yum Brands!	0,91	The Habit Burger Grill	0,42
Buffalo Wild Wings	0,87	Diversified Restaurant Holdings	0,38
Ruby Tuesday	0,84	Fogo De Chao	0,36

Table 2: Super-efficiency analysis

Source: Researcher's computation

2.2.3. Profitability analysis

Profitability is “defined as economic profitability; that is the spread between return on equity and the risk adjusted cost of equity” (Pandey, 2005, p. 105). This can be maintained through realizing the firm’s potential to creating competitive advantage and to keeping this on long term (Grant, 1991, p. 115).

To measure profitability, the indicator of return on equity (ROE) was used. This approach has been widely accepted and as it has been used for the study by Garcia Martin, Medal Bartual, & Peris-Ortiz from 2014 that was taken as a benchmark, in this master’s thesis this indicator will be used as well.

Enterprises will be ranked based on the return of investment for the year 2015 with the following formula:

$$ROE = \frac{returns\ before\ interests\ and\ taxes}{own\ resources}$$

The two rankings will then be compared to conclude whether the size of the franchise company influences profitability or not. On the below table, companies were ranked according to their ROE. It is clearly visible that companies with high ROEs are also the most efficient units.

DMU	ROE %
Jack in the Box	1236%
Sonic Group	668%
Papa John's international	270%
Freshii	241%
Jamba Juice	205%
Yum Brands!	198%
Popeys' Louisana Kitchen	125%
McDonalds	101%
Logan's Roadhouse	87%
DineEquity	87%
Bloomin Brands	52%
Panera Bread	49%
Ruth's hospitality group	46%
Wendys	36%
Bojangles Famous Chicken	31%
Carrols Restaurant Group	29%
Dave & Busters	29%
Fiesta Restaurant Group	26%
Flanigan's Seefood Bar & Grill	22%
Ark Restaurants Corporation	22%
Texas Roadhouse	21%
Buffalo Wild Wings	21%
El Pollo Loco Holdings	20%
Noble Roman's	20%
Restaurant Brands international	19%
Krispy Kreme Doughnuts	18%
Red Robin Gourmet Burgers	18%
Papa Murphy's	16%

DMU	ROE %
Olive Garden	16%
Frisch's Big Boy	13%
Famous Dave's	10%
Del Friso's Restaurant Group	10%
Fogo De Chao	9%
The Habit Burger Grill	9%
Redland's & Stoney River Sth. Grill	9%
Potbelly Corporation	7%
Bravo Brio Restaurant Group	6%
Del Taco	5%
Biglari Holdings	5%
Zoes kitchen	4%
Luby's	0%
Good Times Restaurants	-1%
Ruby Tuesday	-1%
Kona Grill	-7%
Rave Restaurant Group	-10%
Noodles & Company	-22%
Domino's Pizza	-23%
Nathan's famous	-33%
Hooters	-53%
Cosi	-87%
Denny's	-104%
Brickhouse Tavern & Joe's Crab shack	-127%
Diversified Restaurant Holdings	-137%
Dunkin Brands Group	-163%
Wingstop	-204%
Brinker International	-397%

Table 3: Profitability analysis

Source: Researcher's computation

For further analysis, the companies Jack in the Box and Sonic Group were excluded due to the distorted numbers in the equity position for year 2015. It is clear from the balance sheet that these two companies have bought back a large number of their outstanding shares through issuing treasury stocks in this year, which leads to the unusually high return on equity percentage for the analyzed year.

2.3. Results of Empirical Analysis - Part II.

2.3.1. Descriptive statistics

The below table summarizes the data used in this analysis. With regards to the size of the companies analyzed, it can be concluded on a mean age of 40, while the youngest company has been established 11 years ago, the oldest is 83 years of age. The organizations subject to this analysis have on average 432 outlets worldwide, the smallest having only 25 outlets – Flanigan's Seafood Bar and Grill -, while the largest corporation, McDonalds had 36,525 outlets worldwide in 2015. With regards to the profitability measures, the average return on equity amounts to 16%, while the minimum reaches an extreme of -397% in the case of Brinker International. This value is however an outlier compared to the other data, mainly due to the fact that the EBIT of this franchise company is about 4 times higher than its negative equity. This is due to the treasury stock that always appears as a negative value when companies reduce their outstanding shares. As the company took shares off the stock market in value of USD 3.009.249 on 24 and 25 June of the analyzed year, there is a deficit equity appearing on the balance sheet, unfortunately distorting the value of the return on equity. The highest profitability value is at 1.236%, in the case of the company Jack in the Box. This is due to the fact that the EBIT is about 13 times as high as equity, as the treasury stock account reduces total equity by USD 1.571.433 yet again. The average efficiency score is at 0,82, while the least efficient company, Fogo de Chao shows an efficiency percentage of 36,00%. The most efficient company was the Bravo Brio Restaurant Group with a value of 3,55.

	Mean	Standard deviation	Minimum	Maximum
Organization age	42	20	11	83
Organization size	432	7459	25	36525
Profitability (ROE)	16%	210%	-397%	1236%
Efficiency	0,82	0,53	0,36	3,55

Table 4: Descriptive statistics

Source: Researcher's computation, 2017

2.3.2. Criteria for correlation analysis

Before pursuing a linear regression analysis, the correlation analysis will be performed. There are four different assumptions that have to be fulfilled in order to assure the relevance and correctness of the correlation results as follows (Lund Research Ltd, 2013).

2.3.2.1 Test of continuity

Firstly, it has to be ensured that the analyzed data is continuous. The data utilized in this master's thesis as mentioned on the previous pages is as follows: two independent variables, the organization age and log size, and two dependent variables, log profitability and log efficiency computed earlier. The variables size, profitability and efficiency will undergo a log-normal transformation, the reason for which will be explained under point 3.2.2.4. The requirements of continuity are defined as "a measurement not restricted to particular values except in so far as this is constrained by the accuracy of the measuring instrument" (Everitt & Skrondal, 2010, p. 102). It is clear that any of these four variables could take a randomly small or large number including any particular value in between. Thus, the requirement of continuity is fulfilled.

2.3.2.2. Test of linearity

Secondly, there has to be a linear relationship between the data. This implies that "a model in which the expected value of a random variable is expressed as a linear function of the parameters in the model" (Everitt & Skrondal, 2010, p. 253). This was examined by creating a scatterplot in SPSS Statistics to show how one variable behaves against the other one. The results are the follows:

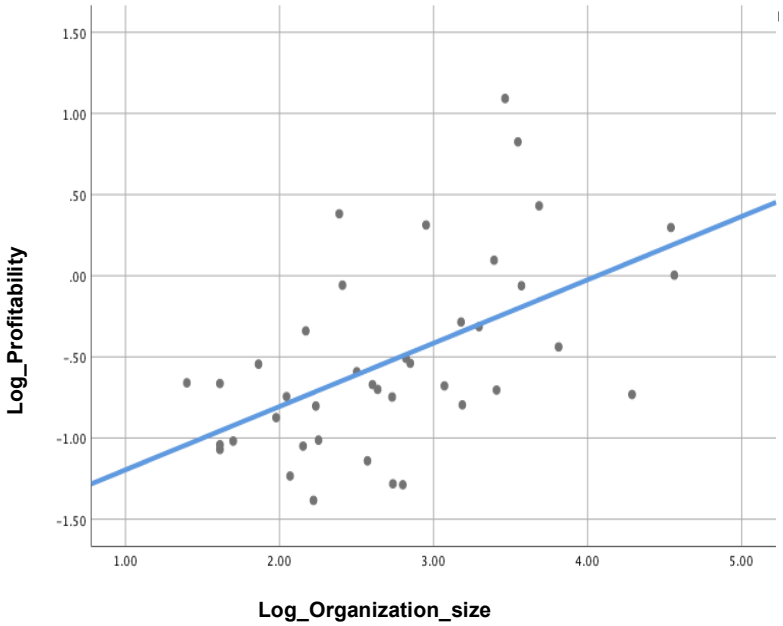

Figure 14: Scatterplot log organization size vs. log profitability

Source: Researcher's computation, 2017

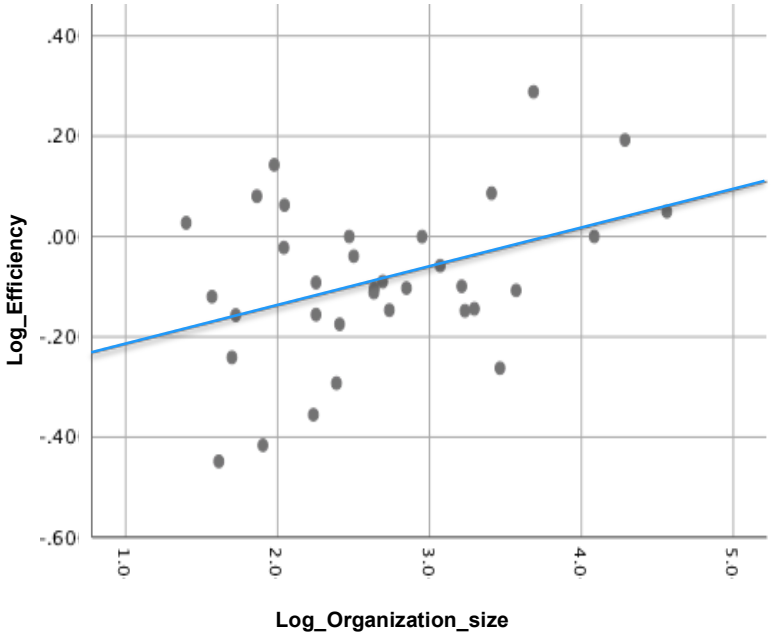

Figure 15: Scatterplot log organization size vs. log efficiency

Source: Researcher's computation, 2017

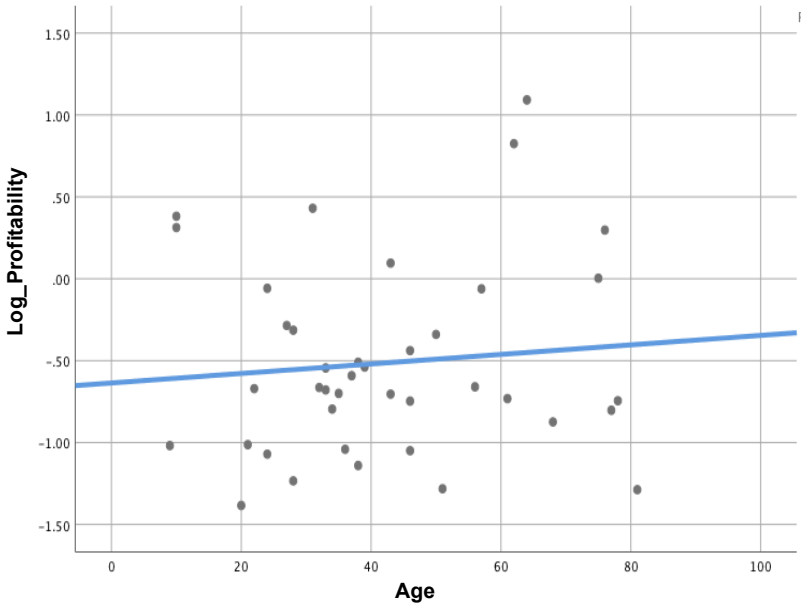

Figure 16: Scatterplot age vs. log profitability

Source: Researcher's computation, 2017

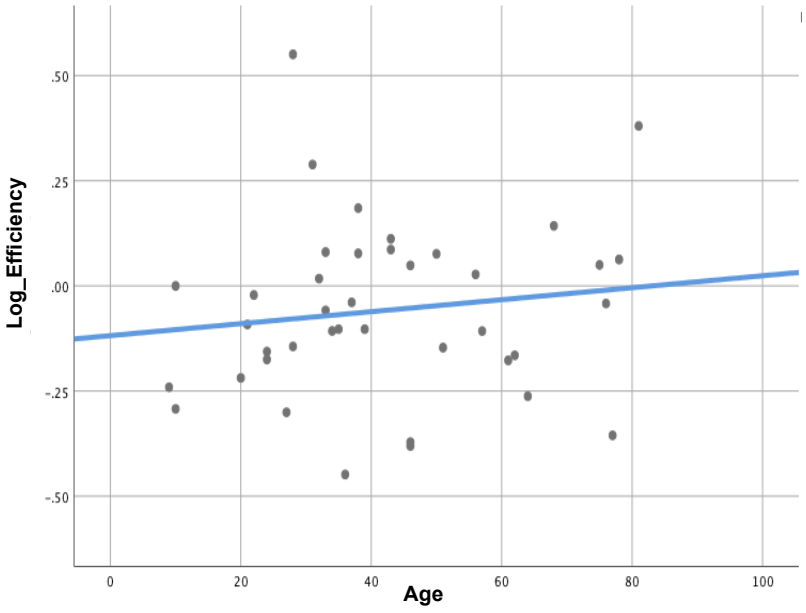

Figure 17: Scatterplot age vs. log efficiency

Source: Researcher's computation, 2017

All above figures show a linear relationship between the variables that is well demonstrated by the fit line depicted in blue, fulfilling thus the linearity requirement for the data.

2.3.2.3. Test for significant outliers

Thirdly, the significant outliers as shown on the above scatter charts have to be removed, which was undertaken accordingly before pursuing the analysis.

2.3.2.4. Test for normality

Lastly, the variables should be approximately normally distributed. The normality test will be pursued in the SPSS Statistics program, using the Shapiro-Wilk test of normality. This test aims to conclude on the fact that the variables used in the later analysis indeed originate from a certain probability distribution, in this case the normal distribution. (Everitt & Skrondal, 2010, p. 390). According to the requirements of this test, the significance has to be greater than 0,05 in order to conclude on the normality of the data. Should this number be below 0,05, then the data shows a deviation from normal distribution (Lund Research Ltd, 2013). The formula for computing Shapiro-Wilks W is shown in equation 8 below, where "$x_{(1)} \leq x_{(2)} \leq \ldots \leq x_{(n)}$ are ordered sample values and $\bar{x}$ is their mean" (Everitt & Skrondal, 2010, p. 391).

$$W = \frac{n}{n-1} \frac{(\bar{x} - x_1)^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

Equation 8: Shapiro Wilks W

Source: Everitt & Skrondal, 2010, p. 391

The below table show the summary of the Shapiro-Wilk test performed for the original data.

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Efficiency	.166	56	.001	.779	56	.000
Profitability	.306	56	.000	.582	56	.000
Age	.086	56	.200*	.959	56	.052
Size	.346	56	.000	.435	56	.000

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Figure 18: Test of Normality with the original data

Source: Researcher's computation

Based on the above, it is clear that only age related data is normally distributed as the p-value representing the significance only exceeds 0,05 in this case when looking at the Shapiro-Wilk test. In order to reach a normal distribution of the other data, a logarithmic transformation has to be performed, leading to the log-normal distribution required for the later analysis (Lane, 2013, p. 531). The log transformation for each non-normally distributed value – efficiency, profitability and size - was undertaken. The transformation will be done by using a basic mathematical formula Z = log (x). This has the advantage that it "turns multiplication into addition, turns variables X > 0 into Z with unrestricted values, reduces positive skewness (may turn it negatively skewed) and often turns skewed distributions into normal ones" (Stahel, 2014). It is clear based on the definition above that negative values cannot undergo a log transformation, however in some cases the values for profitability were negative. These observations had thus to be removed for further analysis. Significant outliers have also been removed as specified above, thus the improved significance value for the variable age. The below table was thus constructed after having transformed the original non-normally distributed values into log-normal values. The only variable that did not undergo the transformation was the variable age as this was originally normally distributed. The new significance values for the Shapiro-Wilk test are summarized as follows:

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Log_Efficiency	.099	38	.200*	.972	38	.448
Log_Profitability	.135	38	.079	.948	38	.078
Age	.122	38	.163	.946	38	.065
Log_Size	.089	38	.200*	.960	38	.192

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Figure 19: Test of normality with log-normal distribution

Source: Researcher's computation

It is clear from the above now all variables meet the criteria of normality as the significance value p is above the required threshold of 0,05. The significance level for age has increased to 0,065 from 0,052 as all franchise companies with negative profitability values had to be removed thus decreasing the sample size.

The new density function for the log-normal distribution values thus fulfilling the required normality criteria is depicted in equation 9 below, where "parameters: μ, σ: expectation of st. dev. of log (X)" (Stahel, 2014).

$$\frac{1}{\sqrt[\sigma]{2\pi}} \frac{1}{x} \exp\left(-\frac{1}{2}\left(\frac{log(x)-\mu}{\sigma}\right)^2\right)$$

Equation 9: Density function

Source: Stahel, 2014

To visually depict the newly acquired normal distribution for variables log profitability, log efficiency and log size, the histograms below were created. The histogram showing the normal distribution for the variable age was also constructed. The below figures highlight thus the achieved normal through the log transformation of the data.

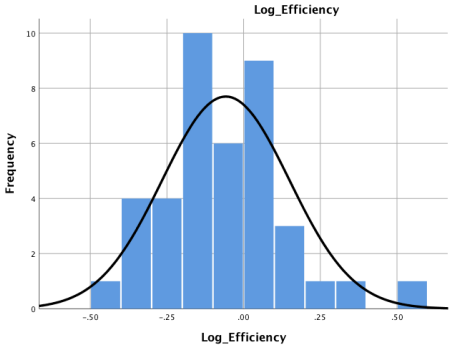

Figure 20: Histogram log efficiency

Source: Researcher's computation

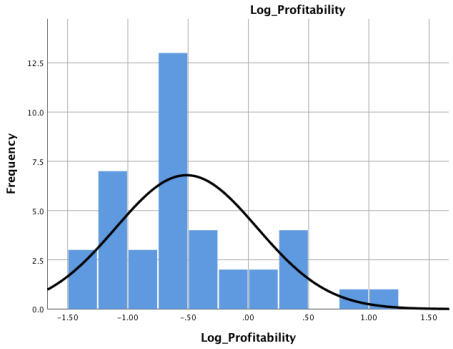

Figure 21: Histogram log profitability

Source: Researcher's computation

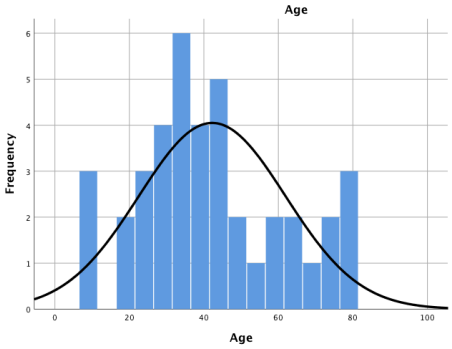

Figure 22: Histogram age

Source: Researcher's computation

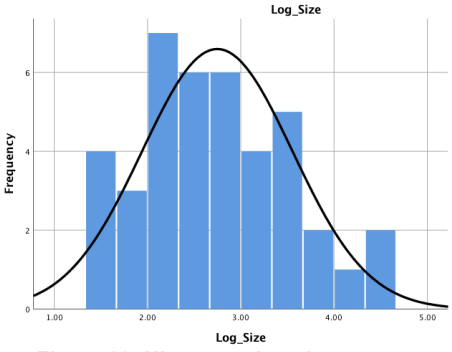

Figure 23: Histogram log size

Source: Researcher's computation

2.3.3. Spearman rank-order correlation

After testing the above assumptions, the Spearman rank correlation can be performed. Generally, correlation is defined as the "extent to which two variables change together" (Minitab Inc., 2016). The correlation coefficient can be anywhere between -1 and 1, where the negative sign indicates a decrease in the dependent variable when the independent variable increases and the positive sign implies that the two variables move together. The closer the coefficient to the negative or positive values of 1 is, the stronger the relationship between the variables. There are two main types of correlation methods that are widely used in literature, the Pearson product moment correlation and the Spearman rank-order correlation. The advantage of the latter method compared to the former one is the fact that in the case of the Spearman correlation the values were transformed into ranked values rather than using the raw data, removing possible irregularities due to non constant distance between two observed values (Minitab Inc., 2016). In this master's thesis, a bivariate correlation was chosen in combination with a two tailed test as the analysis should allow for two outcomes: positive or negative correlation. The results of the Spearman rank-order correlation are shown on table 5 below:

			Log_Efficiency	Log_Profitability	Log_Size	Age
Spearman's rho	Log_Efficiency	Correlation Coefficient	1.000	.088	.057	.223
		Sig. (2-tailed)	.	.601	.732	.179
		N	38	38	38	38
	Log_Profitability	Correlation Coefficient	.088	1.000	.492**	-.071
		Sig. (2-tailed)	.601	.	.002	.670
		N	38	38	38	38
	Log_Size	Correlation Coefficient	.057	.492**	1.000	.222
		Sig. (2-tailed)	.732	.002	.	.180
		N	38	38	38	38
	Age	Correlation Coefficient	.223	-.071	.222	1.000
		Sig. (2-tailed)	.179	.670	.180	.
		N	38	38	38	38

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5: Results of Spearman rank-order correlation

Source: Researcher's computation

Based on the results above, it is clear that the independent variables age and log size always have a positive effect on efficiency. The significance level p is not sufficiently low in either of the cases implying a non-significant correlation in the absence of the p-value being lower than 0,05. This also implies that a correlation obtained by mere chance has the probability of only 5% and that the null hypothesis of no correlation cannot be rejected. The extent of the positive correlation between log efficiency and age is 0,223 with a p-value of 0,179 that implies an 18% chance that the correlation happened by chance. The correlation however between log efficiency and log size is much lower at 0,057 with a significance level of 0,732 that almost reaches the required significance level. On the other hand, the correlation between dependent variable log profitability and independent variable age is slightly negative, whereas the correlation coefficient between log profitability and size is significantly positive. The latter is at 0,492 with a high significance value of 0,002 implying a rather low probability that the correlation has happened by chance. As this value is below the significance level p of 0,05, the criterion for a significant correlation was fulfilled. Spearman's rho shows a somewhat lower negative correlation between log profitability and log age, which is at -0,071 with only a 33% chance that the results did not appear by chance.

These values in themselves are not representative for the study, however they do imply a certain direction in which the results of the linear correlation will lead the research, the computation of which is to follow in the next sub-section of this thesis.

2.3.4 Diagnostic test

In order to assure the relevancy of the linear regression model, the serial correlation test and the test for heteroscedasticity have to be performed.

2.3.4.1 Serial correlation test

The serial correlation test was carried out by using the Durbin Watson Test (d-test). This is widely used to understand if "the residuals from a linear regression or multiple regression are independent" (Everitt & Skrondal, 2010, p. 145). The d-test can take up any result between 0 and 4, while 0 denominates the lowest possible level for the result of the test, denominated d_l .The upper value would be 4,00, also denominated with d_U. As mentioned above, the hypothesis of no autocorrelation being present shall not be rejected if d is > d_U, the limit being determined by the number of regressors "k", the sample size "n" and the significance level "α". The critical limits can be seen on the table below:

Sample Size	Probability in Lower Tail (Significance Level= α)	k = Number of Regressors (Excluding the Intercept)									
		1		2		3		4		5	
		d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U
15	.01	.81	1.07	.70	1.25	.59	1.46	.49	1.70	.39	1.96
	.025	.95	1.23	.83	1.40	.71	1.61	.59	1.84	.48	2.09
	.05	1.08	1.36	.95	1.54	.82	1.75	.69	1.97	.56	2.21
20	.01	.95	1.15	.86	1.27	.77	1.41	.63	1.57	.60	1.74
	.025	1.08	1.28	.99	1.41	.89	1.55	.79	1.70	.70	1.87
	.05	1.20	1.41	1.10	1.54	1.00	1.68	.90	1.83	.79	1.99
25	.01	1.05	1.21	.98	1.30	.90	1.41	.83	1.52	.75	1.65
	.025	1.13	1.34	1.10	1.43	1.02	1.54	.94	1.65	.86	1.77
	.05	1.29	1.45	1.21	1.55	1.12	1.66	1.04	1.77	.95	1.89
30	.01	1.13	1.26	1.07	1.34	1.01	1.42	.94	1.51	.88	1.61
	.025	1.25	1.38	1.18	1.46	1.12	1.54	1.05	1.63	.98	1.73
	.05	1.35	1.49	1.28	1.57	1.21	1.65	1.14	1.74	1.07	1.83
40	.01	1.25	1.34	1.20	1.40	1.15	1.46	1.10	1.52	1.05	1.58
	.025	1.35	1.45	1.30	1.51	1.25	1.57	1.20	1.63	1.15	1.69
	.05	1.44	1.54	1.39	1.60	1.34	1.66	1.29	1.72	1.23	1.79
50	.01	1.32	1.40	1.28	1.45	1.24	1.49	1.20	1.54	1.16	1.59
	.025	1.42	1.50	1.38	1.54	1.34	1.59	1.30	1.64	1.26	1.69
	.05	1.50	1.59	1.46	1.63	1.42	1.67	1.38	1.72	1.34	1.77
60	.01	1.38	1.45	1.35	1.48	1.32	1.52	1.28	1.56	1.25	1.60
	.025	1.47	1.54	1.44	1.57	1.40	1.61	1.37	1.65	1.33	1.69
	.05	1.55	1.62	1.51	1.65	1.48	1.69	1.44	1.73	1.41	1.77
80	.01	1.47	1.52	1.44	1.54	1.42	1.57	1.39	1.60	1.36	1.62
	.025	1.54	1.59	1.52	1.62	1.49	1.65	1.47	1.67	1.44	1.70
	.05	1.61	1.66	1.59	1.69	1.56	1.72	1.53	1.74	1.51	1.77
100	.01	1.52	1.56	1.50	1.58	1.48	1.60	1.45	1.63	1.44	1.65
	.025	1.59	1.63	1.57	1.65	1.55	1.67	1.53	1.70	1.51	1.72
	.05	1.65	1.69	1.63	1.72	1.61	1.74	1.59	1.76	1.57	1.78

Table 6: Critical values of the Durbin Watson statistic

Source: New York University, 2017

In this thesis the sample size is 50 < n < 60 and hence d_L = 1,55 and d_U = 1,62, which can be determined from table 6 as shown above. The results of the Durbin-Watson test are summarized in the below table:

Variables	R	R square	Adjusted R Square	Std. Error of Estimate	Durbin Watson
Log efficiency vs. size	0,051	0,003	-0,025	0,21181	**1,902**
Log efficiency vs. age	0,187	0,035	0,008	0,20832	**1,758**
Log profitability vs. size	0,518	0,268	0,248	0,42414	**2,359**
Log profitability vs. age	0,058	0,003	-0,024	0,49485	**2,351**

Table 7: Summary of the Durbin Watson Test

Source: Researcher's computation

All four d-statistic values are above the upper limit of 1,62 and hence the null hypothesis cannot be rejected implying that no autocorrelation exists. This implies for the future regression analysis that this will provide reliable results.

2.3.4.2 Heteroscedasticity

In the next step homoscedasticity will be tested for, to conclude whether the two predictor variables have the same distance from the regression line or not. In order to reject the presence of heteroscedasticity, the Breusch-Pagan test will be used. This will be done by generating unstandardized predicted values and residuals to generate the square value of residuals. To conclude on heteroscedasticity, the squared values will be used as the dependent variables. The below tables show the test completed for the dependent variable log efficiency and log profitability respectively.

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.031	.017		1.826	.077
	Age	.000	.000	.273	1.496	.145
	Log_Size	-.009	.006	-.266	-1.458	.155

a. Dependent Variable: RES12

Table 8: Breusch-Pagan test for the variable log efficiency

Source: Researcher's computation

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.036	.104		.342	.735
	Age	-.002	.001	-.219	-1.197	.240
	Log_Size	.066	.039	.311	1.705	.098

a. Dependent Variable: RES22

Table 9: Breusch-Pagan test for the variable log profitability

Source: Researcher's computation

Table 8 shows the results when testing for age and log size as independent variables and log efficiency as the dependent variable. The significance level p is for age 0,145 and for log size 0,155. Table 9 shows the results for the coexistence between the constant - profitability – and the independent variables age and log size. The significance level in these both cases amount to 0,240 and 0,098 respectively. It can be concluded for both tables when examining the significance levels p that these are larger than 0,05 implying the presence of homoscedastic residuals. Thus, the null hypothesis concerning the absence of heteroscedasticity cannot be dismissed and hence the presence of homoscedastic residuals is confirmed fulfilling the second criteria required to pursue the linear regression analysis.

2.3.5 Linear regression analysis

2.3.5.1 Correlation age & log efficiency

The below summary table shows the result of the linear regression between the variables age and log efficiency.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.187[a]	.035	.008	.20832	1.758

a. Predictors: (Constant), Age

b. Dependent Variable: Log_Efficiency

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.057	1	.057	1.311	.260[b]
	Residual	1.562	36	.043		
	Total	1.619	37			

a. Dependent Variable: Log_Efficiency

b. Predictors: (Constant), Age

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.132	.079		-1.665	.105
	Age	.002	.002	.187	1.145	.260

a. Dependent Variable: Log_Efficiency

Figure 24: Linear regression analysis: age & log efficiency

Source: Researcher's computation

The summary of the first table above demonstrates that exactly one model was tested. The value R amounts to 0,187 that stands for the correlation between the two variables tested in this model, namely age and log efficiency. This value is slightly lower as the one shown in the Spearman rank-order correlation before, mainly due to the latter being computed with the use of ranked values. The Pearson correlation was also undertaken to determine whether this is indeed the reason for the discrepancy. This also shows a value of 0,187 for the correlation between these two variables, highlighting this argument. R square amounts to 0,035, which is the "proportion of variance in the dependent variable which can be explained by the independent. This is an overall measure of the strength of association and does not reflect the extent to which any particular independent variable is associated with the dependent variable" (UCLA: Statistical Consulting Group, 2017). In general R square can have the value anywhere between 0,00 and

1,00; the higher the number, the better the model in question. R squared is also easily computed manually by dividing the explained variation by the total variation. The adjusted R square even shows a lower number, 0,008 that implies a correction of R square that leads to an exclusion of irregularities caused by other predictor variables. This is computed by calculating 1 – ((1 – R square) ((N – 1) / (N – k – 1)), in which “k” implies the number of independent variables distorting the values.

The analysis of variance table (ANOVA) shows the total variance, which is divided into variance that “can be explained by the independent variables (Regression) and the variance, which is not explained by the independent variables (Residual)” (UCLA: Statistical Consulting Group, 2017). The sum of squares is “associated with the three sources of variance” (UCLA: Statistical Consulting Group, 2017). These sums show the “squared difference of each observation from the overall mean” (Everitt & Skrondal, 2010, p. 432). This aims to conclude on the dispersion from the mean to see how well the data fits into the model. The total sum of squares is 1,619, which is made up of the variance explained by the independent variable age amounting to 0,057 and the one not explained by the independent variable, amounting to 1,562. This implies that only 5,7% of total variance from the best-fit line can be explained by age. The total degrees of freedom (DF) always denominate the number of observations N minus 1,00. “The Regression degrees of freedom corresponds to the number of coefficients estimated minus 1” (UCLA: Statistical Consulting Group, 2017). In this case, the model has two coefficients including the intercept and hence the number shown will be 1,00. The residual degrees of freedom is always the total degrees of freedom minus the one standing for the regression, which in the case of this analysis amounts to 36,00 (UCLA: Statistical Consulting Group, 2017). These numbers do not have a separate meaning in themselves as they only represent “the number of independent units of information in a sample relevant to the estimation of a parameter or calculation of a statistic” (Everitt & Skrondal, 2010, p. 127). The following parameter, the mean square “estimates the assumed common variance in the k groups” (Everitt & Skrondal, 2010, p. 275). It is simply calculated by dividing the respective sum of squares with the corresponding DF. The ANOVA

table also highlights two important measurements, the F-statistic and the corresponding p-value. The F-statistic is computed by dividing the mean square of the regression with the mean square of the residual. This aims to conclude if the means of the two values tested are significantly different. The F-statistic can take a value from 0,00 to a very large number. The F-value in this case (1,311) implies low variability between the means relative to the variability of observed values. The F-value does not lead to a definite conclusion, it is used with the associated p-value, which in this case is 0,260 implying that the model cannot statistically significantly forecast the outcome of the dependent variable as the p-value is not below the required level 0,05 (UCLA: Statistical Consulting Group, 2017).

When looking at the third table in figure 25 showing the coefficients, firstly it is concluded that the constant, also called the Y intercept is at -0,132. This shows the point where the regression line meets the Y-axis and depicts also the value of the regression equation if all other values are set equal to 0,00. The coefficient for age is 0,02, which implies that for every unit increase in age, log efficiency grows by 0,02 as well. This means that every year, the efficiency of the franchised outlets would be 2% more efficient if the results were significant. The regression equation would hence be as follows: Log efficiency = -0,132 + 0,02 (Age). This also shows a positive relationship between age and log efficiency, a correlation that was already predicted by the Spearman's rho above. The standard error for the coefficient for age is at 0,02. The standardized coefficient beta for age is 0,187, which is the coefficient that could be acquired if all variables were on the same scale leading to a standardization of all variables before running the regression analysis. This usually has the advantage that coefficients can be compared amongst each other directly to conclude which one has the largest impact on the dependent variables (UCLA: Statistical Consulting Group, 2017). The t-statistics of the coefficient age is 1,145 with the associated significance of 0,260. This is already considering a two-tailed significance level, which allows for results in both positive and negative directions. These results are not significant as the p-value exceeds the required minimum alpha level of 0,05 and thus the null hypothesis of no significant relationship cannot be rejected.

2.3.5.2.Correlation age & log profitability

The below summary table demonstrates the outcome of the linear regression between the independent variable age and its predictor log profitability.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.058[a]	.003	-.024	.49485	2.351

a. Predictors: (Constant), Age

b. Dependent Variable: Log_Profitability

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.030	1	.030	.122	.729[b]
	Residual	8.816	36	.245		
	Total	8.845	37			

a. Dependent Variable: Log_Profitability

b. Predictors: (Constant), Age

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.531	.189		-2.818	.008
	Age	-.001	.004	-.058	-.349	.729

a. Dependent Variable: Log_Profitability

Figure 25: Linear regression analysis: age & log profitability

Source: Researcher's computation

The one-test model above shows a correlation between age and log profitability of 0,058 expressed by the value R. This result differs from the one obtained earlier through the Spearman rank-order correlation, which has shown a negative correlation of 0,071 associated with a significance level of 0,670 implying a 67% chance for a correlation by chance. To approach the reason behind this inconsistency, a Pearson correlation was also undertaken, which does not consider ranked values as opposed to the Spearman rank-order correlation, which might be the reason for this discrepancy. This coefficient also showed a value of -0,058 and hence a negative relationship between these two variables can be confirmed, which will be further strengthened by the adjusted R square which is also a negative value. This is an improved value in terms of accuracy compared the R value, as it does not account for the impact caused by other predictor variables. The R square for this analysis amounts to 0,003 implying that only 0,3% of the variation in log profitability can be explained by age, which is almost neglectable as this fails to show a strong association.

The ANOVA table shows for sum of squares for the regression the value 0,030 and for the residual 8,816 leading to a total of 8,845 through the addition of these two values. This implies that 0,030 in variance of log profitability can be explained by the independent variable, while the rest of the variance can not be, highlighting that only about 3% that can be reasoned. The total degrees of freedom shows the same values as on the table above due to the fact that the same model was analyzed, hence a DF of 1,00 for regression and DF of 36,00 for the total. The mean square for the regression naturally coincides with the sum of squares, as DF is 1,00. The residual's mean square is at 0,245 showing the remaining common variance. Additionally, it is clear that a rather low F-value of 0,122 is present, implying that the means of the two variables are really close to each other. However the associated p-value is at 0,4729, which fails to allow for a decisive conclusion as it is not below the alpha value of 0,05 and is hence not significant.

The table showing the coefficients for this regression analysis concludes on a Y-intercept of -0,531, which implies the point where the regression line crosses the Y-axis. This would be the value of the equation when all other variables are equal to 0,00. The coefficient for age in this case is -0,001, which means that for each unit increase in age, log profitability decreases by -0,001. The equation hence looks as follows: Log profitability = -0,531 – 0,001 (Age). The real life example would be that every year as the company gets older, profitability decreases by 0,1% if the results were significant. These outcomes further highlight the ones interpreted above and underline the negative correlation concluded on in the Spearman correlation. This low value also shows that age has a very low impact on profitability. The standard error for this analysis is 0,004, while the standardized coefficient beta amounts to -0,058 highlighting the true impact of age on profitability. If all variables were converted to a standardized scale, then for every unit increase in age, profitability would decrease by -0,058. The t-statistics amounts to -0,349 with an associated level of significance of 0,729. This does not meet the minimum requirement for the alpha value of 0,05 and hence it can be concluded that there is no significant relationship between these two variables. Thus the null hypothesis of the absence of influence between these two variables cannot be rejected and the alternative hypothesis cannot be accepted.

2.3.5.3. Correlation log size & log efficiency

The below summary table shows the results for the linear regression between the independent variable log size and its predictor log efficiency.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.051[a]	.003	-.025	.21181	1.902

a. Predictors: (Constant), Log_Size

b. Dependent Variable: Log_Efficiency

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.004	1	.004	.093	.762[b]
	Residual	1.615	36	.045		
	Total	1.619	37			

a. Dependent Variable: Log_Efficiency

b. Predictors: (Constant), Log_Size

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.086	.122		-.703	.487
	Log_Size	.013	.043	.051	.305	.762

a. Dependent Variable: Log_Efficiency

Figure 26: Linear regression analysis: log size & log efficiency

Source: Researcher's computation

Similarly to above, it is clearly visible that only one model was tested. The correlation between the two variables log efficiency and log size is a positive one with an R value of 0,051. When comparing this value with Spearman's rho, this is almost identical as the former one amounted to 0,057 with a significance level of 0,732. The Pearson correlation was examined between these two variables as well, which also amounts to 0,051. The R Square shows a value of 0,003 implying that almost none of the variance of log efficiency can be explained by log size. The adjusted R square shows a somewhat lower number, -0,025 as this value has already been adjusted for possible irregularities. As the difference between these two values is not too large, this highlights the presence of a model would propose a good fit.

The ANOVA table has also concluded on rather low values implying a low dispersion from the mean and supporting the presence of the above data fitting

well into the model. The variance in the dependent variable that can be explained by the independent variable is at 0,004, which is about 2,5%. The total sum of squares is at 1,610, which implies a low overall spread from the mean. The residual sum of squares amount hence to 1,615. The degrees of freedom are in this case identical with the two analyses from above as the same data was used. The mean square showing the common variance within the group is also rather low, for the regression this is identical to the sum of squares as DF in this case is 0,004 again, while for the residual amounts to 0,045. The F-statistic is at 0,093, with the associated p-value at 0,762 implying no statistical significance. However, the significance value is not below the alpha level of 0,05 and hence the null hypothesis of no significant relationship existing between log size and log profitability cannot be rejected.

With regards to the linear regression equation, it can be concluded that the Y intercept is at -0,086 and thus the best-fit line meets the Y-axis again in a negative way. The coefficient for log efficiency is 0,013. This means that for every unit increase in size, log efficiency grows by 0,013 highlighting again a positive dependence, which was already concluded on in the observations for the Pearson correlation as well as Spearman's Rho. The equation hence would be as follows: Log efficiency = -0,086 + 0,013 (Log size). In real life, this represents that with every new outlet that the franchise company would open, efficiency could grow by about 1,3%. The associated standard error for the independent variable log size is 0,043, while the same for the dependent variable is 0,122. The standardized coefficient beta for log size is 0,051 implying that if all values had been transformed into a standardized scale, the influence of log size on log efficiency would have been significantly higher. This would mean that for every unit increase in size, log efficiency would grow by 0,051. The t-statistics for the variable log size is at 0,305 with an associated p-value of 0,762.

2.3.5.4.Correlation log size & log profitability

The below summary table summarizes the results for the linear regression between the independent variable log size and its predictor log profitability.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.518[a]	.268	.248	.42414	2.359

a. Predictors: (Constant), Log_Size

b. Dependent Variable: Log_Profitability

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.369	1	2.369	13.170	.001[b]
	Residual	6.476	36	.180		
	Total	8.845	37			

a. Dependent Variable: Log_Profitability

b. Predictors: (Constant), Log_Size

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-1.439	.244		-5.907	.000
	Log_Size	.313	.086	.518	3.629	.001

a. Dependent Variable: Log_Profitability

Figure 27: Linear regression analysis: log size & log profitability

Source: Researcher's computation

The one-model test shows a correlation between log size and log profitability of 0,518, implying a strong positive correlation. The results for the correlation through the Spearman rank correlation are slightly lower at a value for the Spearman's Rho of 0,492 with a significance level of 0,002 showing a very low probability for this correlation has only happened by chance. The Pearson correlation for the two variables was also undertaken with similar results as shown above: the correlation coefficient R is at 0,518 with a significance level of 0,001, which is again very low. The corresponding R square also shows a rather good result at 0,268 implying that about 27% of variance in log profitability can be explained by the independent variable log size. Looking at the adjusted R square, which shows the adjusted correlation between these two variables after having corrected for irregularities due to other variables, is at 0,248, which is close to the R square value implying that

only minor corrections were necessary. The associated standard error of the estimate is at 0,42.

When considering the ANOVA table, the total sum of squares is high in comparison to the above results at 8,845. The regression sum of squares is 2,369 implying that not even 27% of the variance in log profitability can be explained by the size, highlighting the results for the R square value. The variance that cannot be explained by the independent variable is 6,479, which amounts to about 2/3 of the total. The degrees of freedom is again 1,00 in case of the regression and 36,00 for the residual, similar to the values above as the same model was tested. The regression mean square is at 2,369 while the residual mean square amounts to 0,180. The corresponding F-value is at 13,17 showing a rather high variability with a very low significance level of 0,001, highlighting again the fact that significant statistical results are present as the value is lower than the required alpha value of 0,05. It can thus be concluded that the null hypothesis of no presence of dependence between the two variables log size and log profitability can be rejected. A positive relationship can be concluded on and the alternative hypothesis can be accepted.

The Y-intercept is at -1,439 implying the area at the Y-axis where the regression line crosses through. This would also be the value for the regression equation should all other values be set to 0,00. The coefficient for log size is 0,313, which means that for every unit increase in log size, profitability increases by 0,313. The equation thus would look as follows: Log profitability = -1,439 + 0,313 (Log size). The corresponding t-statistic is at 3,629 with the standardized coefficient beta at 0,518. This would imply for the franchise outlets that with every new outlet opened, the profitability would increase by this value if the data were standardized earlier.

3. Suggestions, Implementations & Limitations

3.1. Limitations

3.1.1. Super-efficiency model

The first problem originates from the weights allocated to each DMU. When computing the mathematical equation of the DEA model, the DMUs receive a rank score, but for the individual units, individual weights are allocated. This leads to the problem mentioned above already, the distortion of the results as the multiplier effect of the weights cannot be leveraged on. A further problem arises through the presence of specialized food and beverage outlets, which due to the one especially great performance of specific input or output variable the entire analysis could be distorted by moving the efficiency frontier in a certain direction. The third problem of the model lies in the fact that some of the results deemed as super-efficient might fail to prove feasible in real life thus not providing useful data (Adler, Friedman, & Sinuany-Stern, 2002, pp. 253 - 254).

3.1.2. Type of data analyzed

Limitations develop through the lack of generalizability of the study. As only a small fraction of franchise companies were analyzed, no general conclusion for the entire franchise industry can be made. Additionally to that, the mean age of companies analyzed is 40 years, with a minimum of 11 years and a maximum of 83 years of age, which limits the analysis for these age categories only. In addition to this, the fact that only companies quoted on the U.S. stock exchange were analyzed, exclude young companies from the analysis not allowing for a comprehensive overview. The mean for the organizational size is at 432 outlets, with a maximum of 36.525 food and beverage franchise locations and a minimum of 25 outlets. This also implies a limitation in size and leads to the absence of generalizability. Companies with total operating sales averaging at USD 1.5 billion were analyzed with a maximum of USD 25 billion, while earnings before interest and tax (EBIT)

averaged at USD 250 million and was at a maximum of USD 7 billion. These two criteria also further limit the scope of the analysis.

3.1.3. Geographic location

Furthermore, only companies quoted on the New York Stock Exchange (NYSE) or the National Association of Securities Dealers Automated Quotations (NASDAQ) in the United States were considered and hence the results cannot be projected to food and beverage companies in any other country. This is underlined by the argument as pointed out by Majumdar in his 1997 study, stating that results concerning the relationship between age and performance might be restrictive due to the limitations in a certain country and hence cannot be generalized (Majumdar, 1997, p. 240).

3.1.4. Year of the data

Due to the limiting scope of the study, only the year 2015 was analyzed. Through the introduction of other years, the scope of the investigation could have been improved and hence might lead to different results. Through the fact that only one year has been analyzed, companies with negative profitability values had to be removed due the log transformation of the data, which has led to a drastic reduction of the sample size. Through the presence of multi-annual data, it would have been possible to only remove certain years from the analysis without having to exclude the entire company from the analysis.

3.2. Suggestions

3.2.1. Expand geographic location

In this master's thesis only companies quoted on the NYSE or NASDAQ were considered, as mentioned above and hence an expansion of the analysis into further countries where the same food and beverages outlets are present, would be of advantage to the academic literature. Franchised chains in different countries might show a different financial behavior and hence the impact of age and size could also be different. As each country shows different demographics, social behavior and trends, significantly different results might emerge.

3.2.2. Expand type of data analyzed

For further research, companies that are below the minimum age and above the maximum age analyzed in this master's thesis should be included for further research. Additionally to this aspect, companies of a smaller and larger size compared to the ones subject to previous analysis should also be analyzed. Food and beverage corporations with larger total operating sales and EBIT could also be added to further broaden the scope of the existing literature on the topic. Depending on the data available to researchers, further explanatory variables might also be added to the analysis to strengthen the validity of the results.

3.2.3. Expand sector of analysis

In this master's thesis only franchised food and beverage companies were considered. The analysis could be expanded onto various types of restaurants or even onto a different sector, such as manufacturing, financial services, lodging, aviation, etc.

3.2.4. Improve number of years analyzed

During the course of this analysis only one year was analyzed due to the limited resources available for this research. The number of years could be expanded to 5-10 years similar to previous studies in the field to allow concluding on more significant results.

3.3. Implementation

The results above have shown a significant positive relationship between size and profitability, which implies that companies should strive for continuous growth to drive their profitability potential. Through the growing size, companies can also leverage on the economies of scale effect, the diversification potential, the ability to rapidly adapt to change and to initiate counter moves towards competition and can benefit from a more transparent management structure due to its separation typical for larger companies.

The non-significant positive linear relationship between efficiency and age as well as efficiency and size unfortunately fail to carry a meaningful potential for implementation. The statistically insignificant regression analysis between age and profitability has shown negative results, which only means for future implementation that the financial performance of aging companies is uncertain and these two variables do not have a direct implication on each other.

4. Conclusion

The master's thesis has researched the link between a company's efficiency, profitability, age and size with an original sample size of 56 companies. All food and beverage companies examined were quoted on the United States stock exchange in the year of 2015. In the first part of this study, data envelopment analysis has led to a conclusion that 39% of the analyzed companies are already operating at full efficiency when compared amongst each other. These most efficient franchise concepts include McDonalds which is the largest company in this analysis, Dunkin Brands Group, which is the fourth largest company analyzed and Domino's Pizza which ranks just behind the Dunkin Brands Group in terms of size. Thus it does not come as a surprise that the linear regression analysis has also concluded on a slight positive relationship (R = 0,051) between the size of a company and its efficiency as well as a positive regression coefficient (unstandardized beta = 0,013) even though it failed to show significant results. Thus the relationship between these two variables has to remain subject to further analysis.

The results of the profitability analysis however show statistically significant results when questioning its relationship to the size of the company. Under the exclusion of the outliers, the most profitable outlet was Papa John's International with a 270% return on equity ranked on 7th place in terms of size, followed by the health-conscious company Freshii with only 244 outlets ranked only 36th when considering the size of the enterprise. The third rank in terms of ROE was granted to the innovative juice company Jamba Juice with 893 locations on rank 19 with a return on equity of 205%. These are followed by Yum Brands!, Popeys' Louisiana Kitchen and McDonalds which are ranked on average in terms of size somewhat higher than the first three companies, all among the top 12 largest companies. Thus the linear regression analysis concluded on a significant relationship between the company size and its profitability with an unstandardized regression coefficient of 0,313 and R equals to 0,518 at a significance level of 0,001. These results are in

line with Akinyomi et al. (2013, p. 1172), Papadogonas (2007, p. 1), (Majumdar, 1997, p. 231). Doğan (2013, p. 54), Akinlo (2011, p. 706) and Sritharan (2015, p. 1).

When considering the relationship between efficiency and age, no significant results were concluded on, despite the fact that these non-significant results suggest a slightly positive correlation (R = 0,187) between these two variables due to the positive correlation coefficient and also somewhat positive regression coefficient (unstandardized beta = 0,002) of the variable age. The most efficient company, the Bravo Brio Restaurant Corporation is slightly below the mean age, while the second most efficient corporation Biglari Holdings is the oldest corporation in the data set. This is followed by the Rave Restaurant Group in terms of efficiency which is positioned in the first quarter when ranked according to age with 57 years of successful operations. Three of the oldest companies, Krispy Kreme Doughnuts, Yum Brands! and McDonalds have also reached top ranking for relative efficiency with Yum Brands!' position being the lowest among these three with 91% of relative efficiency.

Similar results have arisen from the analysis for the relationship between profitability and age. The most profitable company Papa John's International is ranked around the mean with 37 years of age, the company ranked second and third, Freshii and Jamba Juice are rather young with only 10 years. The following three companies, Yum Brands!, Popeys' Louisiana Kitchen and McDonalds belong however to the upper end of the companies when ranked according to age. Keeping in mind these contradictory results, it does not come as a surprise that the results of the linear regression analysis could not statistically prove a relationship between age and profitability. The non-significant results would suggest a slight negative relationship due to the negative regression coefficient of the independent variable amounting to -0,001. Hence this study could not contribute to filling the gap between the controversial views surrounding the relationship between profitability and age.

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6. Appendix

6.1. Term definition

Quick Service Restaurants: "Includes limited-service eating places, cafeterias, fast-food restaurants, beverage bars, ice cream parlors, pizza-delivery establishments, carryout sandwich shops, and carryout service shops with on-premises baking of donuts, cookies, and bagels." (IHS Markit Economics, 2017, p. 27).

Table/Full Service Restaurants: "Establishments primarily engaged in providing food services to patrons who order and are served while seated (i.e., waiter/waitress services) and pay after eating." (IHS Markit Economics, 2017, p. 27).

Retail Food: "Includes food and beverage stores; convenience stores; food-service contractors; caterers; retail bakeries; and beer, wine, and liquor stores; as well as gas stations with convenience stores." (IHS Markit Economics, 2017, p. 27).

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Source: Franchising World, April 2015