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Impact of Famagusta Port Efficiency on North Cyprus Economic Development

Nadir GURPINAR¹, Hasret Benar BALCIOGLU²

Abstract

This study aims at evaluating the performance of the Famagusta Port in order to find out its impact on the economy of NC. It is critical to analyze the economic impact of the Famagusta port in particular. The performance of the economy is correlated to the productivity and the efficiency of the port over a given period of time. The more the port performs the higher the efficiency and productivity. With Famagusta Port's low growth rate, the question of port efficiency is necessary in a country like NC. Data envelopment analysis (DEA) is used to conduct this research. The results obtained determine the efficiency of the port.

Keywords: port efficiency, port performance, port development, economic impact, economic growth, data envelopment analysis, Famagusta port.

Introduction

Ports always play a crucial role in the development of international and domestic trade of both developed and developing countries (Nagorski, 1972). Due to the globalization of the world and the distances getting shorter, ports are playing a vigorous role in sustaining a country's economic growth. One of the main issues in contemporary port economics is efficiency. Port efficiency is highly related with handling cost, and inefficient ports have higher handling costs (Lee, Lee, & Chen, 2012). The advancements in the transport and communication technology along with the ideology of the free-market have brought forth the rise of exceptional flexibility of goods and services. The seaport is the nerve center of foreign trade of a nation, making the efficiency of a port crucial to the present international trade.

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Port Famagusta is located in the sea shows of Northern Cyprus. The port is open to all flags as it's a free port zone (Walsh, 2010). It has a natural harbour and is strategically positioned with convenient access to both regional and international air links. Port Famagusta is the major port for the Turkish Republic of Northern Cyprus. It is the main entry point to the nation, and thus an entry point for its imports and tourists. Though it is a free zone, it is also the country's primary connection to the outside world through the Mediterranean Ocean (Guncavdi & Kucukcifci, 2009). The strategic importance of the island has made it a frequent target of different powers, and was conquered and undergone many changes in history (Joseph, 1997). Famagusta as a city was founded by Ptolemy king Philadelphus in 274 B.C, and was named Arsinoe city after Philadelphus's sister. Famagusta was one of the wealthiest towns in the world in the fourteenth century (Walsh, 2010). The Famagusta port at that time created a lot of wealth since it was an important commercial hub for exports and imports and had the largest business volume in Cyprus until 1974 when the port came under the control of the Turkish army (Vasiliki, 2017) .

Literature review

In past years, several researchers tried to establish the factors that affect port performance and the factors that influenced economic growth. In this part, different methods that are used to determine port efficiency will be mentioned. Secondly, the impact of port efficiency on economic growth of a country will also be discussed. Finally, the direction of the correlation that exists between port efficiency and economic growth will be discussed. . Port impact studies investigate the relationship of port trade and its impact on the regional economy.

Measuring Port Efficiency

Port efficiency can be established through several ways but the most common method used is the throughput volume of goods. The port throughput was compared with the optimal throughput so as to determine whether the throughput of the port has increased or decreased over time.

Researchers have used several approaches to evaluate port efficiency such as Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA). Data Envelopment Analysis (DEA) has been used in several studies on port performance. Researchers such as Roll and Hayuth applied Data Envelopment Analysis model to evaluate efficiency of twenty ports (Roll & Hayuth, 2006). Studies such as Tongzon (2001) and Valentine (2001) used data development analysis to measure the efficiency of a port. Both researcher applied DEA when investigating the efficiency of 16 international ports (Tongzon, 2001; Valentine, F, 2001). The procedure uses data on output, production, and inputs to develop an

approximation of the most effective production frontier crosswise a group of ports. In data envelopment analysis, measuring port efficiencies involves combining available inputs to attain a greater level of outputs comparable Data Management Units. The concept of DEA was established around the basic impression that the efficiency of a decision-making unit was determined by its capability to convert inputs into desired outputs. The efficiency of a process is defined as $\text{Output/Input} \leq 1$. Efficiency of a port is always less than or equal to unity (Tongzon, 1995).

Port Economic Impact

Ports play a crucial role in international and domestic trade, so they seem to have an impact on national and local economic growth (Talley, 2009). The activities that take place at the port can have an impact on economic growth of a country in terms of GDP. According to several researches, ports play a vital role in economic growth of local, regional and national levels (Jung, 2011; Lonza & Marolda, 2016; Dwarakish & Salim, 2015). Port efficiency has been covered in a recent study by Gonzalez and Trujillo (Gonzalez & Trujillo, 2009). The measure of port efficiency is a notion that directly relates to the measure of the productivity of the port. Efficiency and productivity are the two key concepts that correlate to the performance of the economy. The key idea in the two concepts is that a port's performance increases as it becomes more productive and efficient. Productivity concept is usually the proportion of the capacity measure of output to the capacity measure of the used input. Efficiency is the relative concept, for instance, the performance of a port compared to a benchmark (Liu & London, 2010).

Inefficient ports may lower the volume of the trade, especially for the less advanced countries, and this hinders economic growth. Port efficiency is crucial in facilitating trade practices, since ports allow trade to take place from importing and exporting goods and services. Disruption or inefficiency of ports in a country is a major problem since they can considerably impact the supply chains, which in turn affects economic growth. There are factors that contribute to the efficiency of the port which include labor relations, characteristics of the harbour, connection to railway and trucking lines and docking facilities (Blonigen & Wilson, 2008).

The study of a port's economic impact is a significant aspect of determining its influence to economic growth. Several studies on port efficiency and its impact on the economy consider ports as a catalyst to economic growth to the neighbouring regions as the activities and services in them produce socio-economic wealth and remunerations (Talley, 2009). For instance, the volume of export or import cargoes transported can be affected by the performance of the port. Based on this aspect, the performance of the port is measured regarding its ability to produce economic wealth and maximum output (Fourgeaud, 2000). Boske & Cuttino (2003) is a previous study on port impact on economic that was based on input-output analysis. The input-output analysis is a process of analytically enumerating the shared interrelationships between the different sectors of an economic system.

There are two kinds of effects that make up the port secondary impact of the economy. These effects are induced and individual. An individual effect refers to all the economic activities that are developed at the port that fully depend on the primary activities. The primary activities usually involve buying and selling of goods and services (Man, Cheung, & Yip, 2011). Induced effects refer to all the activities that take place at the port that depend on the direct and indirect effects through consumption linkage. Economic impact of the port due to induced effects includes all the activities that come from employees who have been employed directly or indirectly at the port through consumption of the salaries and wages. Port economic impact shows all the economic benefits brought about by the local community being involved with existence and the operation of the port (Begum, 2003). Ports also play a major role in the expansion of the economy. Many developing centers, which function efficiently and freely in ports, make rapid progress. Examples of these rapidly developed cities due to the efficiency of the port are Hong Kong, South Korea and Singapore (Begum, 2003). Levine and Renelt states that “economic growth is the result of a sound macroeconomic policy stance and high investment in physical and human capital” (Levine & Renelt, 1992). Port investments consist of both physical and human capital which stimulates economic growth. According to Meletiou (1998), performance equals to effectiveness, efficiency and participant satisfaction.

Methodology

Several methods can be used to evaluate the efficiency of the port such as Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA). The purpose of this paper is to implement the DEA method to determine the efficiency and productivity of Famagusta Port.

Data Envelopment Analysis (DEA)

Data Envelopment Analysis is a non-parametric method that can be used to measure the relative efficiency of a port by utilizing decision-making units (DMU) that have numerous input and output. Data Envelopment Analysis (DEA) has become the most common management tool. In most cases, DEA is usually used in evaluating the efficiency of several procedures. DEA is a well-established technique that helps in pinpointing efficiency. It helps in lowering costs which may be incurred by the port for investing in inputs, and it helps in increasing output. One of the key advantages of utilizing this technique is that it has the capability of taking into account multiple outputs and inputs to determine efficiency. The utilization of DEA methodology emphasizes several significant questions that need to be answered. These questions include: (1) What is the purpose of measuring and analyzing performance? (2) What are the DMUs and input and output to

be used? (3) What is the appropriate model orientation? Answering the above questions will provide guidance for the utilization of DEA in this study (Cooper, Seiford, & Zhu, 2011).

1. *Purpose of Measurement and Analysis of Efficiency.* It is crucial for any study in port efficiency to have a clear specification of the functions to be considered and clear understanding of the process being estimated since they guide in the selection and output variables. The purpose of this study is to measure and evaluate Port Famagusta technical efficiency by utilizing operational variable of containers so as to enhance resource utilization (Bichou, 2013).
2. *Data Selection (input and output).* The selection of the variables to be used in the efficiency analysis is a key step since it weighs on the accuracy of the analysis. This study will examine the container terminal efficiency, through incoming and outgoing containers. The output and input variables should always reflect the real purposes and process of the port production as precise as possible (Cullinane & Wang, 2006). The container throughput is the cumulative number of containers that are loaded and offloaded in twenty foot equivalent units (TEUs) and it's the most crucial indicator of the container port output. The procedure uses data on output, production, and inputs help us to develop an approximation of the most effective production frontier crosswise a group of ports (Charnes *et al.*, 1994). Measures of port efficiency are then determined by the abnormalities from the frontier obtained.
3. *DEA Model and Orientation.* In data development analysis, measuring port efficiencies involves combining available inputs to attain a greater level of outputs comparable Data Management Units. To calculate Famagusta port's efficiency, the outputs and inputs of the port need to be specified accurately. There are several measures of port output available which depend on the features of the port being evaluated. The first output is based on the number of containers being offloaded and loaded, and the second being the amount of cargo handled per berth hour (Cullinane & Wang, 2006). The significance of using this technique is that it enhances each individual observation with an objective of tabulating a distinct piece-wise frontier which is in contrast to other parametric tactics for instance regression analysis. DEA focuses on individual observation different from other statistical methods that focus on parameters' average. DEA is the best approach since it will focus on each individual observation obtained about Famagusta Port in order to obtain accurate results on port efficiency. Also it's flexible since its calculations are non-parametric which implies that when computing efficiency of Famagusta Port, one does not require having familiarity with priori weights for the outputs and inputs.

Results

Data Envelopment Analysis (DEA)

DEA is a non-parametric mathematical program that is used to obtain relative efficiency of comparable decision-making units with respect to multiple outputs and inputs. The efficiency of the port in this process will be defined as $\text{Output}/\text{Input} \leq 1$. Efficiency of a port is always less than or equal to unity.

$$\text{Efficiency} = \frac{\text{Total imports}}{\text{Total exports}}$$

To indicate efficiency of a port than the value obtained should be less or equal to one. In cases where it's less or greater than one the port is considered to be inefficient (Tongzon, 1995).

Table 1: Famagusta Port Import - Export Data 2010-2015 in Tons

Month/ Year	2010		2011		2012		2013		2014		2015	
	exports	imports										
Jan	8175	43945	14906	53885	20549	22770	30329	99052	46055	145192	14283	117311
Feb	8164	69213	14164	64695	17564	83511	16018	99308	41224	118478	21130	129905
March	22603	78386	21205	76624	49492	137236	20314	117506	35642	95298	32797	117985
April	26621	87455	22955	67270	32182	72436	41394	97819	39936	142188	32434	149571
May	20887	74820	24401	50267	55378	108794	37462	113591	40411	134984	19203	116230

REALITIES IN A KALEIDOSCOPE

June	7643	70147	12890	58510	23986	117728	38282	116865	31428	118671	8544	87717
July	6078	75074	8815	64753	31887	103789	36174	120380	22478	183917	11580	126739
Aug	6849	74110	9192	50890	27295	86991	25336	97105	27097	151582	8501	107517
Sep	13736	55353	8821	46496	31259	94696	28209	120380	33444	181138	6342	125310
Oct	7545	70224	101033	66563	24028	148318	27170	157903	20198	153089	10074	111497
Nov	7898	65540	8974	84942	17820	88864	28562	112079	19690	112475	6724	128432
Dec	13971	74604	11048	62532	38477	89123	171257	121891	34018	144200	5582	162389
Totals	150170	838871	258404	747427	369917	1154256	500507	1373879	391621	1681212	177194	1480603
Efficiency	5.586142	2.892475	3.120311	2.744975	4.292957	8.35583						

Sources: (State Planning Organisation, 2011)

PORT FAMAGUSTA DATA 2010-2015 imports and exports

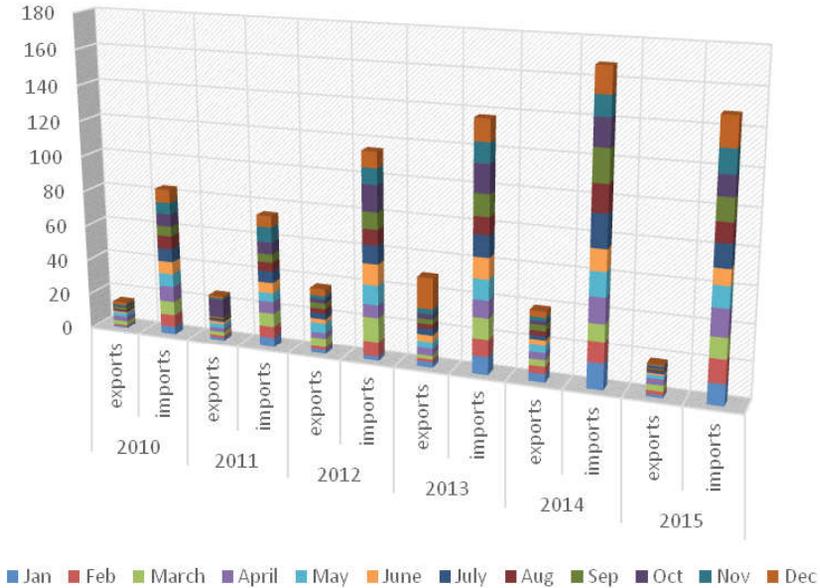


Figure 1: Famagusta Port 2010-2015 imports and exports data

As in the data above, it is clear that the efficiency of the port in the year 2010 was 5.6. It came down to 2.9 in the following year went up again up to 2.1 then down. In the two last years, it rose to 8.4 through 4.3 and at 2.7, 2012 was the year that port Famagusta was most efficient. The year it experienced high inefficiency rates was 2015 at 8.4. The graph below indicates the fluctuation of the efficiency of the port over the period of six years.

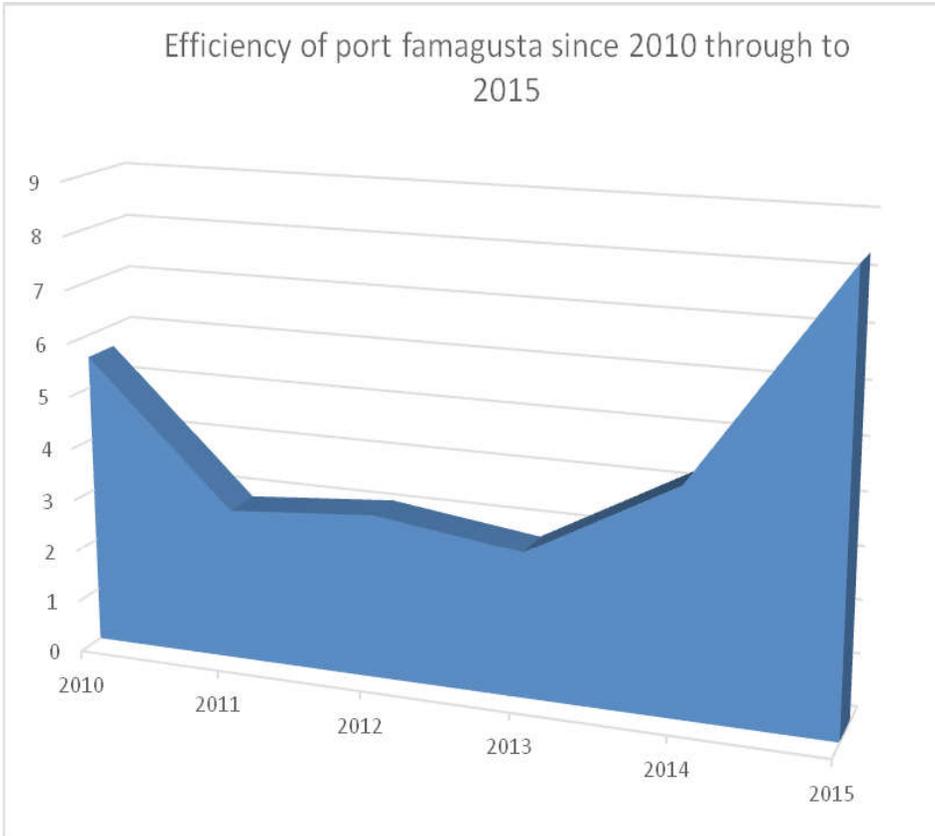


Figure 2: Famagusta Port efficiency from 2010 through 2015

Discussion

Famagusta port offloaded more containers than it loaded between 2010 and 2015. Therefore, the numbers of incoming containers were more than outgoing; however, the number of cargos handled was consistent throughout the five years. This clearly shows that the port had poor performance, indicating inefficiency. According to the graph above, it is evident that there were more imports coming through Famagusta Port than exports. The country was suffering losses because importing cost was higher than the cost generated after exporting. This effect does not favor economic development in the country.

The data employed in determining the efficiency of Famagusta Port extends up to 2015 (State Planning Organisation, 2011). In this light, it is necessary to mention that, considering the annual production of the statistical data for the port, by the

time of the present research, the data for 2016 was not yet available. Also, the data used for statistical analysis was obtained from North Cyprus Port Authority. This paper contributes to the existing composition regarding the efficiency of a port and its influence on the economy. The seaport is the nerve center of a nation's foreign trades, thus, the efficiency of a port is crucial to the present international trade, contributing to the economic growth of the country. An inefficient port reduces the trade volumes, especially in the case of less developed countries, which hinders economic growth. Nevertheless, through its capacity of enabling import and export of goods and services, port efficiency is crucial in facilitating trade practices (Clark, Dollar, & Micco, 2004). In the process of obtaining the relative efficiency of Famagusta port, the present research used the data envelopment analysis. The results revealed that while Famagusta receives many containers, the output is extremely low. The computed relative efficiency is less than one, meaning that the port is inefficient. Inefficient ports slow down economic growth, since importing and exporting goods contribute to economic growth. When a port is inefficient, those activities are not as vibrant as they should be. Ports play a major role in the expansion of the economy (Roll & Hayuth, 2006). Many developing cities have ports that function freely and efficiently, recording a rapid progress, such as Singapore. When using DEA analysis on Singapore port, the relative efficiency is less or equal to one, implying an efficient port (Xiao & Lam, 2017). Also, when using the Singapore port as a decision making unit, the Famagusta port proves to be less efficient. Nevertheless, the impact of Famagusta port's efficiency on the economy lacks adequate research. The results from this study show that Famagusta port is inefficient. As such, in terms of practical applications and knowledge contribution, the current study highlights the usage of data envelopment analysis in tabulating the efficiency of a port. However, given the complexity of the study in obtaining the efficiency of Famagusta port, the following questions emerge: Whether and how the government will act in order to improve the efficiency of the Famagusta Port? Whether and how port Famagusta will benefit from this study in improving its efficiency? Future research is required in order to address these questions and to fully determine the efficiency of Famagusta Port.

In terms of world trade, maritime transport has always been important. Ports constitute the most important infrastructure of maritime trade. Following the use of container in marine transportation, its use in other transportation types has become increasingly widespread. Increasing numbers of large container vessels are pushing port investments to grow (Lee & Cullinane, 2016) (Valentine, Benamara, & Hoffmann, 2013). 90% of world trade (WTO, 2016) and 99% of North Cyprus trade are done through sea (State Planning Organisation, 2011). This is a result of sea transportation being 6.5 times more economic than road transport and 3.5 times more economic than rail transport, as well as transporting huge amounts of cargo safely at once (Novianti, Panjaitan, & Nugraheni, 2015) (Clark et al., 2004). The maritime sector is one of the most important sectors that make countries get into world trade and have a chance of integration. Furthermore, the stronger these

get, the more powerful countries become (Novianti et al., 2015). Ports can be expressed as the bases in which the goods subject to the trade are placed in and out of the economy. As it is in the whole world, a large part of international trade in our country is still carried out by sea, which is the most economical system (Morrissey & O'Donoghue, 2013). It is necessary to increase the capacities of the harbors considering the important role of the ports that constitute the marine part of the transportation chain in the development of the country's economy. There are two options for this. These are; to increase the efficiency of existing ports and to make physical investments (Corbett & Winebrake, 2008). The strategy of sustainable port economics involves the assessment of all social, political, economic, technological and environmental risks and opportunities that may be encountered while moving towards a global success target in the port management sector in which there is intense competition (Boulos, 2016) (Alderton, 2008). Today we live in a world that has a much more complex structure than the old one. Port operators who want to redefine themselves and benefit from possible growth opportunities should also take advantage of the sustainable port economy strategy approach, which would create new values for their customers. It is very important to follow a sustainable growth strategy in Port Enterprises (Muntean, Nechita, Nistor, & Sarpe, 2010). During the growth of the world trade capacity, the importance of maritime transport, the number of vessels entering ports and the volume of freight are also increasing (Fu, 2011). The number and capacity of ports, which are the basic components of maritime transport, are developing (Deng, Lu, & Xiao, 2013). Ports supporting trade and transportation offer important opportunities for the economic development of the city and the region in which they are located and this established a strong link between various trade centers (Lee, Lun, Lai, & Cheng, 2016) (Zhu, 2011). In this context, there is great competition on the global scale in order for the ports to be ready to meet the growing needs. Famagusta is one of the most important places connecting the Middle East and Europe. Therefore, Famagusta Port provides important strategic advantages not only to the city but also to the country.

Conclusion

Famagusta port is inefficient in accordance to the data above. The efficiency of a port is what determines the growth rate of a country's economy. The port is the supply chain and bridge between countries and any failure could impact negative growth. It is through the port that all foreign trade takes place; international trade is promoted by an efficient port. It is also a channel where locally manufactured goods are exported to other countries. Famagusta port is inefficient, but the tables indicate a consistent growth of gross domestic products, which is important in determining the economic growth of a country. If matters affecting port development and growth are well addressed, then the port can rapidly grow. Economic expansion

is determined by an efficient port. The government should look into factors that may lead to port inefficiency which may include employees, infrastructure, and technology and education system. Employees' performance can be negatively affected if their needs are not sufficiently addressed on matters such as wages, salaries, promotions, education, protecting their rights and addressing their problems on time. There should always be strategies to motivate the employees and give them enough time to rest. This paper contributes to the existing composition of the efficiency of a port and its influence on the economy. Inefficient ports may reduce the trade volumes, especially for the less developed countries, which hinders economic growth. Port efficiency is crucial in facilitating trade practices, since ports allow trade to take place from importing and exporting of goods and services. Inefficient ports slowly down economic growth since importing and exporting goods contributes to economic growth, and when a port is inefficient it implies that those activities are not as vibrant as they are supposed to be.

Given the complexity of the study in obtaining the efficiency of Famagusta port, the following questions emerge: Whether and how the government will do to improve the efficiency of port Famagusta? Whether and how port Famagusta will benefit from this study to improve its efficiency? The investigation of these questions will be the focus of future research. Further future research is encouraged in this field to fully determine the efficiency of Port Famagusta.

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