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**CANKIRI KARATEKIN UNIVERSITY
INSTITUTE OF GRADUATE STUDIES
BUSINESS ADMINISTRATION DEPARTMENT**

**LOGISTIC OUTSOURCING'S IMPACT ON THE COST
PERFORMANCE OF USA COMPANIES IN THE FOOD
INDUSTRY**

Abdoulrahman Adoita Ahmed

MASTER'S THESIS

**Supervisor
Assist. Prof. Dr. Hasan DÜNDAR**

Çankırı – 2024

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SCIENTIFIC ETHICS STATEMENT

In the process from the proposal stage to the conclusion of the study titled *Logistic Outsourcing's Impact on the Cost Performance of US Companies in the Food industry*, which I prepared as a master's thesis, I carefully followed the academic ethics and rules that I obtained all the information in the thesis within the framework of academic ethics and tradition that I prepared in accordance with the rules of writing the thesis. I declare that I cited every citation as a reference and that the works I have benefited from are those shown in the bibliography.

23 / 07/ 2024

Signature

Abdoulrahman Adoita Ahmed

THESIS ACCEPTANCE AND APPROVAL

ÇANKIRI KARATEKIN UNIVERSITY

TO THE DIRECTORATE OF THE INSTITUTE OF GRADUATE STUDIES

This study titled *Logistic outsourcing's impact on the cost performance of USA companies in the food industry* prepared by *Abdoulrahman Adoita Ahmed* was found successful *unanimously/by majority of votes* as a result of the thesis defense held on *23.07.2024* and was accepted as a Master's thesis in the Business Administration Department by our jury.

THESIS JURY MEMBERS:

Supervisor: Assist. Prof. Dr. Hasan DÜNDAR	Signature:
Member: Assist. Prof. Dr. Bilge MEYDAN	Signature:
Member: Assist. Prof. Dr. Pembe GÜÇLÜ	Signature:

APPROVAL

This Thesis has been accepted by the jury determined in the session of Çankırı Karatekin University Institute of Graduate Studies Administrative Board, dated 11/07/ 2024. And numbered 2024/31-26-A

Prof. Dr. Ersoy YILMAZ

Director of the Institution

PREFACE

I want to express my gratitude to my respected lecturer Assist. Prof. Dr. Hasan Dündar. I would like to express my gratitude to the academic members of the Department of Business Administration, whose insights and recommendations about my thesis were helpful to me.

I want to convey my unending gratitude and love to my loving mother, father, the rest of my family and my friends, who have always been by my side and supported me financially and emotionally as I pursued my education and thesis work.

23 / 07/ 2024

Abdoulrahman Adoita Ahmed

ABSTRACT

Thesis Title : The impact of logistics outsourcing on companies' cost performance in the USA in the food industry
Author of the Thesis : Abdoulrahman Adoita Ahmed
Supervisor : Assist. Prof. Dr. Hasan Dündar
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Outsourcing logistics activities is an important issue for companies in the food industry. Therefore, it is important to outsource storage and transport services or carry out these activities in-house. The purpose of this study is to measure the impact of outsourcing logistics activities on the cost performance of companies operating in the American food industry between the years 2019 and 2022. The Malmquist Productivity Index was used to determine the long term performance of the companies. In this index, three inputs (annual assets, operation costs and number of employees) and three outputs (annual profit, annual sales and annual revenue) data are considered. The data set used in this study is the compound annual growth rate and annual return on assets, respectively. The data is collected from the food sector, which meets the most important needs of the society. In terms of transparent data access and reliability of the data, the data set used in this study is the data set of businesses operating in the United States. According to the results obtained, it was determined that companies that carry out transport and storage activities by outsourcing have the highest return on assets and lower debt. Although, the companies that in-housed these activities have better efficiency and higher debt.

Keywords: Cost performance, Transportation and warehousing, External Benchmarking, and Malmquist Productivity Index.

ÖZET

Tez Adı : ABD'de gıda endüstride lojistik dış kaynak kullanımının şirketlerin maliyet performansına etkisi.
Tezin Yazarı : Abdoulrahman Adoita Ahmed
Danışman : Dr. Öğr.Üyesi Hasan Dündar
Anabilim Dalı : İşletme
Tez Türü : Yüksek Lisans Tezi
Kabul Tarihi : 23.07.2024

Lojistik faaliyetlerinde dış kaynak kullanımı, gıda endüstrisindeki şirketler için önemli bir konudur. Bu nedenle depolama ve taşıma hizmetlerinde dış kaynak kullanımı veya bu faaliyetleri işletmenin kendi bünyesinde yürütmek önemli bir karardır. Bu araştırmanın amacı, Amerikan gıda endüstrisinde faaliyet gösteren işletmelerin 2019-2022 yılları arasında lojistik aktivitelerinde dış kaynak kullanımının maliyet performanslarına etkisini ölçmektir. Şirketlerin performanslarını karşılaştırmak için Malmquist Verimlilik Endeksi kullanılmıştır. Bu endekste üç girdi (yıllık varlıklar, operasyon maliyetleri ve çalışan sayısı) ve üç çıktı (yıllık kâr, yıllık satış ve yıllık gelir) verisi dikkate alınmıştır. Bu çalışmada kullanılan veri seti sırasıyla yıllık bileşik büyüme oranı ve varlıkların yıllık getirisidir. Veri seti, toplumun en önemli ihtiyacını karşılayan gıda sektöründen toplanmıştır. Şeffaf veri erişimi olması ve verilerin güvenilirliği açısından, bu çalışmada kullanılan veri seti Amerika'da faaliyet gösteren işletmelerin veri seti kullanılmıştır. Elde edilen sonuçlara göre, taşıma ve depolama faaliyetlerini dış kaynak kullanımı yoluyla gerçekleştiren şirketlerin en yüksek aktif kârlılığın ve daha düşük borca sahip olduğu tespit edildi. Buna karşın, bu faaliyetleri bünyesinde barındıran şirketler daha iyi verimliliğe, daha yüksek borca sahiptir.

Anahtar Kelimeler: Maliyet Performansı, Taşıma ve Depolama, Dışsal Karşılaştırma ve Malmquist Verimlilik Endeksi.

ABBREVIATIONS AND SYMBOLS

2PL	Second Party Logistic
3PL	Third Party Logistic
4PL	Fourth Party Logistic
ADM	Archer-Daniels-Midland
ASP	Aerated Static Pile
CAGR	Compound Annual Gross Rate
DEA	Data Envelopment Analysis
DMU	Decision Making Unit
EFFCH	Efficiency Change
ICT	Information and Communications Technologies
IT	Information Technology
JBS	José Batista Sobrinho
MNE	Multinational Enterprise
MPI	Malmquist Productivity Index
NAFTA	North American Free Trade Agreement
NOPAT	Net Operating Profitability after Tax
NT	Network Theory
PECH	Pure Efficiency Change
RBV	Resource-Based Theory
ROE	Return on Equity
SBM	Slacks Based Model
SECH	Scale Efficiency Change
SME	Small and medium-sized enterprises
TCE	Transaction Cost Economics Theory
TECHCH	Technical Efficiency Change
TFPCH	Total Factor Productivity Change

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1. INTRODUCTION

Supply chain management (SCM) has become a significant concept in the global market to guarantee the movement of products, information, and transactions efficiently. Thus, companies around the world started to either invest in and improve their logistics capabilities or use the services provided by a third-party logistics provider (3PL). On the other hand, employing a 3PL is a strategic decision that can reduce expenses associated with logistics. Such a decision to outsource logistical tasks, however, can benefit these businesses in terms of cost performance. Nevertheless, such a decision can help them avoid dealing with an SCM that is expanding in complexity and price in relation to the frequency with which such activities are carried out (Janvier-James, 2012; König, A and Spinler, 2016). Thus, companies in the food sector came to understand how outsourcing logistic activities might boost their level of global and local competitiveness as a result and affect the direct cost of their products.

Although there have been many options when it comes to defining outsourcing or contract logistics. In this study, logistic outsourcing will be defined as the choice to delegate all or some of the SCM's activities, including warehousing, and transportation, to another company (Lieb, R. C. 1992; Lieb, Millen, and Van Wassenhove, 1993; Murphy and Poist, 1998; Sink, Langley Jr, and Gibson, 1996; Skjøtt-Larsen, 2000).

According to Elmuti, Kathawala, and Monippallil, 1998, on average, outsourcing saves businesses 9% in expenses while also increasing their capacity and service quality by 15%. The strategy of outsourcing logistic activities, such as transportation, warehousing, and production, is a risky decision. Therefore, it is crucial to take into account how outsourcing some activities can affect businesses' cost performance, either positively or negatively (Elmuti, Kathawala, and Monippallil, 1998).

This study demonstrates how outsourcing transportation and warehousing can positively affect American companies' cost performance in the food sector. This research uses data gathered from Fortune 500 companies, as inputs (operation cost, number of employees, annual assets) and outputs (annual profit, annual sale, and annual revenue) in the food

sector (2019-2021). Still, this research makes use of external benchmarking and compound annual growth rate to illustrate the cost performance of companies outsourcing these logistical activities. However, this data was gathered in order to compare the decision-making units (DMUs) efficiency, assets to profit ratio and debt to equity ratio. Furthermore, this sector was chosen because it is an essential sector for the functioning of a society due to its vital role and the well-being of the American population during the lockdown of COVID-19 with respect to the rules and regulations.

1.1. Background of the Study

Over the past 25 years, outsourcing logistic-related activities such as transportation and warehousing has been one of the key logistical strategies in international SCM (Akbari, M., and Hopkins, 2016; Leslie and Mary, 1995; Miah, Ahsan, and Msimangira, 2014; Pettersson and Segerstedt, 2014). Companies in the global scene became aware of the significance of outsourcing logistic activities by understanding the importance of logistics in SCM in the mid-1990s (König, A., and Spinler, 2016). As a result of SCM's emergence, logistics gained important attention from scholars and companies willing to take advantage of globalization, as well as non-profit organizations. However, outsourcing logistics-related activities started from transportation and warehousing. In other words, the emergence of SCM due to a globalized new economic world order led to the creation, expansion, and evolution of the logistics sector. However, such context resulted in companies developing new strategies, such as outsourcing logistics-related activities, with the aim to increase their level of competitiveness (Hsiao, Kemp, Van der Vorst, and Omta, 2010; Melo, Nickel, and Saldanha-Da-Gama, 2009; Varsei, Soosay, Fahimnia, and Sarkis, 2014). Furthermore, besides the points mentioned so far, outsourcing activities to third parties has been a common logistic strategy for firms and organizations in order to create an efficient logistics capabilities and reach expanding markets with growing demands (Pettersson and Segerstedt, 2014; Schniederjans and Schniederjans, 2007). In other words, logistics activities becoming complicated and started expanding due to globalization, thus outsourcing logistics became an essential strategy for maintaining an efficient SCM (M. Christopher, Lowson, and Peck, 2004; König, A., and Spinler, 2016; Natalia, C., and Astuario, 2015). However, as SCM

became complex, companies had to ensure that their logistics capacities were updated to fulfill the market's demands. And as outsourcing logistics-related activities to 3PL has become one of the most popular themes, businesses have started to outsource some logistic-related activities to enable themselves to concentrate more on their key competencies, they are choosing to outsource transportation, warehousing, and even manufacturing in order to spare investment in such activities (König, A., and Spinler, 2016; Marasco, 2008). As a result, 3PLs are able to positively affect the logistics efficiency of their clients by developing and expanding their capabilities and growing their inventory portfolio. Because they provide a variety of services to meet the demands of their customers and contribute to the timely delivery of their goods (König, A., and Spinler, 2016).

1.2. Statement of the Research Problem

In various studies, researchers investigated how companies make strategic decisions to enhance the efficiency of SCM by improving their logistic capabilities. Thus, such endeavors led to a better grasp of the concept of logistic outsourcing and the identification of the most outsourced logistic activities.

The literature discussed thus far, have investigated the benefits of contracting out logistics related activities, how it is an advantageous decision and the fact that it can become an important strategic decision aiming to update and improve logistic capabilities in order to enhance companies' SCM. This study, however, looks at logistics-related outsourcing from a cost-performance perspective in the USA food sector. However, in this study, we are going demonstrate how outsourcing transportation and warehousing, whether simple or complex, enable US-based companies to improve their cost performance.

In order to answer this question, this study is going to demonstrate how the companies that outsource transportation and warehousing have better cost performance. By focusing on the assets, number of employees and operating used to achieve significant annual profits, annual sales and annual revenue. The concept of cost performance can be defined as how efficiently a company uses its operational assets to set the price of its

products. In this study, it refers to the cost of primary materials (goods and services) induced in the products of the selected companies in order to determine the price of the final products. That is to mean, how companies efficiently use the strategy of outsourcing transportation and warehousing to lower the price of their products. Through the process of outsourcing transportation and warehousing, companies aim to have a low investments on assets. Thus, attaining cost performance by lowering the cost of the services across SCM. The factors determining the price of a finished product are assets, number of employees and operating assets. How much sales, profits and revenue annually, the selected companies produced with regards to their used annual assets, annual number of employees, and annual operating assets in order to attain efficiency, is going to be investigated by using data envelopment analysis.

1.3. Research Objectives

After reviewing the available literature on logistic outsourcing from the 1980s to the present day. There is a significant research gap regarding logistic outsourcing as it pertains to the US food sector. Despite an extensive amount of research on the topic and how it affects businesses in a range of industries. Only this study specifically addresses the dynamics and complexities of the food industry, which are distinguished by particular logistics issues, strict transportation, warehousing, and perishable commodity laws. The primary aim of this study is to examine the potential benefits of outsourcing logistics operations for American-based businesses in terms of cost performance. Therefore, using data envelopment analysis, a constant return to scale (CRS), input-oriented, Malmquist productivity index (MPI). We are going to use external benchmarking to determine the selected companies' cost performance based on how they generate revenue from their operating assets. But also, by looking at how much profit they make relative to their total sales. Furthermore, this research is going to illustrate a company's level of reliance on borrowing. However, in this study, we are going to demonstrate the evolution of their annual sales, annual operating assets, annual assets and profits in order to determine the cost performance of the selected companies.

1.4. Research Questions

- i. How does outsourcing these logistics related activities have an impact on US companies' logistics efficiency in the food sector?
- ii. How does outsourcing logistics activities can affect US food sectors' based companies' operating assets to profits ratio?
- iii. How does outsourcing transportation and warehousing can affect profits to sales ratio of US-based companies in the food sector?
- iv. How does outsourcing transportation and warehousing have an impact on US food sectors' companies' debt to equity ratio and return on equity?

1.5. Significance of the Study

The research being carried out is significant because it provides insights into logistic outsourcing and how it contributes to the overall cost performance of U.S.A based companies in the food sector. The US companies have been selected due to annual data transparency and accessibility. Based on the studies shown thus far, an organization's capacity for on-time delivery and cost efficiency can be achieved by outsourcing logistical tasks to a 3PL. In order to keep ahead of their competitors, companies must be more efficient, concentrate on running an effective organization, and continually come up with new strategies, such as outsourcing logistic-related activities. This study will open the door for firms and organizations to form strategic alliances or partnerships with logistics providers in order to reduce direct expenses. In other words, in order for these companies to strengthen their core competencies, they have to outsource some tasks and narrow their scope of activity so they can concentrate on the tasks they are most adept at.

1.6. Organization of the Study

The purpose of this study is to determine whether outsourcing logistical activities improves the cost-performance of companies operating in the US food industry. We will review the body of material that is currently available in the first chapter. The following chapter will include the logistics partnership-related aspects that affect a company's decision to outsource logistical activities. However, the third chapter will provide the

data envelopment analysis (DEA) approach that will be used to compare the efficiency of DMUs, external benchmarking, return on assets (ROA) and compound annual growth rate before, during and after the pandemic (Covid 19) from 2019-2022. The empirical results, discussion, conclusion and this study's limitations are all included in the fourth chapter.



2. LITERATURE REVIEW

The methodical strategy to review the literature is finding and assessing the gap in the literature. An organized literature review was selected based on the subject matter in order to highlight the gap to be contributed for and determining direction for future study.

When SCM first came into existence in the mid-1980s, among other new fields, it was thought to have a supporting role but gradually it evolved into a more important field of study due to its implications in the manufacturing chain. It is integrated throughout the input to the output of the production cycle. That is to mean from order fulfillment, production, procurement, product development/commercialization, and refunds (Jones and Riley, 1985; Stock and Lambert, 2001; Bowersox, 1997; Christopher, M. 1999; Larson and Halldorsson, 2002).

Numerous publications in the field of logistics have led to a variety of definitions for the term "logistics" and the phenomena of outsourcing (Masson-Franzil, 2003; Skjøtt-Larsen, 2000; Sohail and Sohal, 2003). Logistics can be referred to as the flow of material and information, it is the handling of both physical as well as informational fluxes. This comprises all activities such as stocking, manufacturing, packing, distribution and return logistics (Colin and Pache, 1988; Halley, 1999; Pache and Sauvage, 1999; Samii, 2000).

The idea of contracting logistics-related activities to a 3PL has been discussed in various research studies mentioned so far at the theoretical level, leading to a range of clarifications. The older notion of subcontracting, or subcontractor, has frequently been used as a synonym for 3PL. Outsourcing a logistic-related activity is the procedure by which a company or non-profit organization assigns a 3PL with producing, transporting, or warehousing goods (Masson-Franzil, 2003; Perrotin and Loubere, 1999).

Several stages of evolution have occurred for logistic outsourcing. It went from transportation and warehousing, and it has attained a higher level, such as contracting the production cycle from input to output. Outsourcing has thus evolved into a strategic

move that demonstrates how businesses want to return to their core competencies and find outside talent to fill skill gaps. The concept of outsourcing has somewhat stabilized because of the growing body of outsourcing research. Outsourcing logistics-related activities' procedure is composed of the outsourcer used to perform the activity, now the outsourced task is accompanied by a transfer of assets and the involved parties have a medium- to long-term relationship (Barthelemy, and Donada, 2007).

Cost, strategy, and politics are the three main reasons for outsourcing some production activities, such as warehousing and transportation. The private sector typically outsources these activities. The four variables that indicate the factors that could influence the choice of which function to outsource are strategy, cost, function characteristics, and business environment. They describe how choices made about outsourcing (type, level, reasons, and efficiency factors) in businesses of all sizes and across a range of industries impact the decision-making involved in outsourcing some logistics activities (Akbari, M., and Hopkins, 2016).

But thus far, a number of theoretical frameworks have been discussed, such as the idea of labor distribution, coordination, the significance of outsourcing, and the direct influence on the product pricing (Ivanaj, V., and Franzil, 2006; Hamdouch, 1996; Skjøtt-Larsen, 2000). Nevertheless, the strategic point of view of logistics outsourcing and cost performance will be discussed in depth based on transaction cost economics (TCE), resource-based view (RBV), and network theory (NT).

2.1. Transaction Cost Economics

TCE draws on the well-known publications of Coase, 1998, as the prevailing framework in SCM and management in general. According to Leslie and Mary, 1995, the framework of TCE is also the one statement that scholars use the most to explain why outsourcing is a strategic and cost-effective decision (Leslie and Mary, 1995). TCE determines if a particular activity should be internalized or protected from the market. Williamson, in 1975 and 1985, claimed that information, bargaining, enforcement and low transaction are the keys to be considered before engaging in outsourcing a logistic related activity (Williamson, O. E., 1975, 1985). Furthermore, they determine that the

activity should be outsourced on the open market or not. The activity would be internalized if transaction cost factors mentioned so far were not met by 3PL. One factor that pushes a company to internalize logistics-related activity is bounded rationality. It can be caused by a lack of information or the ability to comprehend incomplete information. Despite their best efforts, companies on the markets are constrained by their incapacity to effectively decide to outsource based on little information which leads to uncertainty. There are three crucial characteristics frequency, uncertainty, and asset specificity that can be used to better explain TCE (Williamson, O. E., and 1991; Aertsen, 1993).

2.2. The Determinants of Logistics Outsourcing

TCE explains outsourcing logistics-related activities from a transactional perspective by focusing on contracts, licensing, brand agreements, and alliances (Williamson, O. E., 1985). When each partner adopts a unique set of contract terms, outsourcing in the logistics sector can be considered a combination of types of governance (David and Han, 2004). Outsourcing a logistic-related activity to 3PL, which includes logistics costs by forming a contract, to maintain competition, is referred to as a hybrid form of hierarchy. Contracts in hybrid forms must follow neoclassical contract law, which is "more flexible and adaptable than classical contract law." The agreement is two-sided, the company and the 3PL, maintain their independence while remaining dependent (Menard, 2003). According to David and Han, the importance of the two parties is significant for creating a profitable partnership. To make this type of decision-making, each of the participants must display an immense amount of tolerance. A conflict is often handled by mediation prior to any judicial appeal (David and Han, 2004).

The explanation of logistics outsourcing by TCE, mentioned so far, has made it possible to claim that an analysis of outsourcing from the standpoint of TCE is important for understanding outsourcing logistic related activities from a contractual and technological point of view. The challenges discussed moving forward relate to how TCE is present in SCM and its role in affecting the choice to outsource logistics related activities.

2.2.1. The Presence of TCE in SCM

TCE can be observed through the transactions incurred in SCM from the input to the output and to the return logistics (Christensen and Rosenbloom, 1995). In this study, the different transactions in the organization referred to are costs related. However, the presence of TCE in SCM involves collecting data, negotiation for a profitable partnership with 3PL and performance control of outsourced logistic related activities. Furthermore, Information about possible 3PL, their skills and expertise, and the clients they serve, for example, offers strategic benefits but also generates knowledge of former costs for an outsourcer. According to Pache, 2002, the information that 3PL must share are the planning, monitoring, and controlling of the outsourced activities with its customers in order for them to figure out if their performance provides a competitive advantage. But sometimes companies should be aware of 3PL that are willfully omitting and misrepresenting the data in order to gain from better trading circumstances (Pache, 2002).

2.2.2. The Characteristics of TCE

In the logistics sector, the level of asset specialization is a crucial element. The degree of distinctiveness of resources relates to the possibility that physical distribution operations may necessitate the use of specialized management or storage facilities based on the many commodities and/or markets they plan to service (Pache and Sauvage, 1999). 3PL are mostly used for transportation, warehousing, and packaging. They have become highly standardized, which tends to reduce the degree of asset distinctiveness. Many relatively simple tasks, like transportation, handling, and warehousing, demand specialized and expensive investments. For instance forklifts, guidance systems and deep freeze storage areas for frozen items (Bienstock and Mentzer, 1999). Outsourcing logistics activities is a strategic decision regarding the fact that 3PLs, as their skills increase, have the expertise to create customized services for their clients that are frequently extremely complex. These highly specialized, limited or non-replicable assets will provide a competitive advantage for their customers (Pache, 2002).

Furthermore, for instance, when a 3PL purchases pieces of equipment for a client's or principal's end user that are nearby, from the perspective of geographical logistics

integration, that is where the site specificities can be found such as the physical logistical procedures of transport, warehousing, and packaging are more specifically related to site specificities. These significant infrastructure and are best carried by 3PL, with an achievable objectives of decreasing expenses and service improvement like a high quality service and on-time delivery with regards to the type and volume of commodities (Ph-P and Fender, 2001).

There have been two categories of ambiguity: internal and external. Internal uncertainty relates to the complexity of internal operations and includes competition uncertainty which is technological in nature, regulatory, and fiscal ambiguity (Ghertmann, 2000). For instance, internal uncertainty in the logistics sector refers to how challenging it is for companies to effectively forecast their future demands, particularly in terms of volume (Stank and Maltz, 1996). The unpredictability affecting the industry in which the firm is growing is tied to this type of ambiguity. As a result, lack of flexibility and capacity are the two factors that drive enterprises that must meet changing market demands to turn to outsourcing. In logistics, both internal and external uncertainties seem to be strongly related. As a result of some aspects of the market such as the unsteady economic environment which can be Institutional, regulatory, and globalization. In order words, companies with just-in-time production systems that have outsourced some logistics related activities are affected by uncertainty. Due to the variation in demand which causes uncertainty. Forecasts and reality often diverge, particularly in cases when commercial methods that depend primarily on the wildly varying requirements of consumers are employed. Continuous tensions, macroeconomic changes, industrial trends, and marketing strategies are all major sources of uncertainty, and flexibility continues to be the best response to them (Ph-P and Fender, 2001; Sohail and Sohal, 2003; Dornier and Fender, 2001).

The relationship between a high level of uncertainty and the decision to outsource has a negative impact on customers using 3PL. Upfront and latter expenses increase concurrently as uncertainty increases. The former expenses for negotiations that are too significant, challenging, and weighty to handle originate from decisions made with uncertainty. Re-negotiating the former contracts based on new information and drafting

a new contract is another expense related to uncertainty. Furthermore, heightened uncertainty leads to unforeseen circumstances, which ultimately prompts businesses to make costly and incorrect judgments. These conditions may have an impact on the logistics sector (Hatch, 2000; Bienstock and Mentzer, 1999).

In the context of logistics, for instance, in the distribution of products, the frequency may indicate if the volume of goods moved justifies the cost of investing in a specific piece within the company's inventory (Bienstock and Mentzer, 1999). In this situation, it is important to determine whether TCE forecasts about judgments involving decisions including extremely frequently carried out activities, like transportation, which requires assets with low specificity but high costs, will be confirmed. The same concerns could be expressed regarding warehousing, a routine activity that nevertheless calls for increasingly complex organizational, technical, and human skills (Preston and Brohman, 2002).

2.3. Resource Based Theory

Many firms have been pushed to focus on several important departments to increase efficiency and cut costs. Due to this, businesses are now outsourcing tasks and services that were formerly handled in-house. Although outsourcing has gained popularity in recent years, corporations have always made decisions regarding the different activities that should be outsourced. However as information and communications technologies (ICT) have advanced, as well as quickly growing local and international markets for goods and services, outsourcing has expanded to practically every aspect of organizational operation (Aron and Singh, 2005). Rather than just concentrating on peripheral tasks like cleaning, catering, and security, outsourcing has expanded to include more crucial corporate processes like design, manufacture, marketing, human resource management, and logistics. Outsourcing is becoming more and more important to many firms' organizational strategies (Holcomb, T. R., and Hitt, 2007).

Contracting is a useful practice for minimizing expenses and enhancing efficiency. Examples of this include the fact that supply market experts can spend more on core competencies such as software and training systems, get deeper expertise, and work

more efficiently. They are able to pay better salaries and attract better-qualified individuals (Quinn, 1999). Contracting can be utilized in a range of different sectors to manage uncertain demand and benefit from supplier volume efficiencies. The research on the topic of contracting has evolved into a web of theoretical and conceptual foundations with the aid of theories from other domains, including general management, organization theory, business strategy, and economics. Two key concepts in organizational resource-based view and transaction cost economics are two key concepts in the field of the outsourcing process.

According to resource-based scholars, the company consists of an exceptional combination of assets and capital that, when put to creative utilization, can offer an edge over competitors (Barney, 1991; Conner, 1991; Peteraf, 1993). A resource that could provide a competitive edge over a competitor must meet certain criteria, such as worth, rarity, inimitability, and proper organization. When a company can take advantage of opportunities and protect itself from external risks, it is considered to have resources and capabilities. In comparison to 3PL, the scarceness criterion is based on the number of adversaries controlling a resource that is valuable. When several competitors have access to a valuable resource, it is doubtful that it will provide a competitive edge. The replication examines how simple it is for competing companies to replicate an essential and distinctive resource that an organization owns. The framework of a business must be such that its resources and skills are utilized properly and maximally. The 3PL organization parameter encompasses various components, including the management control systems, and reporting structure (Barney, 1991).

The RBV is important to the study of outsourcing since it would help to understand why certain tasks are conducted internally when compared to competitors. How an organization's capabilities evolve and affect its cost efficiency and competitiveness is one of RBV's main concerns. By contrasting one's own capabilities with those of competitors. RBV's concept can be used to construct clear constraints. Therefore, a company's ability to make investments towards developing its skills and maintaining a better performance position in terms of resources than rivals influence the decision about outsourcing. Companies can outsource tasks that it is unable to accomplish domestically

because of a lack of resources or expertise. When internalizing these tasks would not give a company a competitive edge or cost performance, they must find complementary personnel from outside sources (Langlois and Robertson, 1995).

2.4. The Relationship between TCE and RBV

The current literature work on interactions between TCE and RBV is currently expanding (Casson, 2005; Dyer and Singh, 1998; Poppo and Zenger, 1998). Those who support such literary works, often called as relational view advocates, claim that it provide a framework to understand how firms could obtain and retain a competitive edge which includes cost performance. For instance, Dyer and Singh, 1998, suggest that companies may combine capital in new ways beyond the limits of the organization to outperform competitors. The relational perspective was created as a result of the TCE's restrictions in terms of potential management structures and as an extension to RBV (Dyer and Singh, 1998). However, from a TCE perspective, companies should use 3PL in order to lower the cost of the outsourced activity (Madhok, 2002). And resource limitations may force an organization to outsource certain activities (Combs and Ketchen, 1999). TCE and RBV have been addressed as separate approaches to the outsourcing decision. TCE and RBV, however, are argued to be complementary by a growing body of literature, recognizing that neither theoretical framework can fully explain the outsourcing decision on its own (Combs and Ketchen, 1999; Ellram, Tate, and Billington, 2008; Holcomb, T. R., and Hitt, 2007; Jacobides and Winter, 2005; Madhok, 2002; Poppo and Zenger, 1998; Vivek, Banwet, and Shankar, 2008). There may be times when the suggestions made by each theoretical standpoint complement one another. For example, an activity should be internalized when a corporation has the resources necessary to create an ability that is hard to duplicate and there is a significant possibility of opportunism. Each theoretical approach's complementary nature emerges from the idea that some unique skills and assets have something in common: they are hard to replace or replicate (Peteraf, 1993). Others contend that the two perspectives on the subject matter are required because neither can satisfactorily emphasize outsourcing on its own (Combs and Ketchen, 1999).

TCE highlights effective decision making which is driven by lowering costs. In contrast to the RBV, which concentrates on the pursuit of competitive advantage through resource analysis. In fact, RBV emphasizes skills in production while TCE emphasizes skills in management. Additionally, TCE characteristics like asset specificity and a restricted number of suppliers, together with capacity factors, influence outsourcing decisions (Madhok, 1996; McNally and Griffin, 2004). The reason for increasing companies' cost performance is a theme that TCE and RBV are focusing on, yet these two are tremendously relevant to the field of effective operations management and outsourcing decision.

In accordance to former studies' findings, companies are taking organizational competencies and the opportunism from 3PLs into account when making decisions regarding outsourcing (McNally and Griffin, 2004). The impact of RBV in operations management is also becoming more and more significant. Some assert that the operations field is where organizational abilities that provide competitive advantage are developed (Coates, T. T., and McDermott, 2002; Lawson, 2002; Vastag, 2000). Service quality, creativity, and short time-to-market cycles are a few examples of exceptional skills that are closely tied to the 3PL's capabilities in resource-based literary works when an outsourcing decision is made. Competitor priorities, such as cost, quality, flexibility, and delivery, which are at the center of an organization's outsourcing strategy, have a big impact on the growth of capacities (Boyer and Pagell, 2000; Leong, Snyder, and Ward, 1990).

The RBV focuses on and builds on expertise, which has a major effect on which tasks should be performed in-house and which ones should be contracted. Organizational capacity analysis, which connects outsourcing with cost performance and the organization's competitive priorities, can be enhanced by applying RBV principles. Undoubtedly, firms may improve their performance in terms of cost, quality, and service by using outsourcing. The present situation in the supply market must be compared against the possibility for performance improvements. TCE provides a strong theoretical framework to advance how to efficiently outsource certain activities. TCE can assist in

determining if it is better to outsource or conduct an activity in-house, as well as in assessing 3PL efficiency (Grover and Malhotra, 2003; Stratman, 2008).

Although TCE and the RBV have become more well-known in the field of operations management, when outsourcing is considered an achievable option in light of suppliers' market state, combining TCE and RBV may expand the potential collaboration strategies available to an organization. Inter-organizational cooperation can be used to build mutually beneficial assets that help a company gain an edge over its competitors, according to the RBV. While TCE provides a solid theoretical framework for comparing market dynamics when deciding whether to outsource (Barney, 1991; Coates, T. T., and McDermott, 2002; Grover and Malhotra, 2003; Hayes, Pisano, Upton, and Wheelwright, 2005; Holcomb, T. R., and Hitt, 2007; Jiang, Belohlav, and Young, 2007; Vastag, 2000; Vivek et al., 2008; Williams, Maull, and Ellis, 2002).

2.5. Network Theory

The network model's fundamental premise is that each organization is reliant on assets managed by other businesses. Interactions with other businesses are necessary to gain access to these resources. Over time, industrial networks grow. A participant, whether an individual or a group, engages in connections with other participants to learn more about their network partners. The growth of networks has a natural tendency for the links to get stronger and more durable over time collaboration. There are two distinct but related types of interaction that shape the relationships between businesses in a network such as exchange and adaptation processes (Johanson, J., and Mattsson, 1987). Information, product, and service transfers, as well as social processes, are all examples of exchange processes. The latter comprises communications that are technical, logistical, and administrative in addition to interpersonal ties. The parties get to know one another through social interaction activities, which leads to the steady development of trust. While adaptation is a more effective distribution of resources throughout the network that is achieved by the mutual adjustment of products, administrative systems, and industrial processes. Several factors make adjustment processes crucial. They first make the connections between the parties stronger. A supplier's dependence on a particular

customer will increase if he has shaped his manufacturing procedures or his product offerings to meet their needs. Second, the parties convey through the adjustment processes that they consider their relationships as long-lasting and stable rather than being subject to short-term gain. This is what Williamson refers to as credible pledges. The parties establish a variety of mutually beneficial associations through interactions and these interactions lead to technological advancement, building knowledge and trust (Håkansson, H., and Johanson, 1988).

Network structures can be either dynamic or steady. While some relationships end, others are formed. Existing relationships evolve throughout time as well. Consequently, a network is a dynamic entity that is always adapting to new circumstances and does not reach an optimal equilibrium. A given network does not just happen to exist; it is one of many conceivable architectures that management chooses to construct. The company makes use of the network to establish new connections, locate new partners, and make new investments to take advantage of its competitive position. The ability to exert direct influence on some individuals in addition to an indirect effect on others is a key component of a network strategy.

A company in a SCM activities may affect not only just its suppliers and customers, but also the sub-suppliers of its suppliers, such as haulers, and the customers of those customers. Consequently, the network uses several activity chains to connect all of the SCM participants (Ford, 1990). A company's performance is dependent not just on its direct relationships with its partners but also on the nature of those relationships between partners. Examining a third party's strategic alliance partners' quality reputation, stability, and service dependability as well as how they handle subcontractors is crucial when selecting a 3PL (Gattorna, 2017).

As to the network theory, the most important resource of a corporation is usually its connections with other organizations. One essential advantage is having access to complementary investments and expertise of other companies. Because intangible assets are hard to copy, they are crucial to a business's ability to sustain its competitiveness

over time, such as better partnerships with other 3PLs (Nelson and Winter, 1982). They are frequently produced through external relationships built over time (Ford, 1990).

The key tenet of the network model is that new resources and expertise are mostly generated because of a firm's continual interactions with other companies. The concept implies a shift in focus from how internal resources are allocated and structured within the organization to how those resources are linked to the actions and resources of other actors in the external environment such as 3PL. The capacity to put together a chain of capabilities from the companies own and those of the 3PL that it is affiliated with is the most important competency in supply chain network design (Fine and Whitney, 2002).

2.6. Third-Party Logistic Provider Selection Criterion

The 3PL selection procedure is difficult since there are numerous tangible and intangible factors that need to be taken into consideration. Others are common, while certain criteria were developed with specific customer needs in mind. Spencer, Rogers, and Daugherty, 1994, found that out of the 154 businesses who answered to their poll of the American Public Warehouse Register, these businesses selected their 3PL based on unique characteristics. For instance, on-time performance when it comes delivery, service quality, efficient communication, dependability, responsiveness, flexibility, management quality, prompt notification of disruptions, customize services, reputation, price, location, range of services offered, cost reduction, and specialized knowledge (Spencer, Rogers, and Daugherty, 1994).

Maltz ascertained the significance of cost and quality criteria in deciding to use 3PL storage through a survey of 105 companies that were members of the Warehousing Education and Research Council and the Council of Logistics Management in the United States. Private, contract, and public warehousing are the three types of storage. The study demonstrates that private storage offers higher service quality than contract and public warehouses. Contrarily, cost variations do not seem to be essential for the use of 3PLs (Maltz, 1994). Stank and Maltz presented an exploratory evaluation of the variables that affect the choice between domestic and international logistics environments when choosing to use 3PL services. Asset investment, learning capacity,

long-term cooperation, organizational features, service capacity, and uncertainty/volatility are the main variables suggested (Stank and Maltz, 1996). Daugherty, Stank, and Rogers, 1996, however, have proposed that a 3PL's logistics service capabilities should include dedication to urgent assistance, ability to manage environmental changes, flexibility in fulfilling external needs, emergency service provision, ability to make recommendations for potential issues, support for corporations in cost reduction and analysis of problems, ability to handle the unclear requirements of operational situations, and ability to anticipate needs (Daugherty, Stank, and Rogers, 1996).

2.7. Factors Leading to Outsourcing

The arguments presented earlier have demonstrated that a company's decision to outsource or internalize its logistical activities can be influenced by the characteristics of the transaction as well as resources. However, the available literature puts forth that certain contextual elements may affect the choice to outsource by making it feasible. The firm's decision-making process is closely linked to its surroundings, both internal and external. Ivanaj, 2001, states that it makes sense to look at the moderating effects of organizational traits on decision-making regarding the outsourcing of logistics. These traits include organizational structure, power dynamics, the nature and size of the organization, the traits of the top executive and management team (Ivanaj, 2001).

The size of the business may have an impact on the decision to outsource logistics. For instance, Anderson and Schmittlein, 1984 papers show that, despite not being directly tied to logistic activity, the scale and choice of vertical integration are interrelated. This would lend credence to the notion that scale efficiencies are achieved (Anderson and Schmittlein, 1984). Additionally, Pisano, 1990, thought that the scope of his research validates the internal management costs by looking at the outsourcing of research and development activities. Therefore, as a company grows, so do the costs linked to a highly administrative organization (Pisano, 1990). According to Uhlig and Gélinas, who conducted an inquiry about SME and logistic outsourcing in Germany in 1996, large businesses utilize logistics providers more frequently than SME. This might be

explained by the worry that businesses with limited scopes will lose their autonomy in resource management. Consequently, the relationship between transactional characteristics and the company's choice to outsource may change depending on the size of the business. For illustration, in the event of a small amount of transactional characteristics, it may be predicted that larger firms will have a stronger tendency to outsource their logistical services (Uhlig and Gélinas, 1996).

The competence level of the organization is essential in addition to its size. A decision to outsource that is likely to cause organizational gaps requires above-average ability, and competence (Halley, 1999). According to Fine and Whitney, 1996, managing the outsourcing process is a key competence in the automotive sector. Knowledge and collective skills up to the transferred activities are needed for this process (C. Fine and Whitney, 1996).

Therefore, as Preston and Brohman, 2002 imply, the option to outsource or internalize must have effects that are currently unknown due to the creation of complex systems of warehousing management. The business will be encouraged to keep those employees who have the abilities needed for an activity's optimal execution on staff. As a result, it will be able to internalize the parts that provide value and outsource the rest, by more quickly determining if a trait is more or less strategic (Pache and Sauvage, 1999; Preston and Brohman, 2002). According to Hrušecká, Macurova, Juříčková, and Kozakova, 2015, outsourcing logistics is typically used at one of the following stages:

2PL (second-party logistics) of logistics outsourcing is advantageous for upcoming comings with a straightforward SCM. The production sector employs a specialized business to deliver various logistics services, such as transportation.

Third-party logistics providers are businesses that offer logistical services like shipping, warehousing, packaging, and many more. These days, this sector is especially appealing to manufacturing companies that wish to lower their logistical costs or implement specific tried-and-true supply chain strategies. The degree of service offered by third-party logistic providers can help clients' businesses more as they get more experience. This is the type of logistics outsourcing that is most common.

4PL (fourth-party logistics) oversees each 3PL provider separately while simultaneously overseeing supply chain optimization as a whole, this type of partnership is the closest. This type of logistics outsourcing is primarily used by international organizations (Hrušecká, Macurova, Juříčková, and Kozakova, 2015).

2.8. Advantages and Disadvantages of Logistics Outsourcing

Determining the potential strategic or financial benefits of logistic outsourcing is the key problem for many businesses. Mojsilović, Ray, Lawrence, and Takriti, in 2007, found out that contracting out logistic activities does affect a company's financial performance, however, they also stressed how complicated the decisions regarding outsourcing are and how qualitative as well as quantitative factors affect such decision. According to the, the majority of manufacturing companies handle non-core functions like logistics, which can be outsourced to reduce the requirement for capital investments, which increases the organization's return on assets (Mojsilović, Ray, Lawrence, and Takriti, 2007).

Bali, Gümüş, and Kaya in 2015, argued that the importance of having a third-party logistics partner's role in logistics outsourcing advantages such as flexibility, lower cost, lower investment on assets and rapid delivery time (Bali, Gümüş, and Kaya, 2015). However, Bertrand, 2011, investigated how French multinational enterprises (MNEs) use offshore outsourcing to improve their export performance by lowering costs, access to expert and skillful laborers and favorable governmental policies (financial incentives and fewer business regulations). Furthermore, according to Singh, 2009, outsourcing has an impact on companies' capability building, performance and market orientation through network point of view. Additionally, according to Agrawal and Haleem, 2013, outsourcing IT enhances cost efficiency by lower direct cost and increasing return on assets, and improve productivity through advanced informational technologies (Bertrand, 2011; Singh, 2009; Agrawal and Haleem, 2013).

Then disadvantages of outsourcing, as illustrated by Wan, Wang, Lin, and Dong, 2015, in their research, report how selecting the best logistics outsourcing provider has a big impact on how well logistics outsourcing works. As a result, selecting an outsourcing partner may turns into a strategic problem that demands considerable thought (Wan,

Wang, Lin, and Dong, 2015). Broedner, Kinkel, and Lay, in 2009, examined the productivity effects of German manufacturing companies in the capital goods sector and discovered that outsourcing significantly lowers labor productivity in this sector. Manufacturers of machinery and electrical engineering items were among the businesses participating in outsourcing. The authors also discovered that businesses that outsource incur higher costs or see less revenue. Hence, outsourcing businesses are less productive than non-outsourcing or vertically integrated businesses (Broedner, Kinkel and Lay, 2009)

2.9. Research Gap

Several studies in the field of logistics have stated that research should determine how economic and strategic management theories have an impact on logistics outsourcing. Nevertheless, logistics outsourcing has been gaining recognition in a time of widespread production and customer service (Grover and Malhotra, 2003; Coates, T. T., and McDermott, 2002; Ellram et al., 2008; Grover and Malhotra, 2003; Hayes et al., 2005; Holcomb, T. R., and Hitt, 2007; Jiang et al., 2007; Mantel, Tatikonda, and Liao, 2006; Vastag, 2000; Vivek et al., 2008; Williams et al., 2002; Youngdahl and Ramaswamy, 2008).

Despite extensive research on the topic and how it affects organizations in a variety of industries, there is a significant research gap in logistic outsourcing in the United States food sector. The dynamics and complexities of the US food industry, such as specialized transportation and warehousing are investigated in this research.

Prior research has mostly focused on other industries, like the technology sector, which limits the generality of the findings to the particular opportunities and limitations (specialized transportation and warehousing) that US food companies face. Additionally, although some studies have looked at the benefits and drawbacks of logistic outsourcing. There is currently a lack of empirical research examining the peculiar effects of logistic outsourcing on cost performance US food sector. Thus, this study intends to address this gap using metrics such as annual sales, assets, operation costs, and profits.

This study seeks to broaden our understanding of the cost performance for organizations that outsource warehousing and transportation, particularly in the US food industry. Based on US food industry characteristics, TCE, NT, and RBV methods, this study attempts to provide insight into a successful logistic outsourcing strategy. This study seeks to give insightful analysis and useful solutions for improving strategic decision-making processes linked to outsourcing transportation and warehousing in the US food industry.



3. METHODOLOGY

In order to demonstrate the efficiency of the selected DMUs, this study is going to use a constant return scale model, Malmquist productivity index (MPI) for efficiency measurement (2019-2021) of data envelopment analysis on DEAP (Data Envelopment Analysis Program) software. The use of this software requires organizing the data set as text file, giving instructions such as how many inputs and outputs one is going to use, which analysis one is going to run, whether one is going to choose a constant return to scale or variable return to scale, and determining the study period in the instruction text file. The DEAP does not require the data set to be normalized, for this study, all the data set is in millions. A constant return to scale has been selected for this MPI in order to observe if the increased rate of inputs is proportional to the rate of the outputs generated by the selected DMUs. In order to determine if the selected DMUs underwent a steady growth during the study period. However, for this study we have selected 3 inputs 3 inputs (operation cost, number of employees, annual assets) and 3 outputs (annual profit, annual sale, and annual revenue) for the MPI for as study period of 3 years due to a lack of data (Number of employee). These inputs have been selected due to the fact that they determine the cost performance of a company. They have a direct impact on the cost of products sold by the selected DMUs. These outputs have been selected because they determine if a DMU is efficient based on the inputs used in order to generate these outputs. In other words, these outputs are the right cost performance measure because they are the results of the inputs (Namalathan, 2010; Anjaneyulu and Haranath, 2023).

However, this study is going to make use of external benchmarking and compound annual growth rate to determine the debt-to-equity ratio, operating assets to profits ratio and sales to profits ratio in the study period (2019-2022). In order to make a comparative analysis and determine the significance of which group has a better cost performance between companies using logistics outsourcing and companies' in-housing transportation and warehousing.

3.1. Malmquist Productivity Index

The MPI uses a nonparametric approach akin to the DEA to break down productivity increases into changes in efficiency and technology. It quantifies productivity changes through temporal variations. The utilization of a contemporaneous version of the data and the time variations of technology during the study period is required due to productivity decomposition into technical change and efficiency catch-up. Using the observations at time t and time $t+1$, Equation (I) and Equation (II) may be used to represent the MPI in terms of the distance function (E).

$$MPI_{I^t} = \frac{E_I^t(x^{t+1}, y^{t+1})}{E_I^t(x^t, y^t)} \quad (1)$$

$$MPI_{I^{t+1}} = \frac{E_I^{t+1}(x^{t+1}, y^{t+1})}{E_I^{t+1}(x^t, y^t)} \quad (2)$$

The renowned Malmquist input-based productivity index of Fare, Grosskopf, Lindgren, and Roos (1989) is defined as the geometric mean of two Malmquist input-based productivity indices that were initially proposed by Caves, Christensen, and Diewert in 1982.

$${}^tM^{t+1}(u^t, x^t, u^{t+1}, x^{t+1}) = \left[\frac{D^t(u^t, x^t)}{D^t(u^{t+1}, x^{t+1})} \cdot \frac{D^{t+1}(u^t, x^t)}{D^{t+1}(u^{t+1}, x^{t+1})} \right]^{1/2} \quad (3)$$

The decomposition of Malmquist Productivity index geometric mean into a technical change component and an efficiency change component is as follows:

$${}^tM^{t+1}(u^t, x^t, u^{t+1}, x^{t+1}) = \frac{D^t(u^t, x^t)}{D^{t+1}(u^{t+1}, x^{t+1})} \cdot \left[\frac{D^{t+1}(u^{t+1}, x^{t+1})}{D^t(u^{t+1}, x^{t+1})} \cdot \frac{D^{t+1}(u^t, x^t)}{D^t(u^t, x^t)} \right]^{1/2} \quad (4)$$

The ratio of the Farrell technical efficiency measure at time $t + 1$ divided by the Farrell technical efficiency measure at time t is the efficiency change. The geometric mean of the two ratios that show the changes in the frontier at times t and $t + 1$ represents the technical change component. An increase in overall productivity is shown by ${}^tM^{t+1} > 1$, a fall by ${}^tM^{t+1} < 1$, and no change in productivity growth is indicated by ${}^tM^{t+1} = 1$.

The geometric mean of two MPI in Equation (1) and Equation (2) is:

$$MPI_I^G (MPI_I^t MPI_I^{t+1})^{1/2} \left[\left(\frac{E_I^t(x^{t+1}, y^{t+1})}{E_I^t(x^t, y^t)} \right) \cdot \left(\frac{E_I^{t+1}(x^{t+1}, y^{t+1})}{E_I^{t+1}(x^t, y^t)} \right) \right]^{1/2} \quad (5)$$

Using the concepts of input-oriented technical change (TECHCH) and input-oriented efficiency change (EFFCH), as shown in Equation (5), the input-oriented geometric mean of MPI may be deconstructed as follows:

$$MPI_I^G = (EFFCH_1) \cdot (TECHCH_I^G) = \left(\frac{E_I^{t+1}(x^{t+1}, y^{t+1})}{E_I^t(x^t, y^t)} \right) \cdot \left[\left(\frac{E_I^t(x^t, y^t)}{E_I^{t+1}(x^t, y^t)} \right) \cdot \left(\frac{E_I^t(x^{t+1}, y^{t+1})}{E_I^{t+1}(x^{t+1}, y^{t+1})} \right) \right]^{1/2} \quad (6)$$

The first and second phrases, respectively, stand for changes in efficiency and technology. A distance function similar to DEA can be used to define the MPI provided by Equations (5) and (6). In other words, the MPI's constituent parts can be inferred from the estimation of distance functions that were developed using cutting-edge technology. The formal derivation of MPI was presented by Färe, Grosskopf, Norris, and Zhang, 1994, and it is the most widely used approach among those that have been created to estimate a production technology (Coelli, and Rao, 2005; Thanassoulis, 2001). The technical efficiency can be divided into scale efficiency and pure technical efficiency components by using both CRS and VRS DEA frontiers to estimate the distance functions in (5). A scale efficiency change (SECH) is given in equation (7) (K.-R. Lee, Leem, Lee, and Lee, 2011).

$$SECH = \left[\frac{E_{vrs}^{t+1}(x^{t+1}, y^{t+1})/E_{crs}^{t+1}(x^{t+1}, y^{t+1})}{E_{vrs}^{t+1}(x^t, y^t)/E_{crs}^{t+1}(x^t, y^t)} \cdot \frac{E_{vrs}^t(x^{t+1}, y^{t+1})/E_{crs}^t(x^{t+1}, y^{t+1})}{E_{vrs}^t(x^t, y^t)/E_{crs}^t(x^t, y^t)} \right]^{1/2} \quad (7)$$

And a pure efficiency change (PECH) is (8) (Coelli et al., 2005; Färe et al., 1994; K.-R. Lee et al., 2011; Thanassoulis, 2001).

$$PECH = \frac{E_{vrs}^{t+1}(x^{t+1}, y^{t+1})}{E_{crs}^t(x^t, y^t)} \quad (8)$$

A combined metric that can be used to track the evolution of DMU productivity is the DEA-based Malmquist productivity index according to (Färe et al., 1994; Fulginiti and Perrin, 1997; Herrero and Pascoe, 2004; Löthgren and Tambour, 1999; Wei, Liao, and Fan, 2007).

3.2. External Benchmarking

In order to help a business perform better, external benchmarking is the process of finding, comprehending, and incorporating best practices from firms all across different sectors. It is an activity that searches externally for high performance and best practices, then compares real company operations to the company's fixed objectives (Kumar et al., 2006). In other words, external benchmarking is a continual evaluation of strategy, operations, products or services and performances evaluated within or between among the best enterprises by gathering data using the proper data-collecting techniques. With the goal of evaluating a company's present requirements and then implementing adjustments to meet or surpass these requirements to increase performance. Return on equity, operating assets turnover, financial leverage and net operating asset profit margin have been selected to determine the performance of the sampled companies in the US from 2019 to 2022 in the food sector.

Return on Equity (ROE), according to Damodaran, 2007, is a performance measure used by shareholders to determine whether a company is efficient in converting its' equity into profit. High ROE determines that a company has a good performance. The ROE calculation is given below (Damodaran, 2007).

$$\text{ROE} = \frac{\text{NET INCOME}}{\text{SHAREHOLDER EQUITY}} \quad (9)$$

Asset Turnover Over, is a ratio which determines the capability of the company to generate revenue from its' operating assets. It is an indicator that shows how a company can make the best of its' operating inventory. Operating Asset Turnover ratio's formula is mentioned below (Warrad, and Al Omari, 2015).

$$\text{Operating Asset Turnover} = \frac{\text{SALES}}{\text{OPERATING ASSET}} \quad (10)$$

Financial leverage, according Enekwe and Eziedo in 2014, measures a company's level of reliance on borrowing and how effectively it utilizes debt to generate revenue. High

financial leverage can result in increased expenses due to additional processing fees and interest payments. The Financial Leverage formula is mentioned below (Enekwe and Eziedo, 2014).

$$\text{Financial Leverage} = \frac{\text{TOTAL DEBT}}{\text{SHAREHOLDER EQUITY}} \quad (11)$$

Net profit margin after tax (NOPAT), according to Nissim in 2019, is used to determine how much profit a business makes relative to its total sales. It calculates how much net profit a business makes for every dollar of revenue. The NOPAT formula is mentioned below (Nissim, 2019).

$$\text{NOPAT} = \frac{\text{EBIT} * (1 - \text{TAX RATE})}{\text{REVENUE}} \quad (12)$$

Return on assets (ROA) provides information about how a company generates profits with regards to its assets. Investors', managers' and analysts' perceptions of the companies' assets to profits performance are revealed by ROA. According to Selling, and Stickney in 1989, ROA can be used to compare companies in the same sector to determine which companies utilize better its assets to generate profits. The ROA formula is mentioned below (Selling and Stickney, 1989).

$$\text{ROA} = \frac{\text{NET INCOME}}{\text{TOTAL ASSETS}} \quad (13)$$

The rate of return needed for annual investment on assets, a stock to evaluate from its starting balance to its ending balance is known as the compound annual growth rate (CAGR) according to (Verma and Pandey, 2023). Therefore, CAGR is a useful metric for assessing a company's performance over time. The formula of CAGR is mentioned below.

$$\text{CAGR} = \left(\left(\frac{\text{ENDING VALUE}}{\text{BEGINNING VALUE}} \right)^{1/n} \right) * 100 \quad (\text{XIV})$$

With (n) the number of years

3.3. Data Set

In the food sector, logistics is present in all step of the supply chain operation. Thus immensely affecting the costs of foods through distribution, retailing, and warehousing (Sexton, 2000). These DMUs have been in selected for the only reason that they have managed to become the best performing and most profitable companies according the fortune 500 companies. In this study, the inputs are annual numbers of employees, annual assets, and operating annual assets. We have selected these inputs because the cost of warehousing and transportation are mentioned in the annual operating assets for DMUs in-housing these logistical activities or outsourcing them. But these cost are not part of the annual employees and annual assets for DMUs outsourcing transportation and warehousing. While these cost are present in the annual number of employees and annual assets for companies' in-housing these activities. The outputs selected for this study are annual profits, annual revenue, and annual sales. These outputs have selected because the annual revenue by these DMUs includes the annual sales they made and their non-operating capital. Thus it includes more information than just annual sales. They were all selected in order to determine how much they have spent with regards to annual number of employees, annual assets and annual operating as supposed to what they have sold, their non-operating capital, and profits (Namalathasan, 2010; Anjaneyulu and Haranath, 2023). The data for the DEAP software has been gathered cautiously from a variety of websites and then compared to the published annual financial statements on their official pages for the DMUs used in this study from 2019-2021, which can be observed in Appendix 1. These DMUs have been selected because they are all in the same sector. Furthermore, this data have been gathered from first hand website such as fortune 500 companies and second hand such as microtrend.

However, the selected ratios external benchmarking determine the assets, operating assets and debt these DMUs used to gain profits, sales and equity. This is to mean that, these variables mentioned in the methodology, are selected because they determine how companies uses debt to generate equity (financial leverage). By looking at their total debt compared to their shareholder equity. Thus how these DMUs use equity to generate profits (ROE). Meanwhile, others are used to generate profits from assets (ROA) and

monitoring these DMUs assets, sales, profits and operating assets growth in order to determine performance during the study period (CAGR) (Damodaran, 2007; Warrad, and Al Omari, 2015; Enekwe and Eziedo, 2014; Nissim, 2019; Selling and Stickney, 1989; Verma and Pandey, 2023).

The data for external benchmarking have been gathered from first hand resources such these DMUs annual financial statement. The external benchmarking, which can be observed in Appendix 2 including return on assets (ROA), which can be observed in Appendix 3, and compound annual growth rate in Appendix 4. These ratios have been selected to be used for comparative analysis to evaluate the cost performance and efficiency of the selected companies from shareholder and investor perspective (2019-2022).

Table 3.1: Presentation of companies outsourcing or in-housing activities

DMU	Companies	Outsourced activities	Companies	DMU	
Companies outsourcing logistic related activities			Companies in-housing		
DMU 1	Walmart	warehouse, transportation delivery	Pepsi	DMU 7	In-house
DMU 2	Nestlé	transportation, warehousing	McDonald	DMU 8	In-house
DMU 3	Unilever	transportation, freight forwarding delivery	Coca-Cola	DMU 9	In-house
DMU 4	Tyson foods	Warehousing transportation	Mondelez	DMU 10	In-house
DMU 5	General Mills	transportation supply chain operation	ADM	DMU 11	In-house
DMU 6	Chipotle	Transportation, delivery	JBS	DMU 12	In-house
DATA SOURCE	https://www.macrotrends.net/		https://fortune.com/ranking/global500/		

The table above mentions the DMUs that have outsourced or in-housed transportation separated into group A and B. It also contains the different activities they have outsourced and to which degree they outsourcing these activities.

The data for the DEAP software have been gathered cautiously from a variety of websites then compared to the published annual financial statements on their official pages for the DMUs used in this study from 2019-2021. The DEAP software has been selected because it calculates the efficiency of DMUs in each year while observing their efficiency evolution in the study period. However, MPI is used in this study to determine DMUs' scale efficiency, pure efficiency, technical efficiency, efficiency exchange and total productivity factor (TPF). For this reason, we selected the MPI to measure the efficiency of DMUs. Thus, the selected input and output are:

X1: Number of employees	Y1: Revenue
X2: Operation cost	Y2: Profit
X3: Asset	Y3: Sales

The external benchmarking has been selected to compare the cost performance of the selected companies. The data used in this study are directly collected from the annual financial statements published during the study period 2019-2022 and indirectly from other websites. This analysis is going to be carried out from a shareholder perspective to determine which company has better debt to equity ratio, operating assets to profits ratio and debt to equity ratio. The selected variables for determining their performance are return on equity, net operating profits after tax, asset turnover and financial leverage.

The data for ROA has been selected from websites which includes the annual net income and annual assets. A measure of a company's profitability in relation to its total assets is called return on assets. Management, analysts, and investors use it to assess how well a company utilizes its resources to generate profit. Since businesses in the same industry would typically have similar asset bases, this study is going to compare the ROA of the selected 12 companies during the study period 2019-2022.

With the compound annual growth rate, we are going to determine to which extent the decision of the selected companies to outsource transportation and warehousing have been strategically increasing their cost performance with less investment in assets, lower annual cost used for one product, and sales growth. The selected variables are annual sales, annual operating assets, annual profits and annual assets from 2019-2022.



4. ANALYSIS RESULTS AND FINDINGS

This section is going to include the analysis of the DEAP software to determine the efficiency of the selected DMUs (2019-2021). Still, external benchmarking, selected variables mentioned thus far to determine companies cost performance in the study period.

4.1. Malmquist Productivity Index Analysis Result

Results from DEAP Version 2.1

Instruction file = eg2-ins.txt

Data file = eg2-dta.txt

Input orientated Malmquist Productivity Index

The table 4.1 presents the efficiency scores of the DMUs for 2019 -2020 period which can be observed by total factor productivity change (tfpch). The maximum tfpch 1.182 (DMU 8). Followed by DMU 3 with a Tfpch of 1.169. And the minimum is 0.247 (DMU 7). However, group B did not significantly produce outputs due to the fact the p value is 0.333 because group A has the highest mean 0.877 compared to 0.698.

Table 4.1: Efficiency of DMUs (2019-2020)

FIRM	EFFCH	TECHCH	PECH	SECH	TFPCH
GROUP A					
1	1.494	0.632	1.000	1.494	0.944
2	1.000	0.981	1.000	1.000	0.981
3	1.098	1.065	1.000	1.098	1.169
4	1.312	0.564	1.378	0.952	0.740
5	1.000	0.633	1.000	1.000	0.633
6	1.000	0.796	1.000	1.000	0.796
mean	1.150	0.778	1.063	1.090	0.877
GROUP B					
7	0.862	0.287	0.882	0.977	0.247
8	1.000	1.182	1.000	1.000	1.182
9	0.826	0.921	0.997	0.829	0.761
10	1.660	0.629	1.509	1.100	1.044
11	1.188	0.573	1.000	1.188	0.681
12	0.471	0.589	0.792	0.595	0.278

mean	1.001	0.696	1.03	0.948	0.698
P value	0.4352	0.6038	0.7884	0.2612	0.333

EFFCH: Efficiency Change, TECHCH: Technical efficiency change, PECH: Pure efficiency change, SECH: Scale efficiency change, TTPCH: Total factor productivity change

The table 4.2 presents the efficiency of the DMUs for 2020 -2021 time period which can be observed by total factor productivity change (tfpch). The maximum tfpch 1.297 (DMU6). Out of the selected 12 DMUs, DMU 6, which is company with outsource transportation and warehousing has the highest efficiency score. And the minimum is 0.436 (DMU 12). This is to mean that out of the 12 DMUs, DMU 12, a company with in-house transportation and warehousing has the lowest efficiency. Nevertheless, group B did significantly produce outputs with regards to the fact that p value is 0.363 because group A has the highest mean 1.011 compared to 0.363.

Table 4.2: Efficiency of DMUs (2020-2021)

FIRM	EFFCH	TECHCH	PECH	SECH	TFPCH
Group A					
1	1.000	0.994	1.000	1.000	0.994
2	1.000	0.830	1.000	1.000	0.830
3	1.000	0.764	1.000	1.000	0.764
4	0.965	1.016	0.939	1.028	0.981
5	1.000	1.205	1.000	1.000	1.205
6	1.000	1.297	1.000	1.000	1.297
mean	0.994	1.017	0.989	1.004	1.011
GROUP B					
7	0.890	0.982	0.903	0.985	0.874
8	1.000	0.902	1.000	1.000	0.902
9	1.055	0.825	1.003	1.052	0.871
10	1.010	0.934	1.077	0.938	0.944
11	1.000	1.262	1.000	1.000	1.262
12	0.974	0.967	0.967	1.008	0.436
mean	0.988	0.978	0.991	0.997	0.881
P value	0.8007	0.7157	0.9435	0.6441	0.363

The table 4.3 presents the efficiency of the DMUs efficiency during the study period (2019-2021) which can be observed by total factor productivity change (TFPCH). The maximum TFPCH 1.033 (DMU8) followed by 1.016 (DMU6), a company with in-house transportation and warehousing. And the minimum is 0.348 (DMU 12). Furthermore,

group B did not significantly produce outputs with regards to the fact that p value is 0.229 because group A has the highest mean 0.926 compared to 0.763.

Table 4.3: Malmquist index's study period (2019-2021)

FIRM	EFFCH	TECHCH	PECH	SECH	TFPCH
Group A					
1	1.222	0.793	1.000	1.222	0.969
2	1.000	0.902	1.000	1.000	0.902
3	1.048	0.902	1.000	1.048	0.945
4	1.125	0.757	1.137	0.989	0.852
5	1.000	0.874	1.000	1.000	0.874
6	1.000	1.016	1.000	1.000	1.016
mean	1.065	0.874	1.022	1.043	0.926
GROUP B					
7	0.876	0.531	0.893	0.981	0.465
8	1.000	1.033	1.000	1.000	1.033
9	0.934	0.872	1.000	0.934	0.814
10	1.295	0.766	1.275	1.016	0.993
11	1.090	0.850	1.000	1.090	0.927
12	0.392	0.888	0.513	0.764	0.348
mean	0.931	0.823	0.946	0.964	0.763
P value	0.84	0.53	0.4806	0.204	0.229

[Note that all Malmquist index averages are geometric means]

The total factor productivity change was -29% $(1-0.715) * 100$. In the case of DMU 7, the total factor productivity change was 18% $(1.182-1*100)$ followed by DMU 3 was also efficient with 17% $(1.169-1) * 100$. For the year 2020 to 2021, the total factor productivity change was -9% $(0.915-1) * 100$ which was higher when compared to 2019 to 2020. This is due to an increase in technical efficiency changes to the extent of 1.2% $(1.012- 1) * 100$. In the case of DMU 6, the total factor productivity change was 30% $(1.297- 1) * 100$ which was higher when compared to other firms with in-house logistic capabilities. However, only DMU 5 and DMU 12 were efficient.

Malmquist index's study period summary:

The efficiency summary of DMUs means for the entire study period, In the case of DMU 8, the total factor productivity change was 3.3% $(1.033- 1) * 100$ followed by DMU 6 with 3% $(1.016- 1) * 100$ which was higher when compared to other firms.

However, the group B did not produce outputs significantly (0.229) because group B have a higher mean difference 0.926 compared to 0.763.

4.2. External Benchmarking Analysis Results

The external benchmarking has been conducted in this study to compare the DMUs' performance based on variables such as NOPAT margin, Asset turnover, Return on equity and financial leverage. These variables have been determined by using the formula mentioned thus far. In order to compare the efficiency measurement compared to the cost performance measurement. That is to mean that this study is going to make use of a comparative analysis by looking at the significance of selected ratios for cost performance of the DMUs.

Table 4.4 presents the company with the highest value in terms of how much profit a business makes relative to its total sales during the study period (2019-2022). The maximum NOPAT for 2019 and 2020 is (DMU 7) 32% and 29% and the minimum NOPAT is 2%, 1% (DMU 11 and DMU 12). The maximum NOPAT for 2021 is 78 % (DMU 7) and the minimum NOPAT value is 3% (DMU 11). The maximum NOPAT for 2022 is 32% (11) and the minimum NOPAT value is 3% (DMU 12 and 11). The significance between Group A and B for 2019, 2020, 2021, and 2022 is 0.5239, 0.4467, 0.9934 and 0.5734 which means that Group A did not significantly make a NOPAT higher than Group B. In other words, companies with outsourced transportation and warehousing did not significantly make profits relative to their sales during the study period.

Table 4.4: Net operating profitability after tax (2019-2022)

GROUP A	2019	2020	2021	2022
DMU 1	14%	5%	8%	7%
DMU 2	13%	14%	106%	10%
DMU 3	12%	13%	13%	14%
DMU 4	6%	5%	7%	6%
DMU 5	12%	13%	14%	14%
DMU 6	6%	4%	9%	10%
Mean	0.105	0.09	0.2616	0.1016
Standard deviation	0.0356	0.0477	0.3920	0.0337

GROUP B				
DMU 7	12%	11%	78%	11%
DMU 8	32%	29%	37%	32%
DMU 9	23%	22%	21%	21%
DMU 10	12%	11%	12%	8%
DMU 11	2%	3%	3%	3%
DMU 12	2%	1%	5%	3%
Mean	0.1383	0.1283	0.26	0.13
Standard deviation	0.1183	0.1085	0.2834	0.1143
P value	0.5239	0.4467	0.9934	0.5734

Table 4.5 presents the operating asset turnover ratio that determines the capability of the company to generate revenue from its' operating assets. It shows how a company can make the best of its' operating inventory. The company with the highest value has the better operational performance during the study period (2019-2022). The maximum operating asset turnover for 2019 is 2.3 (DMU 1) and the minimum is 0.4 (DMU 6). The maximum operating asset turnover for 2020 and 2021 is 1.59 and 1.69 (DMU 10) and the minimum for 2020 and 2022 is (DMU 2) 0.026 and 0.2. The maximum operating asset turnover for 2021 is 1.69 (DMU 12). The maximum operating asset turnover for 2022 is 1.79 (DMU 10). The year 2019; 2020, 2021 and 2022 the significance value was 0.5398, 0.5384, 0.5783 and 0.5274. Group A did not significantly manage to generate revenue from its operating assets.

Table 4.5: Operating assets turnover (2019-2022)

GROUP A	2019	2020	2021	2022
DMU 1	2.3	0.5	0.6	0.6
DMU 2	0.7	0.026	0.22	0.2
DMU 3	1	1	1	1
DMU 4	1.3	1.2	1.3	1.4
DMU 5	0.56	0.57	0.59	0.62
DMU 6	0.4	0.4	0.3	0.3
Mean	1.0433	0.616	0.6683	0.6866
Standard deviation	0.6945	0.4239	0.4138	0.4484
GROUP B				
DMU 7	1	1	1	1
DMU 8	0.22	0.44	0.36	0.42

DMU 9	0.38	0.38	0.41	0.46
DMU 10	0.11	0.11	0.12	0.09
DMU 11	1.47	1.30	1.52	1.71
DMU 12	1.60	1.59	1.69	1.79
Mean	0.7966	0.8033	0.85	0.9116
Standard deviation	0.6508	0.5824	0.6547	0.7123
P-value	0.5398	0.5384	0.5783	0.5274

The table 4.6 presents the companies' financial leverage ratio and the company with high financial leverage expenses due to additional processing fees and interest payments because it uses more debt during the study period (2019-2022). The company with the lowest financial leverage has a better debt to profit ratio performance. The maximum financial leverage for 2019, 2020, 2021 and 2022 is (DMU 7) 4.28; 5.86; 4.72; 4.34 that is to mean that it is highly in debt and it uses debt to maintain its performance. And the minimum (DMU 8) is -5.71; -6.20; -10.57; -8 which means that it maintains a debt free performance. The significance rate between group A and group B from 2019 till 2022 is 0.2877, 0.6689, 0.4288 and 0.4161 this means that group B is not significantly using debt to generate revenue compared to group A.

Table 4.6: Financial leverage (2019-2022)

GROUP A	2019	2020	2021	2022
DMU 1	1	0.8	0.6	0.8
DMU 2	0.7	0.9	0.9	1.3
DMU 3	2.04	1.63	1.44	1.33
DMU 4	1.6	0.7	0.5	0.4
DMU 5	1.97	1.62	1.51	1.08
DMU 6	1.7	1.6	1.5	1.6
Mean	1.5016	1.2083	1.075	1.085
Standard deviation	0.5389	0.4518	0.4668	0.4294
GROUP B				
DMU 7	4.28	5.86	4.72	4.34
DMU 8	-5.71	-6.20	-10.57	-8
DMU 9	0.57	0.52	0.50	0.46
DMU 10	0.65	0.62	0.60	0.82
DMU 11	0.40	0.39	0.36	0.32
DMU 12	-0.16	1.84	0.41	0.05
Mean	0.005	0.505	-0.6633	-0.335

Standard deviation	3.2204	3.8843	5.1433	4.0780
P-value	0.2877	0.6689	0.4288	0.4161

Table 4.7 presents the companies' return on Equity is used by shareholders to determine whether a company is efficient in converting its' equity into profit. The company with the highest percentage has a better performance in terms of equity during the study period (2019-2022). The maximum ROE for the years 2019, 2020, 2021 and 2022 is 80%,53%,47%,52% (DMU 7) and this means that it is efficient in converting its equity to profits and the minimum -73%, -60%, -164, -103 (DMU 8) but it has lowest ROE rate because it does not convert efficiently its equity to profit. The significance between group A and B for the study period is 0.7220, 0.4528, 0.4394 and 0.4599, this means that group A is not significantly converting its equity to profits compared to group B.

Table 4.7: Return on equity (2019-2022)

GROUP A	2019	2020	2021	2022
DMU 1	9%	17%	15%	17%
DMU 2	24%	26%	31%	22%
DMU 3	41%	32%	31%	35%
DMU 4	14%	13%	17%	16%
DMU 5	24%	26%	24%	25%
DMU 6	21%	18%	28%	38%
Mean	0.2216	0.22	0.2433	0.255
Standard deviation	0.1098	0.0712	0.0697	0.0918
GROUP B				
DMU 7	82%	53%	47%	52%
DMU 8	-73%	-60%	-164%	-103%
DMU 9	43%	36%	39%	37%
DMU 10	7%	8%	9%	11%
DMU 11	8%	9%	12%	18%
DMU 12	19%	11%	43%	31%
Mean	0.1433	0.095	-0.02333	0.0766
Standard deviation	0.5127	0.3854	0.8082	0.5609
P-value	0.7220	0.4528	0.4394	0.4599

Table 4.8 presents the ROA which have been conducted in this study to compare the DMUs' performance when it comes to utilizing efficiently to generate revenue based on variables such as annual income and annual total assets from 2019-2022 by using the formula mentioned so far. The table 4-8 presents the company with the highest return on assets has better efficiency when it comes to making the highest profits in relation to its assets. The maximum ROA for 2019, 2020 and 2021 is DMU 2 with 10%, 10% and 12% (DMU 2). This means that DMU 2 has generated the highest profits relative to its assets. And the minimum for 2019, 2020 and 2021 is 0% (DMU 1 and DMU 3), 1% (DMU 5, DMU 7 and DMU 8), and 0% (DMU 5 and DMU 10). These DMUs made lowest profits relative to their assets. The maximum ROA for 2022 is 14% (DMU 6) and the minimum is (DMU 11 and DMU 7) 1%. DMU 6 has a made the highest profits relatives to its assets while DMU 11 and 7 made the lowest profits. Group A did not attain a significant return on assets during the study period, they significantly managed to generate the highest return on assets 0.8775, 0.2462, 0.7696 and 0.12891.

Table 4.8: Return on assets (2019-2022)

GROUP A	2019	2020	2021	2022
DMU 1	0%	6%	1%	6%
DMU 2	10%	10%	12%	7%
DMU 3	0%	8%	8%	10%
DMU 4	1%	6%	9%	9%
DMU 5	6%	1%	0%	9%
DMU 6	7%	6%	10%	14%
Mean	0.04	0.0616	0.0666	0.0916
Standard deviation	0.0424	0.0299	0.0496	0.0278
GROUP B				
DMU 7	9%	1%	8%	1%
DMU 8	2%	1%	1%	11%
DMU 9	1%	9%	11%	10%
DMU 10	6%	6%	0%	4%
DMU 11	3%	4%	5%	1%
DMU 12	5%	3%	10%	7%
Mean	0.0433	0.04	0.0583	0.0566
Standard deviation	0.0294	0.0309	0.0462	0.0436
P-value	0.8775	0.2462	0.7696	0.1289

Table 4.9 presents the compound annual growth rate has been conducted in this to compare the DMUs' growth rate based on variables such as annual sales trend, annual profits, and annual operating assets during the study period 2019-2022. The company with the highest sales percentage and profit percentage but with lower assets and operating assets has a better performance during the study period (2019-2022). The maximum annual sales growth rate is 131% (DMU 4) and the minimum is -78 (DMU 5). And the highest assets growth rate is 11% (DMU 7) and the minimum -45% (DMU 8). The maximum annual profits growth rate is 251% (DMU 11) while the minimum is -3 (DMU 8). The maximum annual operating assets is 53% (DMU 9) and the minimum -70 (DMU 1). The significance level for sales, assets, profitability and operating assets during the study period is 0.8803, 0.4302, 0.6374 and 0.2568. Which means that Group A did not significantly attain sales, annual assets growth, profitability and operating assets growth.

Table 4.9: Results of compound annual growth rate (2019-2022)

GROUP A	SALES	ASSETS	PROFITABILITY	OPERATING ASSEST
DMU 1	25%	4%	232%	-70%
DMU 2	-42%	3%	123%	-16%
DMU 3	10%	4%	9%	9%
DMU 4	131%	8%	129%	-57%
DMU 5	-78%	1%	146%	-45%
DMU 6	-17%	9%	80%	-50%
Mean	0.0483	0.0483	1.1983	-0.3816
Standard deviation	0.7194	0.0306	0.7379	0.2922
GROUP B				
DMU 7	10%	6%	95%	10%
DMU 8	-21%	-45%	-3%	-15%
DMU 9	127%	4%	145%	53%
DMU 10	-2%	2%	171%	-42%
DMU 11	-75%	11%	251%	-51%
DMU 12	-48%	8%	197%	-39%
Mean	-0.015	-0.0233	1.4266	-0.14
Standard deviation	0.7012	0.2113	0.8830	0.3960
P-value	0.8803	0.4302	0.6374	0.2568

The economy of the US witnessed an unstable state where companies faced difficulties in keeping their net operating profit after tax stable due to regulations. The COVID 19 regulations led companies to either close or work from home. Only a few companies with efficient strategies such as outsourcing some logistics activities maintained or made profits during this period. The leading company with a record NOPAT is DMU 2, a company with outsourced logistic capabilities which has attained a record of 106% during 2021. During the pandemic, companies had to efficiently manage their assets to generate revenue. DMU 1 managed to maintain a higher asset turnover ratio with 2,3 while group A has not significantly generated revenue from their operational assets during the study period. When the pandemic hit the American market, most businesses went bankrupt, others had to take loans to survive the shaken economy. But only a few companies maintained their stance in competitions by not having to ask for loans. Group A has efficiently managed to keep their financial leverage constant. While group B significantly took out loans to maintain their business running. However, when it comes to ROE, DMU 7 has the highest ROE (80% to 52%) which means that it efficiently made profits out of its equity. Furthermore, when it comes to ROA, DMU 2 has managed to generate profits out of its operating assets for 2020 and 2021 with a rate of 10% and 12% as well as DMU 6 with 14% in 2022. Nevertheless, DMU 1 has the highest sales growth rate during the study period with 25%. While DMU 8 (-45%) has the lowest assets growth. When it comes to operating assets growth rate, DMU 2 has the lowest rate (-70%). Meanwhile, DMU 11 has the highest profits growth (251%), followed by DMU 1 with (232%). Although, group A has the most DMUs with a stagnant profit growth rate during the study period, they did not significantly surpass group B.

5. DISCUSSIONS AND CONCLUSION

This study infers that the problem faced by companies in the US, in the food sector, is to achieve cost performance. For this reason, some have turned to outsourcing transportation and warehousing in order to lower direct costs, avoid investments in assets and achieve cost performance.

The aim of this study was to demonstrate how outsourcing leads to cost performance based on TCE, RBV, and NT. The MPI and external benchmarking were used to investigate the performance of DMUs with outsourced (Group A) and in-housed (Group B) logistical capabilities before and during the COVID-19. TCE's primary function is to assess whether a task should be internalized or outsourced with regards to the transaction costs perspective. Bounded rationality, asset specificity, frequency (with outsourcing transportation and warehousing), and uncertainty (due to lack of information on the market) are some of the factors that influence the decision to outsource transportation and warehousing. However, when making decisions about logistics outsourcing, asset specificity and frequency with which companies are going to outsource transportation and warehousing are crucial factors. In this study several DMUs (Group A), with high asset specificity such as specialized warehousing or transportation equipment, are using 3PLs services. On the other hand, low assets specificity but frequent transportations and warehousing, are still outsourced in order to lower direct assets investments. Meanwhile, RBV places a high value on leveraging unique resources and skills to obtain a competitive advantage. The study found that in the context of logistics outsourcing, RBV and TCE are complementary. That is, before deciding to outsource, organizations must assess their own competencies and the strategic value of its own resources. Outsourcing becomes an imperative when internal resources are insufficient or cannot provide a competitive edge. The results showed that businesses can attain greater efficiency and competitive advantage if they have a rare and advanced internal logistical capabilities, as demonstrated by DMU 8 from group B. The results of MPI showed that DMUs' tfpch evolved. DMU 6 attained a 3% increase in total factor productivity as a result of the effective utilization of outsourced logistical capabilities. Outsourcing,

however, was advantageous for businesses without these skills, especially during the pandemic when 3PLs' advanced capabilities were vital.

After all the analysis as stated in the research question section, companies that have in-housed transportation have the highest cost efficiency. DMU 8 has the highest efficiency rate during the study period with a total factor productivity change was 3.3%. And also they have used debt to generate the highest equity. Such as DMU 7 which has a value of 4.28; 5.86; 4.72; 4.34 during 2019, 2020, 2021 and 2022. And they were efficient in converting the equity generated from debt to profits. Due to the fact that DMU 7 has the most ROE ratio 80%,53%,47%,52% in 2019,2020,2021, and 2022. Meanwhile, the companies that have outsourced transportation and warehousing generated the highest return on assets. With DMU 2 and DMU 6 generating considerable profits from their operational assets. DMU 2 achieved ROA of 10% and 12% in 2020 and 2021, respectively, while DMU 6 achieved a 14% ROA in 2022. However, one company (DMU 1) achieved the highest sales growth (25%) during the study period by lowering direct cost through outsourcing transportation and warehousing. When it comes to operating assets growth rate, DMU 2 has the lowest rate (-70%). Similar to other studies, outsourcing logistics related activities have a positive impact on companies whether operationally, from sales growth perspective, but the companies with in-house logistics capabilities maintained better efficiency during the study period by using loans.

5.1. Limitation of the Study

The study's limitation is that several other characteristics that were not considered could also have an impact on how well the organizations do financially, in addition to logistics capability. There are different strategies to increase a company's performance whether they are operational and managerial. Therefore, a company runs the danger of biasing any generalization that may be drawn if it bases its cost estimates solely on its logistics capability. Therefore, it would be very useful to investigate the function of outsourcing which goes beyond logistics competence and its relationship to cost performance in various industries. One of the main objectives of this study was to examine the relationship between logistics outsourcing, logistics outsourcing competencies, and

company success in the food industry. After this investigation is finished, other related research directions become clear. It is evident that generalization is limited in this study because only one sector was used. In some markets, logistics capacity could be a major problem, but not in others.

5.2. Direction for the Future Research

Although this study demonstrated a successful correlation between outsourcing logistics activities and cost performance, future research needs to look at other types of capabilities or strategic tasks and their impact on firms' cost performance. The function of logistics outsourcing and its connection to businesses' cost and performance may become clearer in a new setting. Moreover, future studies could focus on the risks of outsourcing. The outsourced logistic related activities on which this research focuses are transportation and warehousing. Furthermore, the methodology, DEA used in this study, can also be used in other sectors for different objectives. However, Companies in the US, are starting to outsource a wide range of activities, future studies can investigate on new activities that are been outsourced. Future studies can also focus on the impact of outsourcing the complete manufacturing capabilities of a company to put light on whether such a level of outsourcing can be efficient.

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APPENDIX

Appendix 1: Data Presentation for Malmquist Productivity Index Analysis

YEAR 1						
GROUP A						
DMU	Y1	Y2	Y3	X1	X2	X3
DMU 1	514405	667	51441	88000	492448	219295
DMU 2	93469	12691	99752	291000	77286	128772
DMU 3	58218	63	45604	149867	48465	72583
DMU 4	40052	3024	4303	121000	39635	29109
DMU 5	157404	2131	1687	40000	14349	30624
DMU 6	5586	1142	559	83000	5142	5105
GROUP B						
DMU 7	64661	12515	64661	267000	5687	77648
DMU 8	21025	59243	21364	210000	12295	328112
DMU 9	31856	6434	3659	62600	2718	83216
DMU 10	25938	3381	691	80000	22025	62729
DMU 11	64656	1379	6469	38100	63002	43997
DMU 12	51826	1538	513	242000	50412	32014

YEAR 2						
GROUP A						
DMU	Y1	Y2	Y3	X1	X2	X3
DMU 1	523964	14881	52396	2200000	503396	236495
DMU 2	90321	13047	9361	273000	74539	132288
DMU 3	57942	6375	61633	148949	48458	77287
DMU 4	42405	2022	4283	141000	40177	33097
DMU 5	168652	17527	1763	40000	14673	301112
DMU 6	5985	1041	598	88000	5694	5983
GROUP B						
DMU 7	67161	7314	7037	267000	60292	78547
DMU 8	210765	60254	19208	205000	11884	475108
DMU 9	37266	892	3301	86200	24017	86381
DMU 10	25868	387	718	80000	22728	64549
DMU 11	64355	1772	644	39000	62589	49719
DMU 12	5242	892	5049	250000	51442	31778

YEAR 3						
GROUP A						
DMU	Y1	Y2	Y3	X1	X2	X3
DMU 1	559151	1351	55915	2300000	536603	252496
DMU 2	95701	18496	9384	276000	82923	152235
DMU 3	62047	7157	45072	148044	51751	88845
DMU 4	43185	2061	4952	139000	42653	34456
DMU 5	176266	21812	1813	35000	14982	308067
DMU 6	7547	1707	755	97660	6742	6653
GROUP B						
DMU 7	70372	712	7947	291000	68312	92918
DMU 8	192078	47305	23223	200000	12867	526268
DMU 9	33014	7747	3866	80300	28347	87296
DMU 10	26581	3555	776	79000	24067	6781
DMU 11	85249	2709	8526	41000	82256	56136
DMU 12	64984	3796	6487	250000	60339	38377

Appendix 2: Presentation of data for external benchmarking for 2019 (Millions)

YEAR 1							
GROUP A							
DMU	net income	Sales	Operating assets	EBITA	Revenue	Annual tax rate	Annual total debt
DMU 1	6,67	51441	219295	21,957	514405	37,4	75,95
DMU 2	12,691	99752	128772	16,183	93469	23,8	38,37
DMU 3	6,3	45604	72583	9,753	58,218	25,5	31,65
DMU 4	1,98	4303	29109	2,77	40052	16,3	11,444
DMU 5	1,753	1687	30624	2,516	15740	18	14,49
DMU 6	350	559	5105	444	5,586	23,6	2,85
GROUP B							
DMU 7	7,314	64661	77648	10,291	64661	21	63,68
DMU 8	6,025	21364	328112	9,07	21025	24,9	46,88
DMU 9	8,92	3659	83216	10,086	31856	16,7	12,087
DMU 10	3,929	691	62729	3,843	25938	0,1	17,887
DMU 11	1,379	6469	43997	1,654	64,656	13,4	7,672
DMU 12	1,538	513	32014	1,414	51,826	13,8	1,278
DMU 1	7,314	64661	77648	10,291	64661	21	63,68

Presentation of data for external benchmarking 2020 (Millions)

YEAR 2							
GROUP A							
DMU	net income	Sales	Operating assets	EBITA	Revenue	Annual tax rate	Annual total debt
DMU 1	14,881	52396	236495	20,57	523964	24,4	68,48
DMU 2	13,047	93610	132288	15,78	90321	20,9	45,31
DMU 3	6,375	61633	77287	9,485	57,942	23	32,92
DMU 4	2,061	4283	33097	3,008	42405	22,3	11,36
DMU 5	2,181	1763	301112	2,954	16865,2	19	13,539
DMU 6	356	598	5983	290	5,985	21,1	3,16
GROUP B							
DMU 7	7,12	7037	78547	10,08	67161	20,9	79,37
DMU 8	4,731	19208	475108	7,324	21076,5	23	48,52
DMU 9	7,747	3301	86381	8,997	37266	28,3	11,129
DMU 10	3,555	718	64549	3,853	25868	36,2	17,087
DMU 11	1,772	644	49719	1,766	64,355	5,4	7,885
DMU 12	892	5049	31778	978	52,42	43,7	15,56
DMU 1	7,12	7037	78547	10,08	67161	20,9	79,37

Presentation of data for external benchmarking 2021 (Millions)

YEAR 3							
GROUP A							
DMU	net income	Sales	Operating assets	EBITA	Revenue	Annual tax rate	Annual total debt
DMU 1	13,51	55915	252496	22,548	559151	33,3	57,6
DMU 2	18,496	9384	152235	12,778	95701	20,7	50,97
DMU 3	7,157	45072	88845	10,295	62,047	24	33,6
DMU 4	3,047	4952	34456	4,396	43185	24,3	9,36
DMU 5	2,34	1813	308067	3,145	17627	22	12,612
DMU 6	653	755	6653	805	7,547	19,7	3,52
GROUP B							
DMU 7	7,618	7947	92918	11,162	70372	21,8	76,23
DMU 8	7,545	23223	526268	10,356	19208	20,12	48,64
DMU 9	9,771	3866	87296	10,308	33014	21,1	12,353
DMU 10	4,3	776	67810	4,653	26581	27,2	17,062
DMU 11	2,709	8526	56136	2,993	85,249	17,4	8,011
DMU 12	3,796	6487	38377	4,644	64,984	24,5	3,645
DMU 1	7,618	7947	92918	11,162	70372	21,8	76,23

Presentation of data for external benchmarking 2022 (Millions)

YEAR 3							
GROUP A							
DMU	net income	Sales	Operating assets	EBITA	Revenue	Annual tax rate	Annual total debt
DMU 1	13,673	101	244860	25,942	572754	25,4	65,38
DMU 2	9,714	19093	141657	12,916	99320	24,2	58,79
DMU 3	8,052	60	81992	11,331	63293	25	30,46
DMU 4	3,238	53282	36309	4,41	47049	21,7	8,36
DMU 5	2,707	19	31842	3,476	18127	18,3	11,62
DMU 6	899	320	6653	1,16	7547	23,9	3,73
GROUP B							
DMU 7	8,91	86392	92377	11,512	79474	16,1	74,91
DMU 8	6,177	10667	53854	9,371	23223	21,06	48,04
DMU 9	9,542	43004	94354	10,909	38665	18,1	11,9
DMU 10	2,717	651	67092	3,534	28720	26,8	21,96
DMU 11	4,34	102	59774	4,212	101556	16,6	7,735
DMU 12	2,994	72	40311	2,825	72609	11,4	486
DMU 1	8,91	86392	92377	11,512	79474	16,1	74,91

Appendix 3: Data presentation for Return on Assets (2019-2020)

Data presentation for return on assets (2019-2022)

ANNUAL NET INCOME (Millions)				
GROUP A	2019	2020	2021	2022
DMU 1	667	14 881	1 351	13 673
DMU 2	12 691	13 047	18 496	9 714
DMU 3	63	6 375	7 157	8 052
DMU 4	198	2 061	3 047	3 238
DMU 5	1 753	2 181	234	2 707
DMU 6	350	356	653	899
GROUP B				
DMU 7	7 314	712	7 618	891
DMU 8	6 025	4 731	7 545	6 177
DMU 9	892	7 747	9 771	9 542
DMU 10	3 929	3 555	43	2 717
DMU 11	1 379	1 772	2 709	434
DMU 12	1 538	892	3 796	2 994

Annual Assets (Millions)

ANNUAL ASSETS (Millions)				
GROUP A	2019	2020	2021	2022
DMU 1	219295	236495	252496	244860
DMU 2	128772	132288	152235	141657
DMU 3	72583	77287	88845	81992
DMU 4	29109	33097	34456	36309
DMU 5	30624	301112	308067	31842
DMU 6	5105	5983	6653	6653
GROUP B				
DMU 7	77648	78547	92918	92377
DMU 8	328112	475108	526268	53854
DMU 9	83216	86381	87296	94354
DMU 10	62729	64549	67810	67092
DMU 11	43997	49719	56136	59774
DMU 12	32014	31778	38377	40311

Appendix 4: Data presentation compound annual growth rate

ANNUAL SALES (Millions)				
GROUP A	2019	2020	2021	2022
DMU 1	51441	52396	55915	101000
DMU 2	99752	93610	9384	19093
DMU 3	45604	61633	45072	60000
DMU 4	4303	4283	4952	53282
DMU 5	1687	1763	1813	19
DMU 6	559	598	755	320
GROUP B				
DMU 7	64661	7037	7947	86392
DMU 8	21364	19208	23223	10667
DMU 9	3659	3301	3866	43004
DMU 10	691	718	776	651
DMU 11	6469	644	8526	102
DMU 12	513	5049	6487	72

ANNUAL PROFITS (Millions)				
GROUP A	2019	2020	2021	2022
DMU 1	51441	52396	55915	101000
DMU 2	99752	93610	9384	19093
DMU 3	45604	61633	45072	60000
DMU 4	4303	4283	4952	53282
DMU 5	1687	1763	1813	19
DMU 6	559	598	755	320
GROUP B				
DMU 7	64661	7037	7947	86392
DMU 8	21364	19208	23223	10667
DMU 9	3659	3301	3866	43004
DMU 10	691	718	776	651
DMU 11	6469	644	8526	102
DMU 12	513	5049	6487	72

ANNUAL ASSETS (Millions)				
GROUP A	2019	2020	2021	2022
DMU 1	219295	236495	252496	244860
DMU 2	128772	132288	152235	141657
DMU 3	72583	77287	88845	81992
DMU 4	29109	33097	34456	36309
DMU 5	30624	301112	308067	31842
DMU 6	5105	5983	6653	6653
GROUP B				
DMU 7	77648	78547	92918	92377
DMU 8	328112	475108	526268	53854
DMU 9	83216	86381	87296	94354
DMU 10	62729	64549	67810	67092
DMU 11	43997	49719	56136	59774
DMU 12	32014	31778	38377	40311

ANNUAL OPERATING ASSETS (Millions)				
GROUP A	2019	2020	2021	2022
DMU 1	492448	503396	536603	13673
DMU 2	77286	74539	82923	45096
DMU 3	48465	48458	51751	63293
DMU 4	39635	40177	42653	3047
DMU 5	14349	14673	14982	2340
DMU 6	5142	5694	6742	653
GROUP B				
DMU 7	5142	5694	6742	653
DMU 8	5687	60292	68312	7618
DMU 9	12295	11884	12867	7545
DMU 10	2718	24017	28347	9771
DMU 11	22025	22728	24067	4300
DMU 12	63002	62589	82256	7570

Worksheet 1: Annual Efficiency in 2019

Worksheet 2: Annual Efficiency in 2020

Results from DEAP Version 2.1				
Instruction file = eg1-ins.txt				
Data file = eg1-dta.txt				
Input orientated Malmquist DEA				
DISTANCES SUMMARY				
year = 1				
firm	crs	te	rel to tech	in yr vrs
no.	*****			te
	t-1	t	t+1	
1	0.000	0.669	1.059	1.000
2	0.000	1.000	1.053	1.000
3	0.000	0.911	0.969	1.000
4	0.000	0.693	1.111	0.701
5	0.000	1.000	5.969	1.000
6	0.000	1.000	1.286	1.000
7	0.000	1.000	8.239	1.000
8	0.000	1.000	1.421	1.000
9	0.000	1.000	0.879	1.000
10	0.000	0.342	0.569	0.593
11	0.000	0.842	1.281	1.000
12	0.000	0.413	0.912	0.419
mean	0.000	0.823	2.062	0.893

year = 2				
firm	crs	te	rel to tech	in yr vrs
no.	*****			te
	t-1	t	t+1	
1	0.632	1.000	1.021	1.000
2	1.013	1.000	1.440	1.000
3	1.207	1.000	1.572	1.000
4	0.464	0.910	0.896	0.967
5	2.394	1.000	0.979	1.000
6	0.814	1.000	0.877	1.000
7	0.584	0.862	0.868	0.882
8	1.987	1.000	1.409	1.000
9	0.615	0.826	0.998	0.997
10	0.374	0.568	0.618	0.895
11	0.500	1.000	0.934	1.000
12	0.149	0.195	0.161	0.332
mean	0.895	0.863	0.981	0.923
year = 3				

Worksheet 3: Annual Efficiency in 2021

year = 3					
firm	crs	te	rel to tech	in yr	vrs
no.	*****				te
	t-1	t	t+1		
1	1.010	1.000	0.000	1.000	
2	0.992	1.000	0.000	1.000	
3	0.917	1.000	0.000	1.000	
4	0.894	0.878	0.000	0.908	
5	1.422	1.000	0.000	1.000	
6	1.475	1.000	0.000	1.000	
7	0.746	0.767	0.000	0.797	
8	1.146	1.000	0.000	1.000	
9	0.717	0.872	0.000	1.000	
10	0.545	0.574	0.000	0.964	
11	1.488	1.000	0.000	1.000	
12	0.094	0.064	0.000	0.110	
mean	0.954	0.846	0.000	0.898	
[Note that t-1 in year 1 and t+1 in the final year are not defined]					

Worksheet 4: Annual Efficiency from 2019 to 2020

MALMQUIST INDEX SUMMARY					
year = 2					
firm	effch	techch	pech	sech	tfpch
1	1.494	0.632	1.000	1.494	0.944
2	1.000	0.981	1.000	1.000	0.981
3	1.098	1.065	1.000	1.098	1.169
4	1.312	0.564	1.378	0.952	0.740
5	1.000	0.633	1.000	1.000	0.633
6	1.000	0.796	1.000	1.000	0.796
7	0.862	0.287	0.882	0.977	0.247
8	1.000	1.182	1.000	1.000	1.182
9	0.826	0.921	0.997	0.829	0.761
10	1.660	0.629	1.509	1.100	1.044
11	1.188	0.573	1.000	1.188	0.681
12	0.471	0.589	0.792	0.595	0.278
mean	1.030	0.694	1.031	0.999	0.715

Worksheet 5: Annual Efficiency from 2020 to 2021

year = 3					
firm	effch	techch	pech	sech	tfpch
1	1.000	0.994	1.000	1.000	0.994
2	1.000	0.830	1.000	1.000	0.830
3	1.000	0.764	1.000	1.000	0.764
4	0.965	1.016	0.939	1.028	0.981
5	1.000	1.205	1.000	1.000	1.205
6	1.000	1.297	1.000	1.000	1.297
7	0.890	0.982	0.903	0.985	0.874
8	1.000	0.902	1.000	1.000	0.902
9	1.055	0.825	1.003	1.052	0.871
10	1.010	0.934	1.077	0.938	0.944
11	1.000	1.262	1.000	1.000	1.262
12	0.326	1.337	0.333	0.981	0.436
mean	0.904	1.012	0.906	0.998	0.915

Worksheet 6: Mean's Summary of the study period for efficiency (20219-2021)

MALMQUIST INDEX SUMMARY OF ANNUAL MEANS					
year	effch	techch	pech	sech	tfpch
2	1.030	0.694	1.031	0.999	0.715
3	0.904	1.012	0.906	0.998	0.915
mean	0.965	0.838	0.966	0.998	0.809

Worksheet 7: Malmquist Efficiency Index of the study period for efficiency (2029-2021)

MALMQUIST INDEX SUMMARY OF FIRM MEANS					
firm	effch	techch	pech	sech	tfpch
1	1.222	0.793	1.000	1.222	0.969
2	1.000	0.902	1.000	1.000	0.902
3	1.048	0.902	1.000	1.048	0.945
4	1.125	0.757	1.137	0.989	0.852
5	1.000	0.874	1.000	1.000	0.874
6	1.000	1.016	1.000	1.000	1.016
7	0.876	0.531	0.893	0.981	0.465
8	1.000	1.033	1.000	1.000	1.033
9	0.934	0.872	1.000	0.934	0.814
10	1.295	0.766	1.275	1.016	0.993
11	1.090	0.850	1.000	1.090	0.927
12	0.392	0.888	0.513	0.764	0.348
mean	0.965	0.838	0.966	0.998	0.809
[Note that all Malmquist index averages are geometric means]					

