PressAcademia

JBEF

Journal of Business, Economics & Finance

PressAcademia publishes journals, books, case studies, conference proceedings and organizes international conferences.

jbef@pressacademia.org

ISSN 2146-7943

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

ABOUT THE JOURNAL

Journal of Business, Economics and Finance (JBEF) is a scientific, academic, double blind peer-reviewed, quarterly and open-access journal. The publication language is English. The journal publishes four issues a year. The issuing months are March, June, September and December. The journal aims to provide a research source for all practitioners, policy makers and researchers working in the areas of business, economics and finance. The Editor of JBEF invites all manuscripts that that cover theoretical and/or applied researches on topics related to the interest areas of the Journal.

JBEF is currently indexed by

Ulrich's Directiroy, ProQuest, Open J-Gate, New Jour, Index Copernicus, International Scientific Indexing (ISI), Directory of Research Journals Indexing (DRJI), International Society for Research Activity(ISRA), InfoBaseIndex, Scientific Indexing Services (SIS), Google Scolar, Root Indexing, Journal Fctor Indexing, International Institute of Organized Research (I2OR), ASOS, Cabell's Directory, SOBIAD, IndexEuroPub.

Ethics Policy

JBEF applies the standards of Committee on Publication Ethics (COPE). JBEF is committed to the academic community ensuring ethics and quality of manuscripts in publications. Plagiarism is strictly forbidden and the manuscripts found to be plagiarised will not be accepted or if published will be removed from the publication.

Author Guidelines

All manuscripts must use the journal format for submissions.
Visit www.pressacademia.org/journals/jbef/guidelines for details.

CALL FOR PAPERS

The next issue of JBEF will be published in June 2020.
Submit manuscripts to
jbef@pressacademia.org or
http://www.pressacademia.org/submit-manuscript/
Web: www.pressacademia.org/journals/jbef

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

EDITORIAL BOARD

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

CONTENT

Title and Author/s **Page**

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

A NEW APPROACH FOR AIRLINE REVENUE MANAGEMENT: TOTAL REVENUE BOUNDARIES

DOI: 10.17261/Pressacademia.2020.1214
JBEF- V.9-ISS.2-2020(1)-p.62-67

Asli Emine Ertugrul, Ramazan Sahin
Turkiye Is Bankasi, Data Management Department, Tuzla, Istanbul, Turkey.
asliemineertugrul@gmail.com , ORCID: 0000-0002-4104-1103
Gazi University, Industrial Engineering Department, Maltepe, Ankara, Turkey.
rsahin@gazi.edu.tr , ORCID: 0000-0001-7074-4038

Date Received: February 26, 2020 **Date Accepted:** May 12, 2020

To cite this document
Ertugrul, A.E., Sahin, R., (2020). A new approach for airline revenue management: total revenue boundaries. Journal of Business, Economics and Finance (JBEF), V.9(2), p.62-67.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2020.1214

ABSTRACT

Purpose - The purpose of the paper is developing and testing an advanced version of an existing method in the literature, which is used for airline revenue management (ARM).
Methodology – Expected marginal seat revenue (EMSR) is the mostly used heuristic revenue management model for literature and real life problems. In the paper, EMSR is developed, and an advanced heuristic method is formed. The new method is called total revenue boundaries (TRB). The method is tested by a problem and compared with EMSRa, EMSRb and EMSRc, which are three types of EMSR in the literature.
Findings- According to the results, TRB outperforms than EMSRa, EMSRb and EMSRc. It gives higher revenue levels with higher load factors.
Conclusion- At the end of the study, the most common ARM method is improved. By this way, a new heuristic model is gained, which does not need complicated calculations. TRB keeps the uncomplicated nature of EMSR but gives better results.

Keywords: Airline revenue management, total revenue boundary, expected marginal seat revenue (EMSR), optimization, seat inventory management.
JEL Codes: C61, R40, R49

**This article is the extended version of Total Revenue Boundaries for Determining Booking Limits in Airline Revenue Management presented in 5. International Conference on Engineering Sciences Ankara 2019.*

1. INTRODUCTION

Some companies apply for revenue management tools for the optimization of their revenues like hotels, airlines and cruise lines. Because, their products are not tangible and cannot be stocked. An empty hotel room for a night or an empty seat in a flight is gone when the night or flight is over. That is why, these limited product resources should be sold as efficiently as possible. In order to ensure the efficiency, revenue management methods are applied by companies.

Airline industry is an expensive environment. Initial investment and operating cost rates are so high. In the study of Gelirli (2019), it is mentioned that airlines prefer to lease their aircraft to avoid big initial investments, decrease risk, to access the latest technology and etc. Leasing the aircraft is one of the ways that they use to make profit. Another method which airlines apply is managing their revenues to maximize it. Airline revenue management (ARM) studies generally focus on two main areas: pricing and seat inventory management. As for seat inventory management for ARM, there are three main subtitles worked on by scientists and experts: overbooking, fare class mix and origin - destination control (Belobaba, 2015). In overbooking problems, scientists try to assign authorized capacity of a flight. On the other hand, fare class mix and origin-destination (OD) control problems handles optimal flight ticket distribution in a flight or flight in the network. The studies about ARM started up in 1970s firstly in American Airlines. Thanks to the success of American Airlines in ARM applications, the latter attracted attention of airlines and scientists. Since then, airlines and scientists have been working on ARM with a view to developing new methodologies and

algorithms. There are heuristics, dynamic and linear methods in the literature for ARM, which yields efficient results. A new heuristic method is to be developed in this paper. In addition, it is going to be experimented and compared by some numerical examples.

This paper is developed based on the study of Ertuğrul and Şahin (2019) and expanded in accordance. The outline of the paper continuous with literature review. In the third section, the methodology of the paper is explained while under the fourth section, numerical examples are provided. The results thereof are going to be discussed under the same section, as well. The paper ends with a conclusion section, where the review of the study and recommendations for further studies are provided.

2. LITERATURE REVIEW

Revenue management and especially ARM are studied by many scientists. Hundreds of papers and studies can be found in the literature. However, there are some basic resources, that explains the logic of revenue management and its applications, in the literature (Belobaba , 2015), (Talluri & van Ryzin, 2004), (Phillips, 2005).

As has been already stated, the studies about ARM started up in 1970s in the United States. Starting therefrom, many researches and studies have been conducted by scientists and airlines. The first and most important studies in this regard belonged to Littlewood (1972) and Belobaba (1987). Littlewood developed Littlewood's rule and Belobaba expanded the rule by the method of expected marginal seat revenue (EMSR). In the following years, EMSR was renewed by Belobaba's another research paper (1992) as EMSRb. Later in the years, many studies were published about EMSR. Some of them developed new EMSR versions while others applied EMSR for model comparison (Boyd & Kallasen, 2004), (Weatherford, 2004), (Frank & Friedemann, 2009), (Fiig, Isler, Hopperstad, & Belobaba, 2010), (Tavana & Weatherford, 2017). One of the newest studies about EMSR belongs to Banciu, Odegaard and Stanciu (2019). In their paper, dependency between fare levels is considered while the original EMSR calculates booking limits with the assumption of independency between fare levels. In addition, different distributions for the demand are tried in their study.

Seat inventory management models makes decision on whether to accept or reject arrival customers based on the inputs of the system. For this decision process, there are not just heuristic models. Dynamic programming, bid price control or linear programming are also very popular methods for seat inventory management. To examine the logic of the dynamic programming for ARM, the book of Talluri and Van Ryzin (2004) or the study of Chapuis (2008) could be perused. Lee and Hersh (1993) carried out a study about dynamic programming of seat inventory control, as well, which has been one of the first and most popular studies. Another detailed study on dynamic programming belong to El-Haber and Al-Taha (2004). In their article, a Markov decision process has been developed for a two-leg flight, which defines the booking limits dynamically. There are also many other detailed studies about dynamic programming in the literature (Huanga & Liang, 2011), (Elmaghraby & Keskinocak, 2003), (Wright, Groenevelt, & Shumsky, 2010). One another common method for ARM is bid price control, which is used for network revenue management. Bid price control determines a price limit for each leg of a networked flight. According to the logic of the algorithm, the price of a flight ticket cannot be less than the total of the bid prices of flight legs. Studies about bid price control can be about determination or control of bid price in an ARM model. One of the recent studies about the bid price was carried out by Hosseinalifam et al. (2016). This study brought in a new and changeable customer choice-based mathematical model for the prediction of the bid prices. Another example for bid price control belongs to Topaloğlu (2008). He made a research about a new method of computing bid prices, which is called SDD. Topaloglu (2009) used lagrangian relaxation for bid price determination in another paper, that calculates bid prices according to the left number of seats and time to departure. Linear programming is also an option for ARM problems. However, it is generally used for finding initial solutions (Talluri & van Ryzin, 2004). Stochastic methods are also applied for ARM. Zhang and Cooper (2005) have a study about simultaneous seat inventory control, and they implement a stochastic method to develop their algorithm.

Apart from all these, there are new methods, ideas or studies that have different angels in the ARM literature. In the study of Lardeux et al. (2019) idea of buy-back the flight tickets and reselling them in a case of demand increasing is handled. On the other hand, some scientists prefer to study about ARM for a specific region like Yazdi, Kaviani, Hanne and Ramos (2020). Their study is developed for a case about an airline in Iran and the airline company's flight operations. Also, there are papers, which make some arguments about the ARM applications in airline markets (Belobaba, 2011), (Aslani, Modarres, & Sibdari, 2014), (Kramer, Friesen, & Shelton, 2018).

3. DATA AND METHODOLOGY

In this study, a new revenue management model, which is called total revenue boundaries (TRB), is built and examined for an ARM seat inventory problem. Similar to a regular ARM system, TRB determines whether to accept or reject arriving passengers. Every ARM system has its own logic, booking limit or bid price for this decision process. TRB has also a logic or limitation or such kind of bid price, through which it makes a decision on whether to reject or accept an arriving passenger. In this algorithm, the decision variable is x. It is a binary decision variable, which means 0 or 1. The system has a sales period, signified by T. The period is divided into t sub-periods, and at most one sale can occur in each t. There are three check points to control the total revenue. Since business travelers, who are flexible in price, tend to purchase their flight tickets close to the departure time, check points are placed periodically in the last sections of T. In addition, the model is based on single-leg flight.

As can be understood from the name of the model itself, TRB functions according to some total revenue boundaries, which are predetermined. On some points of the sale period, TRB checks if the total revenue boundary is reached or not. If it is not reached, the system closes the sale of the cheapest fare level that is available. Otherwise, TRB does not change anything in the system. For example, the first total revenue boundary is $10,000. In the first check point, TRB controls if the total gained revenue until that moment is less or greater than the boundary. If total revenue is less than or equal to $10,000, TRB closes the sale of the lowest fare level tickets. Otherwise, it does not change anything. Mathematical explanation of the model exists on the Equation (1).

If $\sum_{t=1}^{T}\sum_{i=1}^{n} x_{it}\, F_i b_{it} \leq r_t$, then $\sum_{t}^{T} x_{i_k t} = 0$ (1)

where
i – fare level;
F_i– ticket price of fare level i;
b_{it}– number of seats sold by fare level i at time t;
k – number of fare levels available for sale;
i_k – cheapest fare level available for sale;
l – number of total revenue boundaries.

Each passenger buys his/her flight ticket from the fare level that they can afford. In the literature, there are two kinds of demand structure (Tavana & Weatherford, 2017), (Boyd & Kallasen, 2004). In the paper of Boyd and Kallasen (2004), these two demand structures are determined as yieldable and priceable. For the yieldable demand, passengers purchase the ticket from the fare level that they are interested in even when there is a cheaper one. If there is no available seat for their fare level, they are denied. On the other hand, for the priceable demand, passengers try to buy their flight tickets as cheap as possible. If there is an available seat in a fare level the price of which does not exceed their willingness to pay, passengers purchase the flight ticket. Tavana and Weatherford (2017) describe yieldable demand as restricted while priceable demand is defined unrestricted. They also state that the demand in real life is between restricted and unrestricted structure. In TRB, the demand structure is restricted, which means every passenger purchases the flight ticket that s/he is interested in. In addition, the model accepts that there are enough passengers in the market, so there are new arriving people instead of rejected ones.

4. HYPOTHETICAL APPROACH

In this section, TRB will be examined by a numerical example. The same example is also going to be applied for EMSRa, EMSRb and EMSRc. As it is mentioned above, EMSRa and EMSRb are two models developed by Belobaba in 1987 and 1992. The third EMSR model, which is called EMSRc, is a new version of EMSR. It is developed by Tavana and Weatherford (2017). The logic of EMSRc is as easy as EMSRb and EMSRc. In the article of Tavana and Weatherford, it is proved that EMSRc outperforms than EMSRa and EMSRc under some certain conditions.

There are four different fare levels in the example, which are shown in the Table 1. The demands for each fare level are normally distributed. In addition, there are 150 seats in the aircraft.

Table 1: Fare Levels and Ticket Prices

Fare Level	Ticket Price
Y	500
B	420
M	290
Q	125

As has been mentioned before, there are three check points during T. The first check is made at t=140 by total revenue of $42,000 (these points are found by trial and error method). The second and third check points exist on t=150 and t=160. The revenue limits are calculated according to the approximate income of 10 seats. Extra income coming from the sale of 10 more seats is added to $42,000 and the new limits are experienced. After that, the limits are increased systematically. It is seen that while the revenue limits are increasing, the total revenue is increasing until a certain point, as well. In the end, the revenue limits are determined as $42,000-$45,000-$49,000.

An example as below can be further examined in order to apprehend the functioning logic of TRB more clearly: In the first check point, total revenue is checked to understand whether it is greater than $42,000 or not. All passengers coming for Q fare level are rejected after t=140 if the first total revenue condition is not provided. When it comes to the second limit, the system starts to reject both B and Q fare customers if the limit is not achieved. In the last condition, only Y fare passengers are accepted in the case where the revenue cannot reach $49,000.

For all fare levels, there are individual demand data which represent the normal distribution shown in the Table 2. According to these data, random demand numbers are created. 20 different demand scenarios are built. As ensuring the accuracy for the performance measurement of the models is desired, the same scenario's data are used for the simulations of all the models (TRB, EMSRa and EMSRb). All the ARM systems are built and run on Microsoft Visual Studio Express 2015 for Windows. They are run, and the results are recorded. Each model has an approximate total revenue and load factor. As it is seen on Table 3, TRB outperforms EMRSa EMSRb and EMSRc. In addition, the load factor of TRB is significantly greater than the other ARM models.

Table 2: Mean Demand and Standard Deviation Values of Fare Levels

Fare Level	Mean Demand	Standard Deviation
Y	16,5	5,6
B	44,2	15
M	35,1	11,2
Q	55,0	9,3

Table 3: Results of Numerical Example for Each ARM Model

ARM Model	Approximate Mean	Approximate Load Factors	Maximum Revenue	Minimum Revenue
TRB	$45.623,25	149,9	$53.860,00	$35.380,00
EMSRa	$45.494,75	140,7	$53.860,00	$33.005,00
EMSRb	$45.571,50	147,5	$53.860,00	$30.825,00
EMSRc	$44.978,00	131,6	$51.810,00	$29.190,00

As it is seen on the results table, TRB gives good result numerically, which makes the airline earn more revenue. Besides the results, there are more advantages of TRB to mention. By the development of TRB, a new and useful model, which performs better than the most common models in the literature, is gained. At the same time, this new model does not require complicated calculations like bid price control or dynamic programming. Therefore, TRB can be an advantageous ARM tool for both literature experiments and business applications. TRB differs than the other ARM models by its limitation logic. While the EMSRa, b and c

are looking for number of seat limitation, TRB is determining the limits according to the revenue level. Also, the limitation rules become invalid when the constrained is provided. By this method, TRB can reach higher load factors.

5. CONCLUSION

Revenue management is a kind of business method, which is applied by companies whose product cannot be stocked. These companies must manage their product inventory to sell them by the most effective and efficient way. Airlines are one of these companies and ARM methods are studied and searched by scientists and airlines for about 50 years. In this study, a new model for ARM, TRB has been developed. TRB decides to accept or reject an arrival passenger just like the other ARM models. However, TRB has some different features than the other ARM models. TRB defines limitation points according to the number of fare levels just like EMSR. On the other hand, our model does not set limitations on the number of seats. Instead, it defines boundaries on total revenue. From this perspective, TRB is similar with bid price control but our model does not need so much calculations like bid price control.

Proposed TRB method is tested with 20 flight ticket sale scenarios. The same scenarios are applied to the other ARM methods to make a comparison. EMSR is selected for this comparison because it is the most common and mostly applied ARM method. Since EMSR has two types, which are EMSRa and EMSRb, TRB has been compared with two of them. In addition, a new version of EMSR, which is EMSRc, is experimented. The results demonstrate that TRB yields higher revenue levels than EMSRa, EMSRb and EMSRc. In addition, the load factor result of TRB is better than all EMSR models. Therefore, proposed TRB method for the ARM in this paper, which is easy to understand and apply, and requires not many calculations, has been developed.

For further studies, the determination of the boundaries and check points can be ensured by a definitive algorithm instead of trial determination. Additionally, in the algorithm of TRB, the number of total revenue boundaries is settled by number of fare level in the problem (l=n-1). In an advanced version of TRB, the number of the boundaries may be increased systematically for a better total revenue control. Besides, TRB can be compared with the same models under different conditions to handle the performance of the model deeper. Another comparison test may be done with other popular ARM algorithms like bid price control or dynamic programming.

REFERENCES

Aslani, S., Modarres, M., & Sibdari, S. (2014). On the fairness of airlines' ticket pricing as a result of revenue management techniques. *Journal of Air Transport Management*, 56-64. DOI: 10.1016/j.jairtraman.2014.05.004

Banciu, M., Odegaard, F., & Stanciu, A. (2019). Distribution-free bounds for the expected marginal seat revenue heuristic with dependent demands. *Journal of Revenue and Pricing Management*, 155-163. DOI: 10.1057/s41272-018-00170-6

Belobaba, P. (2015). Airline Revenue Management. P. Belobaba, A. Odoni, & C. Barnhart, The Global Airline Industry. Wiley.

Belobaba, P. (1987). Air Travel Demand and Airline Seat Inventory Management. *Doctor of Philosphy*. United States of America: Massachusetts Institute of Technology.

Belobaba, P. (1992). Optimal vs. Heuricstic Methods for Nested Seat Allocation. *Proceedings of AGIFORS Reservations and Yield Management Study Group* (s. 28-53). Brussels: AGIFORS.

Belobaba, P. (2011). Did LCCs save airline revenue management. *Journal of Revenue and Pricing Management*, 19-22. DOI: doi.org/10.1057/rpm.2010.45

Boyd, E. A., & Kallasen, R. (2004). Practice Papers: The science of revenue management when passengers purchase the lowest available fare. *Journal of Revenue and Pricing Management*, 171-177. DOI: 10.1057/palgrave.rpm.5170104

Chapuis, J. M. (2008). Basics of Dynamic Programming for Revenue Management. *Revenue Yield Management eJournal*, 21.

El-Haber, S., & El-Taha, M. (2004). Dynamic two-leg airline seat inventory control with overbooking, cancellations and no-shows. *Journal of Revenue and Pricing Management*, 143-170. DOI: 10.1057/palgrave.rpm.5170103

Elmaghraby, W., & Keskinocak, P. (2003). Dynamic Pricing in the Presence of Inventory Considerations: Research Overview, Current Practices, and Future Directions. *Management Science*, 1287-1309. DOI: 10.1287/mnsc.49.10.1287.17315

Ertuğrul, A. E., & Şahin, R. (2019). Total Revenue Boundaries for Determining Booking Limits in Airline Revenue Management. *5th International Conference on Engineering Sciences.* Ankara.

Fiig, T., Isler, K., Hopperstad, C., & Belobaba, P. (2010). Optimization of mixed fare structures: Theory and applications. *Journal of Revenue and Pricing Management*, 152-170. DOI: 10.1057/rpm.2009.18

Frank, M., & Friedemann, M. (2009). A simulation study: comparing the Markov decision process approach to the expected marginal seat revenue b heuristic under differing demand behaviour. *International Journal of Revenue Management*, 133-147. DOI: 10.1504/IJRM.2009.024161

Gelirli, N. (2019). Analysis of Financial Implications Due to Absence of Indegenous Aircraft Leasing Enterprice in Turkey. Journal of Business, Economics and Finance, 235-246. DOI: 10.17261/Pressacademia.2019.1167

Hosseinalifam, M., Marcotte, P., & Savard, G. (2016). A new bid price approach to dynamic resource allocation in network revenue management. *European Journal of Operational Research*, 142-150. DOI: 10.1016/j.ejor.2016.04.057

Huanga, K., & Liang, Y.-T. (2011). A dynamic programming algorithm based on expected revenue approximation for the network revenue management problem. *Transportation Research Part E: Logistics and Transportation Review*, 333-341. DOI: 10.1016/j.tre.2010.11.005

Kramer, A., Friesen, M., & Shelton, T. (2018). Are airline passengers ready for personalized dynamic pricing? *Journal of Revenue and Pricing Management*, 115-120. DOI: 10.1057/s41272-017-0122-0

Lardeux, B., Sabatier, G., Delahaye, T., & Boudia, M. (2019). Yield optimization for airlines from ticket resell. *Journal of Revenue and Pricing Management*, 213-227. DOI: 10.1057/s41272-018-00167-1

Lee, T. C., & Hersh, M. (1993). A Model for Dynamic Airline Seat Inventory Control with Multiple Seat Bookings. *Transportation Science*, 252-265. DOI: 10.1287/trsc.27.3.252

Littlewood, K. (1972). Forecasting and Control of Passenger Bookings. *AGIFORS Symposium Proc.* (s. 95-117). Nathanya: AGIFORS Symposium Proc.

Phillips, R. L. (2005). Pricing and Revenue Optimization. Stanford, California: Stanford University Press.

Talluri, K., & van Ryzin, G. (2004). The Theory and Practice of Revenue Management. Boston: Kluwer Academic Publishers.

Tavana, H., & Weatherford, L. (2017). Application of an alternative expected marginal seat revenue method. *Journal of Air Transport Management*, 65-77. DOI: 10.1016/j.jairtraman.2017.02.006

Topaloğlu, H. (2008). A Stochastic Approximation Method to Compute Bid Prices in Network Revenue Management Problems. *INFORMS Journal on Computing*, 596-610. DOI: 10.1287/ijoc.1080.0269

Topaloğlu, H. (2009). Using Lagrangian Relaxation to Compute Capacity-Dependent Bid Prices in Network Revenue Management. *Operations Research*, 637-649. DOI: 10.1287/opre.1080.0597

Weatherford, L. (2004). EMSR versus EMSU: Revenue or utility? *Journal of Revenue and Pricing Management*, 277-284. DOI: 10.1057/palgrave.rpm.5170114

Wright, C. P., Groenevelt, H., & Shumsky, R. A. (2010). Dynamic Revenue Management in Airline Alliances. *Transportation Science*, 15-37. DOI: 10.1287/trsc.1090.0300

Yazdi, A. K., Kaviani, M. A., Hanne, T., & Ramos, A. (2020). A binary differential evolution algorithm for airline revenue management: a case study. *Soft Computing*. DOI: 10.1007/s00500-020-04790-2

Zhang, D., & Cooper, W. L. (2005). Dan Zhang, William L. Cooper. *Operations Research*, 415-431. DOI: 10.1287/opre.1050.0194

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

THE IMPACT OF COVID-19 TO GLOBAL PHARMACEUTICALS AND BIOTECHNOLOGY COMPANY STOCKS RETURNS

DOI: 10.17261/Pressacademia.202.1215
JBEF- V.9-ISS.2-2020(2)-p.68-79

Caner Ozdurak[1], Gulsah Alcan[2] , Serap Dursun Guvenbas[3]
[1]Yeditepe University, Department of Financial Economics, Ataşehir, Istanbul, Turkey.
caner.ozdurak@yeditepe.edu.tr , ORCID: 0000-0003-0793-7480
[2]Yeditepe University, Department of Financial Economics, Ataşehir, Istanbul, Turkey.
gulsah.alcan@yeditepe.edu.tr, ORCID: 0000-0002-9397-1361
[3]Trakya University, Department of Economics, Balkan Campus, Edirne, Turkey.
serapdursun@trakya.edu.tr, ORCID: 0000-0001-8683-0854

Date Received: March 3, 2020 **Date Accepted:** June 5, 2020

To cite this document
Ozdurak, C., Alcan, G., Guvenbas, S. D., (2020). The impact of COVID-19 to global pharmaceuticals and biotechnology company stocks returns, Journal of Business, Economics and Finance (JBEF), V.9(2), p.68-79.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2020.1215

ABSTRACT

Purpose – A mix of legacy drug makers and small startups have stepped forward with plans to develop vaccines or treatments that target the infection caused by Covid-19. In this paper, we examine whether COVID-19 related news triggers investment to pharma and biotech companies.
Methodology We investigate the news impact of the pandemic on global pharmaceuticals and biotechnology industry stock returns by utilizing EGARCH models and News Impact Curves
Findings- Due to our results, there are outstanding companies such as Gilead with its remdesivir which was originally developed to treat the Ebola virus and Dynavax partnering with vaccine developer companies to use its technology.
Conclusion- The asymmetry in the NICs for the favor of good news suggests that companies like Gilead and Dynavax are priced by the market with an expectation to find the cure or play an important part in this process.

Keywords: Covid-19, stock returns, pharmaceuticals, biotechnology.
JEL Codes: C58, G14, G15

1. INTRODUCTION

Many epidemic diseases have occurred worldwide in history. There is abundant literature as regards the social, political, and economic effects of diseases. The literature review shows us that many epidemics have resulted in the deaths of millions of people around the world for centuries.

Some of the most socially and economically affected epidemics are namely; the Black Death, known as the Pestilence, between 75 and 100 million people who died between 1346 and 1352; the Viral hemorrhagic fever, in which about 50% of the population in Mexico between 1545-1548 died and 2-25 million people died; the Cholera epidemic, in which approximately 1 million people died in Russia between 1852-1860 and a total of 800 thousand people in the continents of Europe Asia and Africa between 1899-1923; HIV AIDS, which is the first seen in the Congo basin, where approximately 30 million people have died since 1960, Spanish Flu, in which about 75 million people died in the worldwide between 1918-1920 years, SARS(Coronavirus) from 2002 to 2003, and epidemic diseases like Swine influenza, Avian flu, and Ebola (Sherman, 2016).

In December 2019, pneumonia was observed in various patients that developed for no specific reason and did not respond to treatment and vaccines. A respiratory disease outbreak caused by a new coronavirus, called COVID-19, was first detected in

Wuhan, China's Hubei Province. With the virus detected in tens of thousands of people in a short time in China, Chinese health officials stated that the infection spread from person to person. COVID-19 was declared as a global epidemic by the World Health Organization on March 11 2020, after reporting virus cases in several countries in Europe, North America and Asia-Pacific in January and February. As of April 10, 2020, the total number of patients in 212 countries worldwide is 1 million 619 thousand, the total number of deaths is 97,056[1].

After the COVID-19, the Chinese economy slowed down with production cuts, disrupted the functioning of global supply chains, and gave the first warning of a global depression. Since China has both a producer and consumer role, it has seriously affected the real sectors and the stock market as well as its economy. Depending on the inputs from China, companies' production started to shrink regardless of their size. After the transportation became limited among countries, global economic activities slowed down even more. High-risk industries such as manufacturing, tourism, travel, transportation, and automotive sectors have been among the sectors most struggling and most affected by the epidemic.

According to the Organization for Economic Cooperation and Development (OECD), it has stated that the world economy will face the lowest growth rate since 2009 due to the coronavirus outbreak this year. Especially with the expansion of the epidemic in China, the closure of factories in the Wuhan region and the dismissal of a significant number of workers to reduce the dangerous effect of the virus harmed the Chinese economy. Along with the decrease in production in China, the shrinkage in raw material and energy demand has affected the world trade volume dramatically. Along with the decrease in production in China, the shrinkage in raw material and energy demand has affected the world trade volume dramatically. Afterward, the spread of the virus to Europe and America caused similar effects to be seen in these economies as well. For instance, in the USA, unemployment applications reached 10 million people in two weeks. The transition to partial quarantine after the outbreak caused demand shock. Supply shock has occurred due to the breakage of chains in the supply channel. On the other hand, the demand for many various sectors mentioned above decreased drastically. As a result, inevitably, the reduction in world trade volume and critical disruptions in production will adversely affect the world economy. Because of all these, it is expected that negative growth figures dominate many countries. While the demand for sectors such as automotive, tourism, and financial services decreased, medical supply services, e-commerce, food sectors' demand increased excessively.

Some panic among consumers and companies in all markets disrupted their usual consumption habits and created market anomalies. Global financial markets also responded to changes, and global stock indices diminished. The evolution of the disease and the uncertainty of its economic impact make it difficult for policymakers to formulate an appropriate macroeconomic policy response. All this proves that even an epidemic can significantly affect the global economy in the short term. Almost all economists address the importance of investing more in public health systems in all economies, especially in less developed economies where health systems are less developed, and the population density is high. The decisions taken by investors in line with the bad news spread reveal a financial contagion just like in infectious diseases. Contagion in financial sectors is the spread of the reaction of several sectors and regions to a shock in an economy to all financial sectors or countries with a strong financial structure. As can be seen from the previous global financial crises, financial sectors are sensitive to shocks. (Tiryaki and Ekinci, 2015).

Of course, the developments in this real economy will inevitably increase the volatility in the financial markets and decrease the risk appetite. Thus, the S&P 500 index, which is the best indicator of US stock markets, decreased by 35 percent even though there was a slight recovery afterward. Decreasing appetite for taking risks in the markets and increasing willingness to avoid risky investments led to a drop in asset prices in financial markets. The destruction in asset prices decreased the collateral values as a result of the mainly leveraged transactions in the financial markets and increased the collateral completion requests called Margin-Call. That exceedingly increased the need for liquidity in financial markets, and central banks of developed countries, especially the Fed, had to infuse tremendous amounts of liquidity into the markets by increasing their purchases. These significant changes in exchanges can affect many investments. After the COVID-19 outbreak, FTSE, Dow Jones Industrial Average, and Nikkei have seen massive drops. Dow and FTSE have recently seen their most prominent daily decline since 1987.

All these volatility impacts are closely related to the business of global pharmaceutical and biotechnology deeply related to infectious diseases. In this sense, it is essential to measure how infectious disease outbreaks influence the market behavior and stock performance of the companies operating in these sectors. In this period, GlaxoSmithKline decided to invest $250m in San Francisco-based start-up Vir Biotechnology to develop antibodies that could be used to treat coronavirus. Due to this

[1] (https://www.worldometers.info/coronavirus/)

announcement, Vir share hiked up almost 20 percent to $34.75 in mid-morning trading in New York. In addition, Pfizer Inc. informed about its plans to support the development and distribution of BioNTech SE's BNTX COVID-19 vaccine candidate. BioNTech targets to start the clinical trials across the US and Germany in late April 2020.

Moreover, three drugs with the potential to treat COVID-19 have received the most public attention. Gilead's remdesivir, which was originally developed to treat the Ebola virus, is in late-stage clinical studies and could be the most promising treatment. Finally, the biopharmaceutical company Dynavax Technologies decided to allow usage of its adjuvant technology by partnering with companies that develop COVID-19 vaccines, alongside working on the vaccine development with the University of Queensland. In this context, we investigated whether news related to COVID-19 triggered investment in pharmaceutical companies, namely Abb Vie Inc, Bristol Myers Squibb, Chinext, Dynavax Technologies, Gilead Sciences, and Pfizer by utilizing volatility models and new impact curves. Finally, this paper is a preliminary study for upcoming research papers after the impact of COVID-19 on financial markets, pharmaceuticals and biotechnology companies becomes more visible.

2. LITERATURE REVIEW

Zeren and Hızarcı have exposed the potential effects of coronavirus pandemic on stock exchanges that were reviewed with Maki (2012) cointegration test by using COVID-19 daily total death, and COVID-19 daily total case. Research results show that all stock markets considered with total death act in unison over the long term. Furthermore, after the investigations, it can be said that even though total cases of COVID-19 have a cointegration association with SSE, KOSPI, and IBEX35, have no cointegration association with FTSE MIB, CAC40, and DAX30. In these circumstances, it is suggested that investors tend to derivative markets, which are more reliable than the stock market, and to stock markets of other less risky countries (Zeren, and Hızarcı, 2020).

Spectral causality and the well-known Granger causality model have been tested to see the effects of the COVID-19 on the stock markets, such as Shanghai Se A Share, France Cac 40, Dax 30, etc. These countries' stocks rank as the world's leading markets. Moreover, COVID-19 has interpreted as a "black swan" event for the financial markets. As a result of the analysis, it has seen that the Shanghai Se A index had a short-term effect on global markets at the beginning of the epidemic (Morales, and Andresosso, 2020).

Researchers, who predict that COVID-19 will become a dangerous global pandemic before being declared an epidemic by the World Health Organization, have analyzed the effects of various situations on macroeconomic results, and financial markets in a global dynamic stochastic general equilibrium (DSGE), and computable general equilibrium (CGE) models. These models demonstrate that the global economy has dramatically influenced in the short term (McKibbin, and Fernando, 2020).

Event study analysis and regression-based methods have been implemented in another research that investigated the investor's impression on the stocks of pharmaceutical companies in the USA, which was steered by media news about global pandemics. In this examination, 102 drug companies listed on the New York Stock Exchange (NYSE) or NASDAQ, and S&P500 Drug index American Deposit Receipts (ADR) have analyzed. After the results of the research, disease-related news (DRN) has a positive and substantial impact on the stock returns of pharmaceutical companies. Besides, these impacts of the disease news last several days. The news about the disease caused fear and anxiety among investors. The index, which is affected by the fear of investors, affects to pharmaceutical companies, and returns of the stocks tremendously negatively (Donadelli et al, 2017). Besides, in another research, they also analyzed the financial returns of the top 10 pharmaceutical companies in the USA, using all historical data on serious infectious diseases considered epidemic by the World Health Organization. In this study, its negative impacts have also mentioned (Donadelli et al, 2015).

In this study analyzing the consequences of the SARS outbreak, the association between the Chinese and Asian (Hong Kong, Taiwan, Singapore, Japan) exchanges have examined using the cointegration model. According to the consequences of the research, it has observed that the co-integration relationship that changed over time in the total stock price indices between China and Asian countries weakened. Consequently, investors can have achieved arbitrage gains by portfolio diversification amongst the mentioned countries during disruptive pandemic infections (Chen, M. P. et al, 2018).

Taiwan, officially the Republic of China, is so essential country for this research since it has faced several epidemics, such as dengue fever, enter virus 71, H1N1, and SARS in the decade. In this analysis, a total of 75 observation numbers from 38 biotechnology companies have examined, and the expected return has acquired from the ordinary least squares (OLS) method. When the relationship between biotechnology companies' financial reports and abnormal returns is analyzed, it can be said to have a significant effect (Wang Y. et al, 2013).

Another article investigating the impacts of the SARS outbreak, one of the various pandemic diseases, has studied its effects on the Taiwan stock exchange. In this article, it has concluded that unlike the other sectors, such as tourism, and retail, the biotechnology sector received positive shocks from the effects of the SARS crisis by using the GARCH method. Moreover, investors can buy stocks, especially of the biotechnology sectors, and gain investment profit during the SARS crisis. (Chen, C. D. et al, 2009)

The event study methodology (ESM), and ARCH, GARCH, and EGARCH models have used in a study investigating the impact of the SARS outbreak on the Taiwan Stock Exchange and hotels' stock prices. The findings of the study demonstrated that hotel share prices are sensitive and respond to outbreaks. Moreover, most of the sectors, especially the tourism sector, have damaged along with the SARS (Chen M.H. et al, 2007). Moreover, Keogh-Brown et al emphasized the fact that countries' economies are extremely sensitive to the strategies and macroeconomic policies implemented in response to a pandemic (Keogh-Brown et al, 2010).

In 2004, unlike other similar studies, the SARS virus, which negatively affects China, and Vietnam stocks, has been found to have no negative impression on the stock markets of other infected countries such as Canada, Indonesia, the Philippines, Singapore, and Thailand. In this study, pioneer stock indices, non-SARS period indices, and S&P 1200 global index have compared. Besides, conventional t-tests and non-parametric Whitney tests have used (Nippani, and Washer, 2004).

In a study looking at the effect of swine flu (H1N1), panel data analysis and Monte Carlo simulation have implemented. The tourism industry has a substantial contribution to Sarawak's economy and its GDP. Thus, 10 major markets in Sarawak tourism have used in this research. Furthermore, it can be said that shocks are not permanent in the short term. Even though these markets had faced lots of shocks, they recovered themselves quickly over and over (Solarin, 2015).

The MONASH-Health model was applied to analyze the economic impacts of swine influenza (H1N1) pandemic on the Australian macroeconomy. This also analysis supports that there is a notable effect of the H1N1 pandemic in the short term. However, the critical point is that the order of stationarity of physical capital and labor (Verikios et al, 2012).

All these literature reviews show us that pandemic diseases have serious effects not only on health but also on the world economy.

3. METHODOLOGY

One model that allows for asymmetric effect of news is the EGARCH model. One problem with a standard GARCH model is that it is necessary to ensure that all the estimate coefficients are positive. Nelson (1991) proposed a specification that does not require non-negativity constrains.

Consider:

$$\ln(h_t) = \alpha_0 + \alpha_1 \left(\frac{\varepsilon_{t-1}}{h_{t-1}^{0.5}}\right) + \lambda_1 \left| \frac{\varepsilon_{t-1}}{h_{t-1}^{0.5}} \right| + \beta_1 \ln (h_{t-1}) \quad [1]$$

Equation (1) is called the exponential-GARCH or EGARCH model. There are three interesting features to notice about EGARCH model:

1. The equation for the conditional variance is in log-linear form. Regardless of the magnitude of ln(h_t), the implied value of h_t can never be negative. Hence, it is permissible for the coefficients to be negative.
2. Instead of using the value of ε_{t-1}^2, the EGARCH model uses the level of standardized value of ε_{t-1}^2 [i.e., ε_{t-1}^2 divided by $(h_{t-1})^{0.5}$]. Nelson argues that this standardization allows for a more natural interpretation of the size and persistence of shocks. After all, the standardized value of ε_{t-1}^2 is a unit-free measure.
3. The EGARCH model allows the leverage effects. If $\varepsilon_{t-1}^2/(h_{t-1})^{0.5}$ is positive, the effect of the shock on the log of conditional variance is $\alpha_1 + \lambda_1$. If $\varepsilon_{t-1}^2/(h_{t-1})^{0.5}$ is negative, the effect of the shock on the log of the conditional variance is $-\alpha_1 + \lambda_1$.

The trade-off between future risks and asset returns are the essence of most financial decisions. Risk mainly composes of two factors such as volatilities and correlations of financial assets. Since the economy changes frequently and new information is distributed in the markets second moments evolve over-time. Consequently, if methods are not carefully established to update estimates rapidly then volatilities and correlations measured using historical data may not be able to catch differentiation in risk (Cappiello et. all, 2006).

If we consider EGARCH models, the news impact curve has its minimum at ε_{t-1}=0 and is exponentially increasing in both directions but with different parameters. The news impact curves are made up by using the estimated conditional variances equation for

the related model as such the given coefficient estimates and with the lagged conditional variance set to the unconditional variance.

Consider EGARCH (1,1)

$$\ln(h_t) = \alpha_0 + \beta \ln(h_{t-1}) + \alpha_1 z_{t-1} + \gamma(|z_{t-1}|) - E(|z_{t-1}|) \quad [2]$$

where $z_t = {\varepsilon_t}/{\sigma_t}$. The news impact curve is

$$h_t = \begin{cases} Aexp\left[\frac{\alpha_1+\gamma}{\sqrt{h_t}}\right] & for\ \varepsilon_{t-1} > 0 \\ Aexp\left[\frac{\alpha_1-\gamma}{\sqrt{h_t}}\right] & for\ \varepsilon_{t-1} < 0 \end{cases} \quad [3]$$

$$A \equiv h_t^{\beta} exp\left[\alpha_0 - \gamma\sqrt{2/\pi}\right] \quad [4]$$

$$\alpha_1 < 0 \qquad \alpha_1 + \gamma > 0 \quad [5]$$

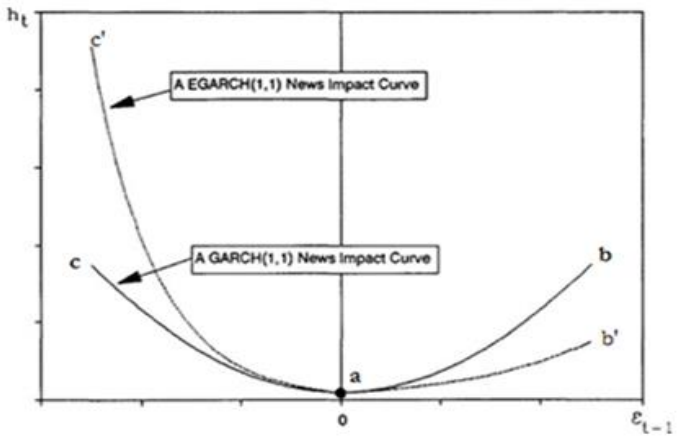
An important characteristic of asset prices is that "bad" news has more persistent impact on volatility than "good" news has. Most of the stocks has a strong negative correlation between the current return and the future volatility. In this context we can define leverage effect as such volatility tends to decrease when returns increase and to increase when returns decrease.

The idea of the leverage effect is exhibited in the figure below, where "new information" is defined and measured by the size of ε_{t-1} . If ε_{t-1}=0, expected volatility (h_t) is 0. Actually, any news increases volatility but if the news is "good" (i.e., if ε_t is positive), volatility rises from point ***a*** to point ***b*** along ab curve (or ab' for EGARCH model). However, if the news is "bad", volatility rises from point ***a*** to point ***c*** along ac curve (or ac' for EGARCH model). Since ac and ac' are steeper than ab and ab', a positive ε_t shock will have a lower impact on volatility than a negative shock of these same magnitude (Figure 1).

Asymmetric volatility models are the most interesting approaches in the literature since good news and bad news have different predictability for the future volatility. Overall, Chen and Ghysels (2010) found that partly good (intra-daily) news decreases volatility (the next day), while both very good news which is unusual high intra-daily positive returns, and bad news which is negative returns increase volatility. However, the latter has a more severe impact over longer horizons the asymmetries fade away.

The news impact curve illustrates the impact of previous return shocks on the return volatility which is implicit in a volatility model.

Figure 1: News Impact Curves



4. DATA AND PRELIMINARY ANALYSIS

The study covers daily closing prices for AbbVie Inc[2] **(ABBV),** Bristol Myers Squibb **(BMY)**[3], Chinext[4] **(CHINEXT)**, Dynavax Technologies[5] **(DVAX)**, Gilead Sciences[6] **(GILD)**, Pfizer **(PFE).** Daily data for all assets have been taken from Thompson Reuters Eikon. The time span for the study runs from 01 January 2015 to 30 March 2020.

Figure 1: Closing Price Graph of the Dataset

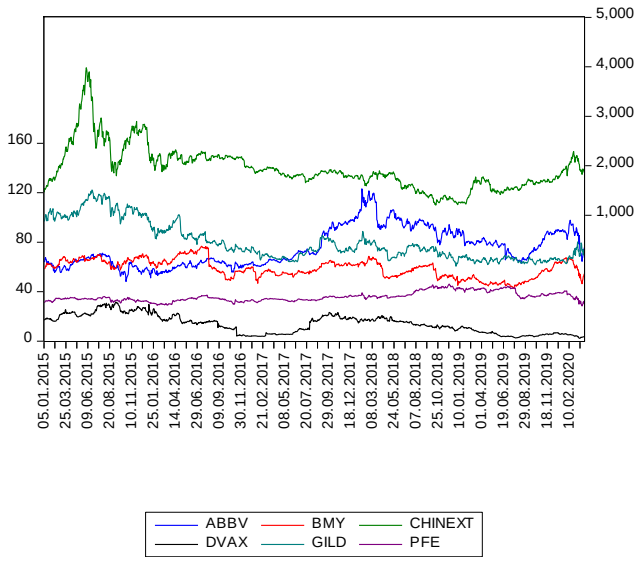


Table 1 illustrates the descriptive statistics of the return of the series. As evident from Table 1, returns of all series are negatively skewed and the kurtosis is much higher than 3 for all the cases. This is indicative of the deviation of series from the normal distribution which is also supported with Jarque-Bera statistics. Further, the stationarity of the variables has been examined using the Augmented Dickey-Fuller (ADF) unit root test. The null hypothesis of the unit root is rejected for all return series.

[2] AbbVie is an American publicly traded biopharmaceutical company founded in 2013. It originated as a spin-off of Abbott Laboratories

[3] Bristol Myers Squibb Company is an American pharmaceutical company, headquartered in New York City. Bristol Myers Squibb manufactures prescription pharmaceuticals and biologics in several therapeutic areas, including cancer, HIV/AIDS, cardiovascular disease, diabetes, hepatitis, rheumatoid arthritis and psychiatric disorders.

[4] ChiNext is a NASDAQ-style subsidiary of the Shenzhen Stock Exchange. The first batch of firms started trading on ChiNext on October 30, 2009. As of June 2015, there were 464 firms listed on ChiNext. ChiNext aims to attract innovative and fast-growing enterprises, especially high-tech firms

[5] Dynavax Technologies Corporation (Nasdaq: DVAX) is a fully-integrated biopharmaceutical company focused on leveraging the power of the body's innate and adaptive immune responses through Toll-like Receptor (TLR) stimulation. Dynavax develops, and commercializes novel vaccines.

[6] Gilead Sciences, Inc., is an American biotechnology company that researches, develops and commercializes drugs. The company focuses primarily on antiviral drugs used in the treatment of HIV, hepatitis B, hepatitis C, and influenza, including Harvoni and Sovaldi.

Table 1: Descriptive Statistics

	RABBV	RBMY	RCHINEXT	RDVAX	RGILD
Mean	6.72E-05	-0.000192	0.000161	-0.000983	-0.000174
Median	0.000946	0.000815	0.000000	0.000000	0.000306
Maximum	0.128985	0.059407	0.06914	0.538546	0.083497
Minimum	-0.177363	-0.174176	-0.093319	-1.040018	-0.090087
Std. Dev.	0.01941	0.017185	0.020966	0.055971	0.017102
Skewness	-1.077872	-2.175612	-0.584761	-4.082499	-0.351434
Kurtosis	16.34614	20.58435	5.818517	110.6006	7.545792
Jarque-Bera	9404.863	16885.67	479.1707	599209.1	1088.768
Probability	0	0	0	0	0
ADF Tests (Level)	-34.91	-36.65	-33.58	-39.13	-36.74

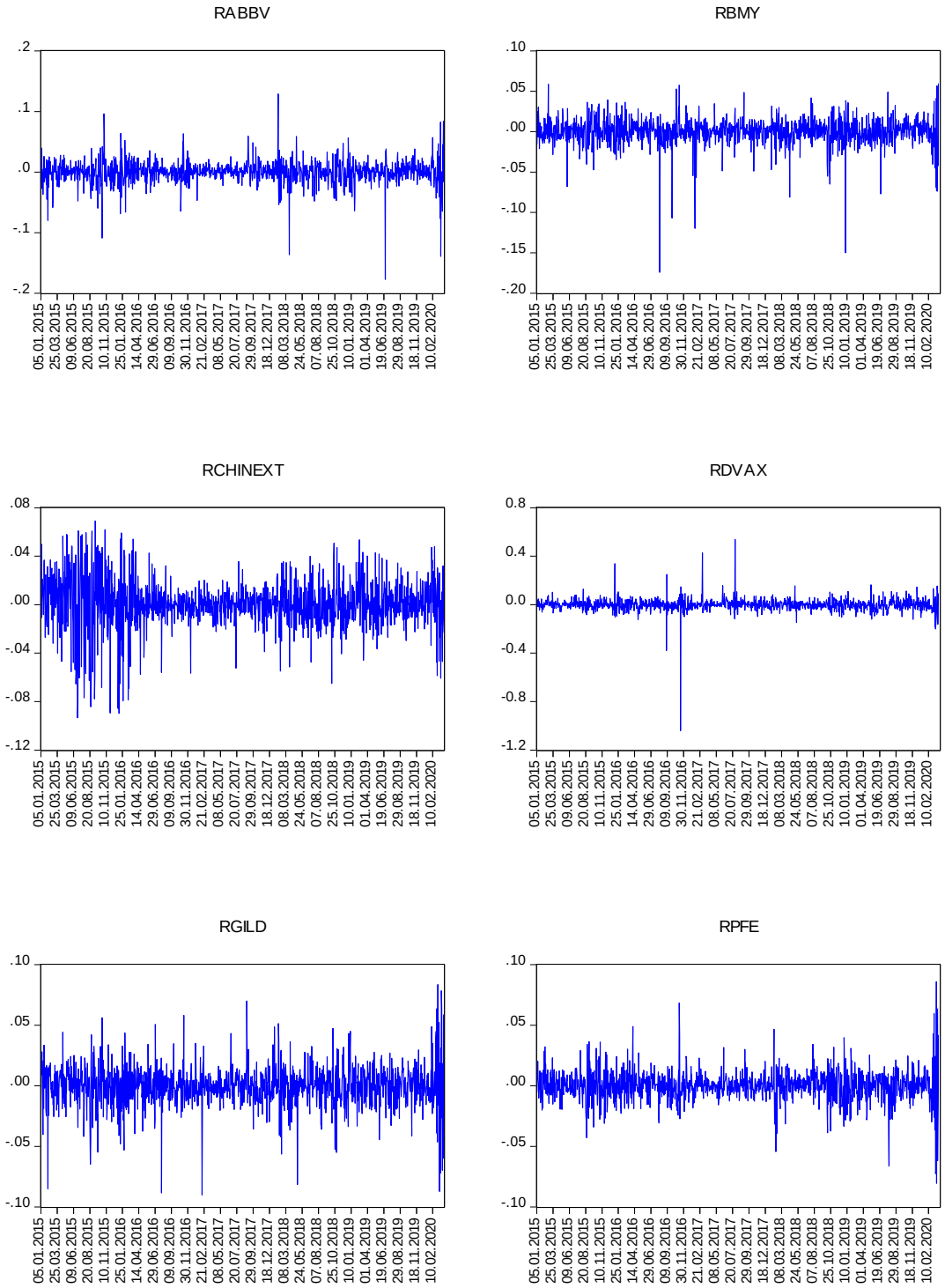
Notes: Betw een parenthesis: p-values. The number of observations for first period is 1235

JB are the empirical statistics for Jarque Bera tests for normality based on skew ness and kurtosis

ADF Tests refer to Augemented Dickey Fuller test for the presence of unit root for long differences (returns)

Returns of all series are calculated by taking the first differences of the logarithm of the two successive prices i.e. $r_t = \log(P_t/P_{t-1})$ which are RABBV, RBMY, RCHINEXT, RDVAX, RGILD, and RPFE. Time-series graphs of the returns have been illustrated which exhibits vividly how volatility has varied in the last three months in Figure 3. It is also visible that industry index Chinext experienced huge volatility clustering in 2015 due to the Chinese stock market bubble burst. A dummy variable for the COVID-19 outbreak is also created and included into the models. The period after the first case was announced by the Chinese government takes the value of "1" till the end of the dataset period and "0" before the announcement back to 01 January 2015.

Figure 2: Time Series Graphs of the Returns



5. EMPIRICAL RESULTS

Having performed unit root tests the next step is to run different versions of EGARCH models for all selected companies. In Table 2 the results of multivariate EGARCH models indicate that coefficients of the COVID-19 dummy variable are positive and significant at %1 significance level in the mean equation of Chinext while it is negative and significant at %1 significance level in the mean equation of Dynavax. On 22nd of February 2020, Shenzhen's technology-focused ChiNext index increased 22 percent which was the most among more than 300 leading benchmarks tracked by Bloomberg. Technology and internet companies, which are set to benefit from higher spending by consumers forced to stay indoors because of the viral outbreak were the main drivers of this hike. However, what is more important for our study is healthcare and biotechnology stocks which have also rallied on hopes that these companies will develop coronavirus treatments or get more business owing to the epidemic.

Table 2: EGARCH Models

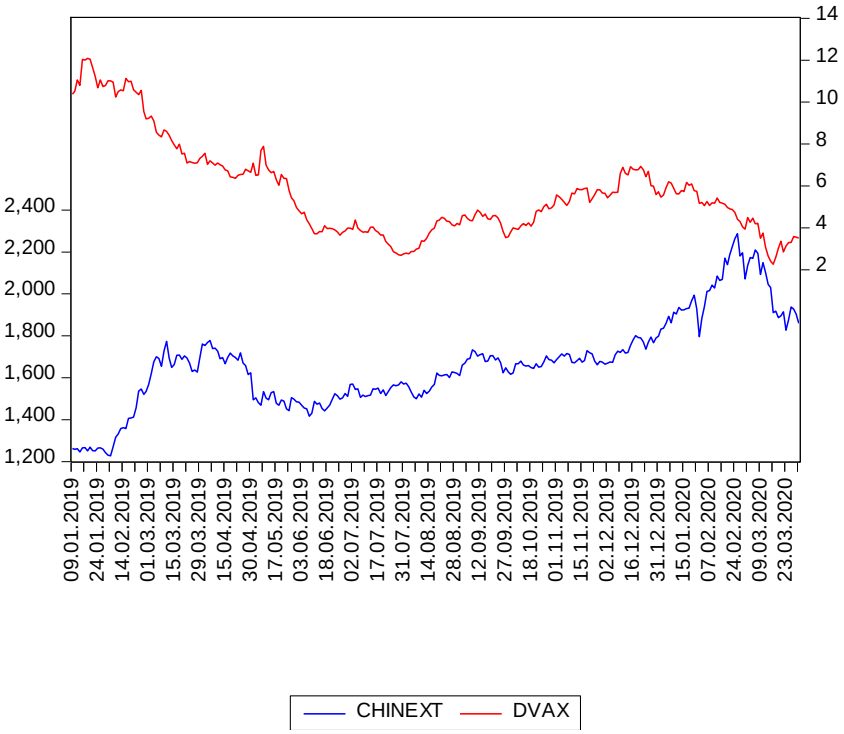
	RCHINEXT				RGILD				RDVAX			
	Mean Equation		Variance Equation		Mean Equation		Variance Equation		Mean Equation		Variance Equation	
	coefficient	z-stats	coefficient	z-stats	coefficient	z-stats	coefficient	z-stats	coefficient	z-stats	coefficient	z-stats
C	-0.7796	-0.0004			0.0892	0.0892			0.0002	0.2159		
RGILD	4.9369	0.1134							0.1617	3.4512	-10.9079	-7.6186
RABBV												
RCHINEXT					0.1016	0.1016	-1.6152	-4.0556	0.1448	4.4927		
RDVAX					0.0180	0.0180						
RBMY							-2.1525	-4.8664	0.2746	5.9438	0.0685	2.5689
RPFE									0.1476	1.5158	-24.0989	-14.7944
COV19	1.3744	0.0029	0.0245	3.0877			0.0481	6.0816	-0.0072	-1.9431	0.2490	4.3727
α_0			-0.1204	-6.3153			0.1692	-2.8023			-2.1743	-13.7551
α_1			**-0.0161**	**-1.8935**			**0.0541**	**5.1276**			**0.1848**	**8.6462**
λ_1			0.0928	7.2087			0.0503	4.4253			0.8666	22.1568
β_1			**0.9938**	**597.1417**			**0.9843**	**148.8343**			**0.7411**	**33.3894**
Observations	1235				1235				1235			
R^2	0.0160				0.0178				0.0231			
DW	1.9221				2.1881				2.2449			

	RABBV				RBMY				RPFE			
	Mean Equation		Variance Equation		Mean Equation		Variance Equation		Mean Equation		Variance Equation	
	coefficient	z-stats	coefficient	z-stats	coefficient	z-stats	coefficient	z-stats	coefficient	z-stats	coefficient	z-stats
C	0.0005	1.2866			0.0028	7.2701			0.0000	0.1962		
RGILD					0.2041	16.8851			0.0490	3.4316	-3.7563	-2.4818
RABBV									0.1557	16.4996	3.9763	3.8843
RCHINEXT					0.0721	4.8970	2.4410	4.5589				
RDVAX	0.0136	2.3627	-0.9916	-2.4221								
RBMY	0.3871	23.4960	-12.7331	-14.4177			-17.9676	-29.1097	0.2466	20.9511	-7.0298	-5.7251
RPFE	0.4147	13.6764	1.9380	2.4671	0.4256	16.7840	4.7112	3.5582				
COV19											0.1590	2.2555
α_0			-1.6089	-10.9871			-0.9208	-10.8398			-2.2217	-8.3934
α_1			**0.0093**	**0.4590**			**0.1820**	**10.3454**			**-0.0859**	**-3.2006**
λ_1			0.4716	14.2694			-0.0817	-4.6271			0.4981	11.6877
β_1			**0.8472**	**50.1501**			**0.8868**	**85.7061**			**0.8040**	**30.8188**
Observations	1235				1235				1235			
R^2	0.2824				0.2359				0.3137			
DW	1.9797				1.9753				2.1119			

Dynavax stocks experienced a fall in contrast with the major stock indices in the global financial markets just after the announcement of the outbreak. However, the biopharmaceutical company's stocks rebounded very quickly since Dynavax, as a commercial-stage vaccine company, which is providing CpG 1018, the adjuvant contained in U.S. FDA-approved HEPLISAV-B vaccine, to support the rapid development of Clover's COVID-19 vaccine, can play a vital role in the fight against this pandemic.

For the variance equation, the COVID-19 dummy variable is valid and significant at %1 level for Chinext, Gilead[7], Dynamax, and Pfizer and has volatility increasing impact. Considering its unique contribution to the hassle with COVID-19, α_1 in RDVAX model is one of the highest levels observed among all other models which refers that short-term shock has a more significant impact on Dynavax stock returns. The level of α_1 is also high in RBMY model compared to other models Bristol-Myers Squibb's stock has declined due to the Coronavirus/Oil Price War crisis however, it could bounce back strongly as the crisis winds down. COVID-19 dummy is not significant in both mean and variance equation in the RBMY model so we can conclude that short term shocks for Bristol-Myers is due to the major market indices trend, not a specific reaction to pandemic itself but a reaction the overall falling trend of financial markets. The sum of the coefficients of the lagged squared error and the lagged conditional variance are close to unity (0.99) for Chinext, Gilead, Dynamax, and Bristol-Myers Squibb, implying that shocks to conditional variance are highly persistent. For Pfizer and Abbvie the impact of persistency is lower compared to Chinext, Gilead, Dynamax, and Bristol-Myers Squibb.

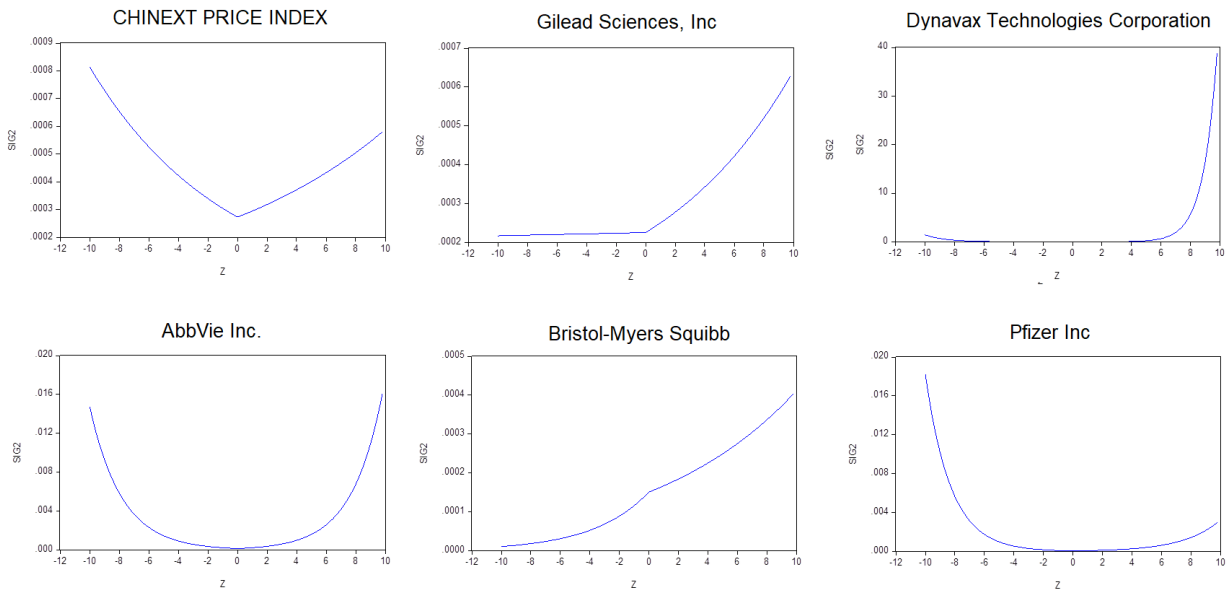
Figure 3: Chinext and Dynavax Price Graph after Covid-19 Outbreak



Hence EGARCH models are important for us to obtain News Impact Curves (NICs) and test the leverage effect (Figure 5). Any news increases volatility however if the news is "good" volatility increases along the right side of the curve. If the news is "bad" volatility increases along the left side of the curve.

[7] Gilead has been working in consultation with regulatory authorities to establish additional expanded access programs for remdesivir, our investigational medicine for COVID-19. The programs enable hospitals or physicians to apply for emergency use of remdesivir for multiple severely ill patients at a time.

Figure 4: News Impact Curves



Since Gilead and Dynamax's right side of the NICs is steeper than the left side, a positive ε_t shock will have a bigger effect on volatility than a negative shock of the same magnitude. For Abbvie the NIC is nearly symmetric which suggests that any news good or bad has the same impact on the volatility of returns. Finally, Chinext and Pfizer since the left side of the curve are steeper than the right side, a negative ε_t shock will have a bigger effect on volatility than a negative shock of the same magnitude which is quite consistent with an approach that Chinext and one the major players of the pharma industry, which is not specifically related with the fight against this pandemic, represents a more general market. In this context, we can also conclude that companies like Gilead and Dynavax which have more to the point roles in the outbreak period compared to other global pharmaceutical companies react to good news more intensely. Gilead is a longtime drugmaker best known for developing the first major cure for hepatitis-C in Sovaldi while Dynavax's adjuvant technology can help provide an increased immune response to a vaccine that makes them usual suspected solution providers for the pandemic.

6. CONCLUSION

Financial markets in the time of the coronavirus pandemic hard to predict due to the noise in the markets. Dow Jones Industrial dropped nearly 1,200 points marking the worst intraday point decline in the history of the Dow. The reason for this collapse was a growing consensus that COVID-19 has landed on U.S. shores and will likely have a stronger impact on the economy than the investors initially predicted. COVID-19 is a once-in-a-lifetime business opportunity for most of the pharmaceutical and biotech companies. However, due to the news impact curves, we claim that the impact of COVID-19 is not a de facto for all related industry companies. There are outstanding companies such as Gilead with its remdesivir which was originally developed to treat the Ebola virus and Dynavax partnering with vaccine developer companies to use its technology. The asymmetry in the NICs for the favor of good news suggests that companies like Gilead and Dynavax are priced by the market with an expectation to find the cure or play an important part in this process. Companies like Gilead and Dynavax which have more to the point roles in the outbreak period compared to other global pharmaceutical companies react to good news more intensely. Finally, this paper is a preliminary study for upcoming research papers after the impact of COVID-19 on financial markets, pharmaceuticals and biotechnology companies becomes more visible.

REFERENCES

Cappiello, L., Engle, Sheppard, K., (2006), Asymmetric Dynamics in the Correlations of Global Equity and Bond Returns, Journal of Financial Econometrics, Vol. 4, No. 4, pp. 537–572

Chen, C. D., Chen, C. C., Tang, W. W., and Huang, B. Y. (2009). The positive and negative impacts of the SARS outbreak: A case of the Taiwan industries. The Journal of Developing Areas, 281-293.

Chen, X., Ghysels, E., (2010), News-Good or Bad-and Its Impact on Volatility Predictions over Multiple Horizons, The Society for Financial Studies, Oxford University Press.

Chen, M. P., Lee, C. C., Lin, Y. H., & Chen, W. Y. (2018). Did the SARS epidemic weaken the integration of Asian stock markets? Evidence from smooth time-varying cointegration analysis. Economic research-Ekonomska istraživanja, 31(1), 908-926.

Chen, M. H., Jang, S. S., and Kim, W. G. (2007). The impact of the SARS outbreak on Taiwanese hotel stock performance: an event-study approach. International Journal of Hospitality Management, 26(1), 200-212.

Donadelli, M., Kızys, R., & Rıedel, M. Globally (2015). Dangerous Diseases, Sentiment and Pharmaceutical Stock Prices. http://sfm.finance.nsysu.edu.tw/php/Papers/CompletePaper/038-1674094255.pdf

Donadelli, M., Kizys, R., & Riedel, M. (2017). Dangerous infectious diseases: Bad news for Main Street, good news for Wall Street?. Journal of Financial Markets, 35, 84-103.

Keogh-Brown, M. R., Smith, R. D., Edmunds, J. W., and Beutels, P. (2010). The macroeconomic impact of pandemic influenza: estimates from models of the United Kingdom, France, Belgium and The Netherlands. The European Journal of Health Economics, 11(6), 543-554.

McKibbin, W. J., and Fernando, R. (2020). The global macroeconomic impacts of COVID-19: Seven scenarios

Morales, L., and Andreosso-O'Callaghan, B. (2020). Covid19: Global Stock Markets "Black Swan". Critical Letters in Economics & Finance, 1(1), 1

Nelson, B., D, (1991), Conditional Heteroskedasticity in Asset Returns: A New Approach, Econometrica, Vol. 59, No. 2., pp. 347-370

Nippani, S., & Washer, K. M. (2004). SARS: a non-event for affected countries' stock markets?. Applied Financial Economics, 14(15), 1105-1110.

Sherman IW. Dünyamızı Değiştiren On İki Hastalık. (Çev:Emel Tümbay, Mine Arığ Küçüker). Türkiye İş Bankası Yayınları. İstanbul, 2016.

Solarin, S. A. (2015). September 11 attacks, H1N1 influenza, global financial crisis and tourist arrivals in Sarawak. Anatolia, 26(2), 298-300.

Tiryaki, H.N., Ekinci, A., (2015). "Finansal bulaşıcılık çerçevesinde küresel kriz ve Türkiye'ye etkileri", Sakarya İktisat Dergisi, Cilt.4, Sayı:1, 1-30

Verikios, G., McCaw, J. M., McVernon, J., and Harris, A. H. (2012). H1N1 influenza and the Australian macroeconomy. Journal of the Asia Pacific Economy, 17(1), 22-51.

Wang, Y. H., Yang, F. J., and Chen, L. J. (2013). An investor's perspective on infectious diseases and their influence on market behavior. Journal of Business Economics and Management, 14(sup1), S112-S127.

Worldometers, URL: https://www.worldometers.info/coronavirus (2020)

Zeren, F., and Hızarcı, A. The Impact Of Covıd-19 Coronavırus On Stock Markets: Evıdence From Selected Countrıes. Muhasebe ve Finans İncelemeleri Dergisi, 3(1), 78-84.

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

COVID-19 AND NET FOREIGN EXCHANGE RESERVE RELATIONSHIP IN TURKEY: EVIDENCE FROM ARDL BOUNDS TESTING APPROACH

DOI: 10.17261/Pressacademia.2020.1216
JBEF- V.9-ISS.2-2020(3)-p.80-96

Gulgun Cigdem
Istanbul Gelisim University, Banking and Insurance Department, Avcilar, Istanbul, Turkey.
gulguncigdem@gmail.com , ORCID: 0000-0001-5353-8638

Date Received: April 25, 2020 **Date Accepted:** June 11, 2020

To cite this document
Çiğdem, Gülgün (2020). COVID-19 and net foreign exchange reserve relationship in Turkey: evidence from ARDL bounds testing approach. Journal of Business, Economics and Finance (JBEF), V.9(2), p.80-96.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2020.1216

ABSTRACT

Purpose- This work inquires whether there's a correlation between Covid-19 and the net foreign exchange reserve, which shows sensitivity to crises.

Methodology- For this purpose, the daily data on COVID-19 seen in Turkey (case taken from Republic of Turkey Ministry of Health, cumulative case and infection rate data from Public Health Experts Association (HASUDER) and daily net foreign exchange reserve data calculated with the data obtained from the Central Bank of Turkey (CBT) balance sheet for the period between 11 March-14 May 2020 were tested applying the ARDL Bounds Test Approach and analyzed within the framework of the Error Correction Model (VECM). And to query short-run relationship, Granger Test over the VECM Model has been applied.

Findings- According to the analysis result; There is a cointegration in the long-run between COVID-19 and the net foreign exchange reserve, and is statistically significant. Also, net foreign exchange reserve is a Granger cause for the quantity of cases, the cumulative quantity of cases, and the rate of infection in the short-run.

Conclusion- In the process of transformation of a health crisis caused by a pandemic into a global economic crisis, this study contributes to the formation of the literature and is noteworthy with its results. Especially in the short-run, net foreign exchange reserves were determined to be a Granger cause of COVID-19, and therefore it was determined empirically that the change in reserves escalated the pandemic. The study is a contribution to the literature.

Keywords: COVID-19, net foreign exchange reserve, bounds test, ARDL
JEL Codes: E58, I18, C01

1. INTRODUCTION

A new crisis period is being experienced across the world, with a total of 7.633.886 detected cases and 426.317 deaths (WHO) from December 31, 2019, to June 13, 2020. The process that started with a health crisis brought along losses of consumption and investment and mass unemployment cases due to the increased uncertainty, and promotion of isolation and social distance that caused financial markets and companies to close.

World Health Organization (WHO), stating that *"A pandemic is the worldwide spread of a new disease. An influenza pandemic occurs when a new influenza virus emerges and spreads around the world, and most people do not have immunity,"* declared COVID-19 an outbreak on March 11, 2020. According to the US, Centers for Disease Control and Prevention (CDC); *"Pandemic refers to an epidemic that has spread over several countries or continents, usually affecting a large number of people."*

In the historical process, various pandemic cases were recorded since the 14th century. In Europe of the 14th century, the bubonic plague caused the death of approximately 25 million people, roughly one-fourth of the population. The influenza pandemic in the period of 1918-1920 caused the death of 50 million or more people (Surico and Galeotti,2020). In the 20th centenary, after the

Spanish Flu in 1918; two major outbreaks occurred, namely Asian Flu (H2N2) in 1957 and Hong Kong Flu in 1968. In the 21st century; there were four outbreaks: Bird Flu in 2009, Severe Acute Respiratory Syndrome(SARS) in 2002, Middle East Respiratory Syndrome(MERS) in 2012, and Ebola in 2013 (Baldwin and Weder di Mauro, 2020). Below are listed the death cases recorded in the aforementioned outbreaks;

1957 Asian Flu (H2N2): Although the total loss of life is uncertain, it is estimated that 1.1 million people died globally.

1968 Hong Kong Flu (H3N2): According to the CDC, one million people died worldwide, mostly over the age of 65.

2009 Avian Flu (N1H1): The CDC guess that 151,700 to 575,400 people died globally.

2002 SARS: 8096 cases were detected from November 2002 to July 2003, and 774 of them resulted in death. Although the mortality rate was 9.6%, it was recorded as less infectious than prior outbreaks.

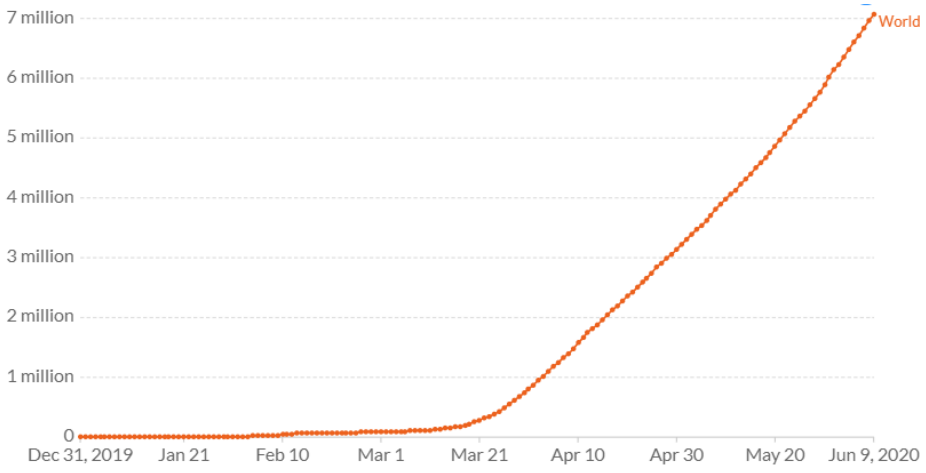
2012 MERS: The pandemic, which was first detected in Saudi Arabia, spread to 27 countries, but more than 80% of cases were concentrated in Saudi Arabia. It is estimated that 35% of those who contracted this highly lethal disease died.

2013 Ebola: The mortality rate of this deadly disease is 50%. First seen in Sudan and the Democratic Republic of Congo in 1976, the rate of mortality in these countries was 53% and 88%, respectively. The second wave started in West Africa in 2014-2016 and it was recorded with the mortality rate of 67% Guinea, 28% in Sierra Leone, 45% in Liberia, and 61% in the Democratic Republic of Congo in 2018-2019.

2018 HIV/AIDS: Approximately 32 million people died from the disease since the day it started, and it was found that 37.9 million people living with HIV worldwide (WHO) as of the end of 2018.

2019 COVID-19: This current pandemic started with various cases of acute respiratory syndrome detected in Wuhan, China on December 31, 2019. It is a type of coronavirus (ECDC) that has not been beforehand described in humans and it spread rapidly since its first detection.

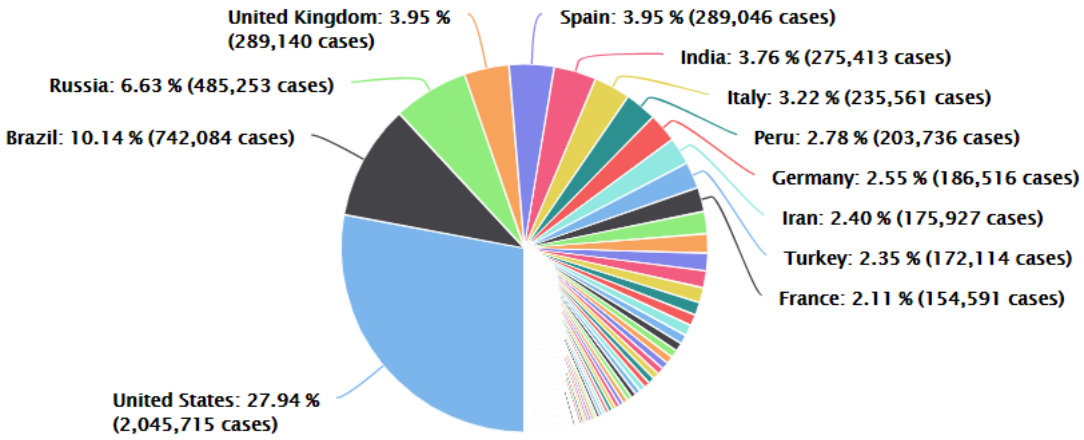
Figure 1: Total Confirmed COVID-19 Cases Worldwide (31th Dec 2019 -9th June 2020)



Source: European CDC.

Figure 1 shows the total confirmed COVID-19 cases worldwide. It is seen that the number of cases exceeding 100 thousand on March 7, 2020, has increased to over 200 thousand on March 18, and has started to increase rapidly. As of June 13, 2020, 10:00 a.m., the total number of cases in the world has reached 7.625.883 and the total quantity of deaths has reached 425.931 (ECDC). Within this global view, with a total of 172.114 cases (Ministry of Health), Turkey has a total of 2.35% of cases worldwide (Figure 2).

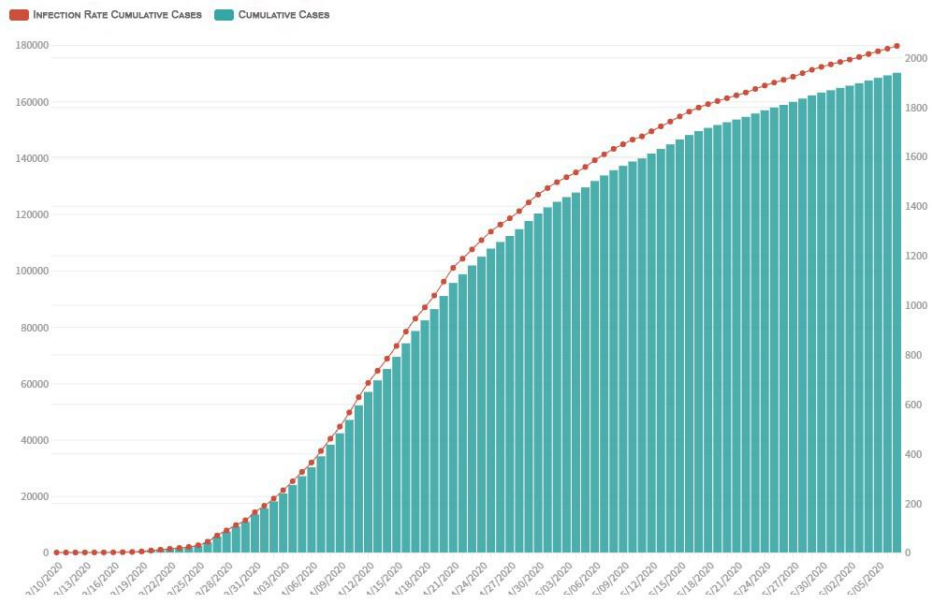
Figure 2: Countries Cases Distribution



Source: Worldometer.

The virus entered Turkey later thanks to the measures taken and showed the same trend as other countries. Based on the data obtained between March 11, 2020, which is the date when the first case was recorded, and May 17, 2020, the Figure 3 states the cumulative quantity of cases and the infection rate in Turkey, and the Figure 4 shows the number of new cases and the infection rate. Figure 5 graphically shows the current state of cases in Turkey in comparison with other countries.

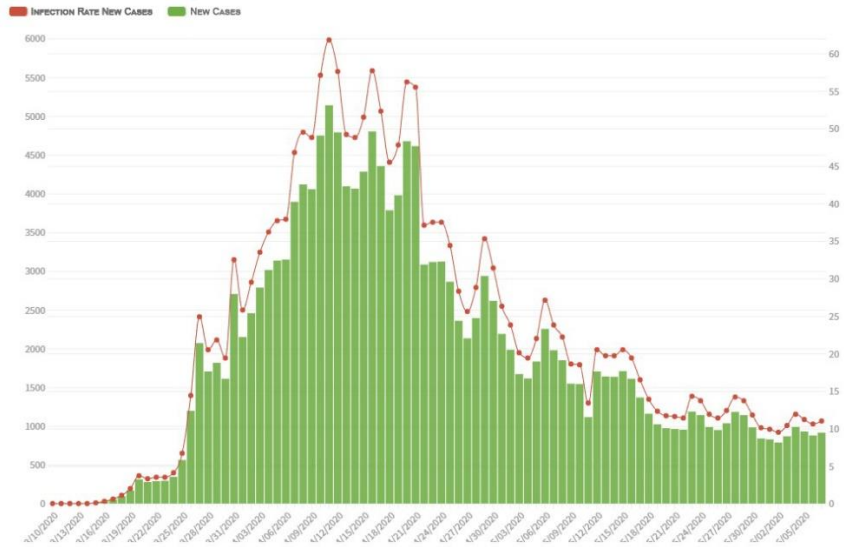
Figure 3: Cumulative Cases and Infection Rate, Turkey (10 March-8 June 2020)



Source: HASUDER.

The cumulative quantity of cases in Turkey on March 22, 2020, exceeded the figure of 1000, showing an increase of 77% and was recorded with 1236. The rate of infection, which reached 11.18% on 18 March, had a rapid rise with 20.20% on 19 March and 37.40% on 20 March (Figure 3). The number of new cases registered was 5138 on 11 March 2020. The new rate of Infection was 61.8% on the same date. The overall trend in both the quantity of new cases and the rate of infection - along with the leaps seen - was downward (Figure 4).

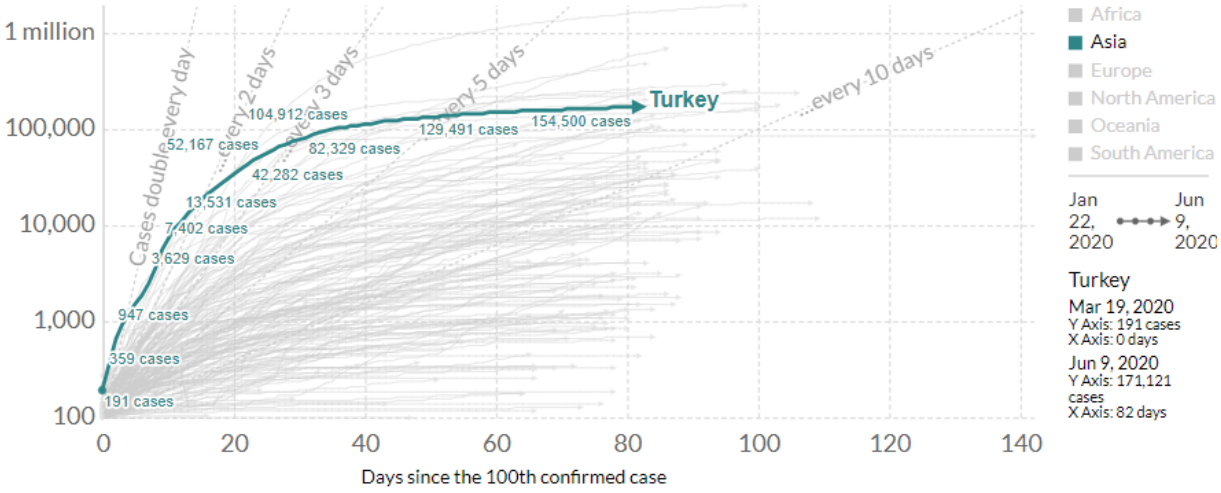
Figure 4: New Cases and Infection Rate, Turkey (11 March-8 June 2020)



Source: HASUDER.

The speed of the pandemic in Turkey up to 65.111 cases, remained higher than almost all countries (Figure 5). Then, as of June 9, 2020, the USA with the total quantity of 2.049.251 cases, it was in the first place as the new center of the pandemic, followed by Brazil with 743.047 cases, Russia with 493.657 cases, England with 289.140 cases, Spain with 289.046 cases, India with 284.322 cases, Italy with 235.561 cases, Peru with 203.736 cases, Germany with 186.525 cases, and Iran with 177.938 cases, respectively. Turkey ranks 11th with 172 114 cases (Worldometers) (Figures 2-5).

Figure 5: Total Confirmed COVID-19 Cases, Turkey (21 Jan.-9 June 2020)



Source: EUROPEAN CDC.

The multidisciplinary shock created by COVID-19 sparked a debate on this process where vital anxieties are combined with economic problems, as well as its consequences. This process, which started with a health crisis, is evolving into an economic crisis that will bring along a paradigm shift collapse, or even a global collapse that can be called slumpflation (Çiğdem, 2020). Initially, COVID-19 created a massive global uncertainty shock that was greater than the global crisis 2008 and it resembled the Great

Depression (Baker and Bloom et al., 2020) and triggered a new type of recession in the modern world, different from the triggers observed in the historical process (Ozili and Arun, 2020).

Any practice for limiting the spread of the pandemic and above all, saving human life comes at a *"price".* In the short run, focusing on emergency calls to defenseless populations and companies, measures are taken to prevent mass layoffs and insolvencies. In the medium-run, recovery packages containing monetary and fiscal measures should be introduced. In this critical process that requires international coordination, *"a well-designed government management plan"* is important (Loayza and Pennings, 2020).

The measures and actions were taken against COVID-19, and achievements in the fight against the pandemic vary by countries depending on the decision-makers and the financial power. The fight with a pandemic is carried on with the available resources in line with the decisions of the political authorities. COVID-19 has become a factor that causes all macro-economic targets to be put aside and depletes resources. From a different point of view, *"lack of sufficient resources"* can also be a cause of failure in the fight against COVID-19.

It is thought-provoking that COVID-19 coincided a period involving discussions about the changes experienced in the foreign exchange (fx) reserves of Turkey since alteration in the fx reserves of the countries is important in terms of showing sensitivity to the crises. *Foreign Exchange Market Pressure criterion*, which was created by Girton and Roper (1977) to examine the changes in fx reserves and exchange rates, has been used as a leading indicator in financial crises and successful results were obtained. It is also noteworthy that during the first global financial crisis, many Developing Countries (DC) during 2008: Q4–2009: Q1 period experienced depreciation in their foreign exchange reserves and exchange rates. From this point of view, the objective of this study is to investigate whether there is a relationship between the change in net fx reserves of Turkey in the process of pandemic and COVID-19. The study starts with literature research questioning the impacts of COVID-19 on the economy. The next section will mention the empirical study conducted and describe and discuss its results.

2. LITERATURE REVIEW

After WHO notified COVID-19 as an *"outbreak"* on March 11, 2020, national emergency was acclaimed in many countries, especially in the USA. Also, the fact that Ben Bernanke and Janet Yellen stated that the public health crisis will turn into a deep and possibly long-run economic recession in the Financial Times increased the concerns about uncertainty shock (Bernanke and Yellen, 2020). To prevent this bad scenario, the studies for pandemics, which are still new, have accelerated. Due to the insufficient number of observations yet, past pandemics were analyzed and various policy inferences were made. Different applications of the countries and the results obtained were also the focus of researchers.

Among the studies, it is remarkable and essentially important to determine how many people actually get infected with COVID-19, actual death numbers and infection rate. Knowing the actual number of cases and deaths; it is particularly crucial for policy-makers to determine the appropriate scale to control the virus [Alvarez, Argente, and Lippi (2020); Eichenbaum, Rebelo, and Trabandt (2020)], as well as for public health policies to slow the outbreak.

The reported quantity of infected people is probably much lower than the actual number of cases [Andrei, (2020); Nishiura, Kobayashi, et al. (2020)]. Bendavid et al. (2020) reported in a research that only 956 people were reported in Santa Clara (California) as of April 1, although 48,000-81,000 people were infected. Berger, Herkenhoof, and Mongey (2020) and Stock (2020) investigated the importance of unreported COVID-19 cases in the context of the pandemic.

Li et al. (2020), Wu, Leu, and Leu (2020), Flaxman, Mishra, and Gandy (2020), Hortaçsu, Liu, and Schweig (2020), Korolev (2020), Liu, Magal, Seydi, and Webb (2020 a , b), Nishiura, Kobayashi, et al. (2020), Zhao et al. (2020) used various models and made recommendations to estimate the number of true infections not reported.

Almost all of the studies carried out consist of research on diagnosis, treatment, spreading prevention, and health policies to expand the limited information about the new virus, to rapidly prepare health systems for this unknown pandemic, and to find a global response. Some studies on this subject are given below;

Table 1a: Studies on COVID-19 (Health, Mortality, and Outbreak Modeling)

Ai et al. (2020)	Dong et al. (2020)	Liu et al. (2020)	Qin et al. (2020)	Sohrabi et al. (2020)
Alhazzani et al. (2020)	Gattinoni et al. (2020)	Livingston and Bucher (2020)	Remuzzi and Remuzzi (2020)	Sohrabi et al. (2020)
Arentz et al. (2020)	Gautret et al. (2020)	Mehta et al. (2020)	Richardson et al. (2020)	Tian et al. (2020)
Bai et al. (2020)	Guo et al. (2020)	Mizumoto et al. (2020)	Rothan and Byrareddy (2020)	Touret and Lamballerie (2020)
Chen and Guo et al. (2020)	Hu et al. (2020)	Musetti et al. (2020)	Ruan et al. (2020)	Touret and Lamballerie (2020)
Chen and Liu et al. (2020)	Klok (2020)	Nishiura et al. (2020)	Sanders et al. (2020),	Wang and Zhang (2020)
Chen and Xiong et al. (2020)	Lai et al. (2020)	Onder et al. (2020)	Shen et al. (2020)	Xu et al. (2020)
Chinazzi et al. (2020)	Lauer et al. (2020)	Pan et al. (2020)	Shi and Han et al. (2020)	Zhonghua (2020)
Chinazzi et al. (2020)	Lauer et al. (2020)	Peto (2020)	Shi and Qin et al. (2020)	Zhou (2020)
Cucinotta and Vanelli (2020)	Li et al. (2020)	Poyiadji et al. (2020)	Singhal (2020)	Zu et al. (2020)

In addition to these studies, Baker and Farrokhnia et al. (2020) examined the response of household expenditures to COVID-19. Pindyck (2020) tested the reduction of pandemic spreading and welfare effects.

Conducted studies on COVID-19-labor markets are given in Table 1b. As for the studies carried out for COVID-19-Asset Market; Caballero and Şimşek (2020), Alfaro et al. (2020), Baker and Bloom et al. (2020)'s studies can be given as an example.

Table 1b: Studies on COVID-19 (Labor Markets)

Alon et al. (2020)	Coibion et al. (2020, a)	Kahn et al. (2020)	Montenovo et al. (2020)
Alstadsæter(2020)	Dingel and Neiman (2020)	Mongey et al. (2020)	Rojas et al. (2020)

Studies questioning the effects of a pandemic on households and firms are as follows; Baker et al. (2020, a), Baker et al. (2020, b), Barrero, Bloom, and Davis (2020), Bartik et al. (2020), Coibion et al. (2020, b), Ding et al. (2020), Fahlenbrach et al. (2020), Hassan et al. (2020), Krueger et al. (2020).

Atkeson (2020), Avery et al. (2020), Goldstein and Lee (2020), Haris (2020), Hortaçsu et al. (2020), Kuchler et al. (2020), Lin and Meissner (2020), Manski and Molinari (2020), Fernández-Villaverde and Jones (2020), conducted studies on Health, Mortality, and Outbreak Modeling. There is a rapidly expanding literature on COVID-19 and its macroeconomic effects. Table 1c shows the studies conducted.

Table 1c: Studies on COVID-19 (Economy)

Author	Conclusion
Acemoğlu et al. (2020)	To minimize both economic and life losses; targeted policies combined with measures such as reducing interaction, increasing testing, and isolation should be developed.
Baker, Bloom, Davis, and Terry	As a negative effect of the uncertainty caused by COVID, an 11% -20% contraction is foreseen in the US real GDP as of the 4th quarter of 2020.
Baldwin and Weder di Mauro (2020)	They offer various policy suggestions in their study.
Fornaro and Wolf (2020)	They examined COVID-19 as a negative impact on the growth rate of productivity.
Faria e Castro (2018)	COVID-19 is modeled as a major negative impact in favor of consumption.
Eichenbaum, Rebelo and Trabandt (2020)	"the best simple containment policy increases the severity of the recession but saves roughly half a million lives in the U.S."
Jorda et al. (2020)	They provide time-series evidence for the impact of historical pandemics on return rates, demonstrating that pandemics reduce real rates of return. Besides, it has been determined that the macroeconomic effects of outbreaks continue for approximately 40 years.
Gregory, Menzio and Wiczer (2020)	"The lockdown to prevent the spread of the novel coronavirus is shown to have long-las instituting negative effects on unemployment."
Guerrieri et al. (2020)	Their study suggests that, in the case of a pandemic, the most appropriate combination of policies should be the loose monetary policy and social insurance.
Ludvigson et al. (2020)	It has been determined that the effect of the pandemic will continue from 2 months to 2 years depending on the economy.
Ozili and Arun (2020)	It was found that increasing quarantine days, monetary policy decisions, and international travel bans have serious effects on i. economic activities, and ii. share prices. Internal movement and higher fiscal policy expenditures were found to have a positive effect on economic activities.

As can be seen from the tables, no sufficient empirical study in macroeconomic field could be conducted yet since the COVID-19 is a rather new shock with an insufficient number of observations. From this aspect, this study contributes to the literature.

3. DATA, METHODOLOGY AND EMPIRICAL RESULTS

In this section, the relationship between COVID-19 and the net foreign reserve has been tested empirically.

3.1. Data

Foreign assets and total foreign exchange liabilities data between March 11 and May 14, 2020, were obtained from the Balance Sheet of the Central Bank of the Republic of Turkey (CBRT) to test the relationship between the draining net foreign exchange reserve and COVID-19. *Net foreign exchange reserve* was calculated using the equation no 1 with the exchange rates taken from the CBRT.

Net Foreign Exchange Reserve=Foreign Assets-Total Foreign Exchange Liabilities / Exchange Rate (1)

The quantity of COVID-19 cases detected in Turkey in the same date range was obtained from the Ministry of Health, and the cumulative cases and the infection rate data were taken from HASUDER (Association of Public Health Professionals) to include in the analysis. Daily data and E-Views10 were used in the analysis. Logarithms of the series were taken and analyzed for ease of interpretation and suppression of heteroscedasticity. Table 2 shows the variables used in the analysis.

Table 2: Variables

Variable Name	Code	Source
Net Foreign Reserve	NFR	Central Bank of Turkey (CBT)
Number of cumulative cases	CUM	HASUDER
Confirmed cases	CASE	Republic of Turkey Ministry of Health
Infection Rate	INF	HASUDER

3.2. Unit Root Tests

The obligatory first footstep when making these analyses is to issue the variables to unit root tests. The degree to which the time-series is stationary can be determined by unit root tests. Table 3 shows the ADF and PP test results.

Looking at the ADF and PP test results, the net foreign reserve (NFR) is found to be I_1, and the number of cumulative cases (CUM), confirmed cases (CASE), and infection rate (INF) series I_0 . This shows that when the first difference of the net foreign reserve is taken, it becomes stationary and the other variables are stationary in level degree.

Table 3: ADF and PP Unit Root Test Results

			Variables	Test Statistic	Crucial *(Critical)* Values		
					%1	%5	%10
1	**Net Foreign Reserve**	**ADF**	LOGNFR, *level*	-2.195797	-4.309824	-3.574244	-3.221728
			LOGNFR, *1st difference*	-5.388732	-4.205004	-3.526609	-3.194611
		PP	LOGNFR, *level*	-2.646625	-4.186481	-3.518090	-3.189732
			LOGNFR, *1st difference*	-5.301844	-4.205004	-3.526609	-3.194611
2	**Number of Cumulative Cases**	**ADF**	LOGCUM, *level*	-6.045428	-4.211868	-3.529758	-3.196411
		PP	LOGCUM, *level*	-14.82130	-4.170583	-3.510740	-3.185512
3	**Confirmed cases**	**ADF**	LOGCASE, *level*	-11.68746	-4.211868	-3.529758	-3.196411
		PP	LOGCASE, *level*	-3.267272	-4.165756	-3.508508	-3.184230
4	**Infection Rate**	**ADF**	LOGINF, *level*	-10.95878	-4.219126	-3.533083	-3.198312
		PP	LOGINF, *level*	-11.13940	-4.180911	-3.515523	-3.188259

Note: The quantity of lags in the ADF testing is identified per the Schwarz criteria which is a more powerful criterion and yields preferable outcomes than the other criteria. In the Philips Perron tests, the quantity of lags identified per Newey-West Bandwith is received. Maximum lag length is taken as nine.

3.3. ARDL Model

According to the results of the analysis, the series are not at the same level stationary. In the ARDL Bounds testing developed by Pesaran et al. (2001), it is sufficient if the series are I_0 or I_1 and the cointegration relationship can be investigated. Another important advantage is that healthy and effective results can be obtained in small samples. Also, short-run dynamics and long-run balance can be integrated through error correction (ECM).

The null hypothesis tested by the ARDL Bound Test is "There is no cointegration correlation between variables", thus, rejecting this hypothesis shows that such a cointegration correlation exists. If the F statistic from the test is greater than the critical upper bound, H_0 is rejected. When F statistic is less than the critical lower bound, H_0 is accepted. And when F statistic is between the upper and lower critical bounds, other cointegration tests should be considered as there is not sufficient data to reject or fail to reject the H_0 hypothesis (Pesaran, Shin, Smith, 2001).

Table 4: ARDL Bounds Test Results

Predicted Equality =DT=*f*(PI)		
F Statistic	4.214929	
Significance level	Critical Value	
	Lower Limit	*Upper Limit*
%1	3.65	4.66
%5	2.79	3.67
%10	2.37	3.2

Diagnostic tests	Statisitcs
R^2	0.755702
Adjusted R^2	0.568885
F Statistics	6.704611 (0.000612)
Breusch-Godfrey	0.7750 (0.9978)
Breusch-Pagan-Godfrey	0.3450 (0.3959)
ARCH LM	0.7108 (0.8760)

Note: The values in parentheses are the probabilities.

Data in Table 4 shows that there is a cointegration correlation between the variables as the calculated F statistic value (4.214954) is greater than the upper bound (3.67) at 5% significance level. In this case, there is a long-run correlation between LOGNFR, LOGCASE, LOGINF, and LOGCUM. The model has been analyzed with the 1st and 2nd order LM autocorrelation test and with Breusch-Pagan Godfrey (1979) test to address heteroscedasticity. The results obtained indicate that the model does not have heteroscedasticity or variance.

3.4. Error Correction Model (ECM) and Long-Run Coefficients

There are two important points showing whether the ECM works; EC parameter "CointEq (-1)" must take a negative value and be statistically significant. According to the results contained in Table 5, the error correction coefficient (CointEq (-1)) is negative and significant. Basic conditions are provided. A long-run correlation between series can be considered to be in existence in the case of a negative and significant error correction coefficient.

Table 5: Error Correction Model and Long-Run Coefficients

ECM				
Variable	**Coefficient**	**Std. Error**	***t*- Statistic**	**Prob.**
D(LOGNFR(-1))	0.482237	0.163071	2.957232	0.0111
D(LOGNFR(-2))	0.359638	0.172458	2.085364	0.0573
D(LOGNFR(-3))	0.413521	0.198942	2.078596	0.0580
D(LOGCUM)	3.285898	58.19338	0.056465	0.9558
D(LOGCUM(-1))	-343.3261	78.84683	-4.354343	0.0008
D(LOGCUM(-2))	-127.9802	37.18984	-3.441268	0.0044
D(LOGCUM(-3))	26.64521	7.228678	3.686042	0.0027
D(LOGINF)	0.906247	61.82117	0.014659	0.9885
D(LOGINF(-1))	356.3760	82.02099	4.344937	0.0008
D(LOGINF(-2))	127.5044	37.11036	3.435818	0.0044
D(LOGINF(-3))	-26.54874	7.222769	-3.675701	0.0028
D(LOGCASE)	-4.246000	4.536542	-0.935955	0.3664
D(LOGCASE(-1))	-13.43405	3.561120	-3.772423	0.0023
CointEq(-1)*	**-0.874756**	**0.166630**	**-5.249691**	**0.0002**
Long Run Coefficients				
Variable	**Coefficient**	**Std. Error**	***t*- Statistic**	**Prob.**
LOGCASE	24.96807	14.27994	1.748471	0.1039
LOGCUM	694.7681	295.1702	2.353788	0.0350
LOGINF	-719.8989	308.6918	-2.332096	0.0364
C	-3163.982	1363.981	-2.319667	0.0373

Dependent Variable: LOGNFR.

According to the ECM results obtained, a 1% increase in LOGCASE will result in a 24.96807% increase in LOGNFR. A 1% increase in LOGCUM will result in a 694.7681% increase in LOGNFR. A 1% increase in LOGINF will lead to a 719.8989% decrease in LOGNFR (Table 5).

When interpreting ECC; It is possible to calculate the rebalance ratio of the system by dividing the ECC by "1" (1 / 0.874756 = 1.143). This value indicates that the system will take approximately 1,143 days to rebalance.

A negative correlation was found between LOGNFR and LOGINF, and a positive correlation was found between other variables. Surprisingly, when the model was re-estimated taking LOGCUM as the dependent variable to test a positive relationship; a negative relationship was found between LOGCUM AND LOGNFR. A 1% increase in LOGNFR will create a 0.000110% decrease in LOGCUM (Table 6).

Table 6: Long Run Coefficients (Dependent Variable: LOGCUM)

Variables	Coefficient	Std. Error	t- Statistic	Prob.
LOGNRF	-0.000110	0.000148	-0.743798	0.4645

Similarly, when LOGCASE is taken as a dependent variable; there seems to be a negative relationship between the variables. A 1% increase in LOGNFR will result in a 0.149984% decrease in LOGCASE (Table 7).

Table 7: Long Run Coefficients (Dependent Variable: LOGCASE)

Variables	Coefficient	Std. Error	t- Statistic	Prob.
LOGNRF	-0.000110	0.000148	-0.743798	0.4645

3.5. Granger Causality Test over VECM Model

Having identified the long-run correlation between the variables, Granger Causality Test over VECM Model has been applied to analyze the short-run correlation. As can be seen from Table 8, the null hypothesis H_0 is rejected since prob<0.05 in the short-run, and therefore the alternative hypothesis is accepted. That is, LOGNFR is a Granger cause for the LOGCASE, LOGCUM, and LOGINF.

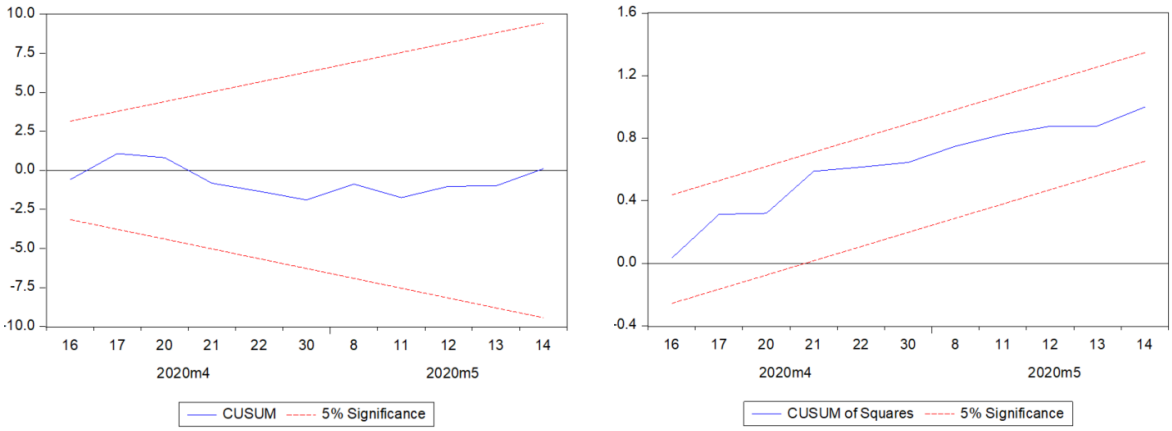
Table 8: Long Run Coefficients (Dependent Variable: LOGCASE)

Hypothesis	Prob.	Direction of Causality
LOGNFR does not (Granger) causes LOGCASE	0.0461	**LOGNFR → LOGCASE**
LOGNFR does not (Granger) causes LOGCUM	0.0462	**LOGNFR → LOGCUM**
LOGNFR does not (Granger) causes LOGINF	0.0462	**LOGNFR → LOGINF**

3.6. CUSUM Test and CUSUM SQUARE Test

The stability of the coefficients estimated in the ARDL model was investigated by CUSUM and CUSUM SQUARE (CUSUMQ) tests. The CUSUM test suggests that the estimated coefficients/parameters are stable if the related error terms are within the confidence interval. The CUSUMQ test is used to evaluate coefficients based on the squares of cumulative error terms (5% significance level (95% confidence band)) (Brown et al., 1975). Straight lines in Figure 6 show parameter estimates and red dashed lines show 95% confidence limits.

Figure 6: CUSUM and CUSUM SQUARE Test Results



As can be seen from Figure 6; residues remain within the confidence zone indicated by dashed lines. According to these tests, the coefficients appear to be stable.

4. CONCLUSION

COVID-19, another pandemic faced by human beings, emerged as an important factor triggering a global collapse in the modern world, unlike the previous ones. In today's world involving a struggle to save lives and slow down the transmission of the disease, the final scale of which is not yet predicted; countries have different practices to avoid mass layoffs and bankruptcies. Neither the loss caused by the global pandemic nor the losses of production, consumption (due to decreased demand), and investment resulting from the promotion of social distance and isolation could be calculated yet. Different practices in different countries brought along different success rates against the pandemic. The fight against COVID-19 and immediate support measures vary from country to country, with the influence of decision-makers and financial power.

Change in the net foreign exchange reserves of Turkey is also noteworthy among the macro-economic indicators that have deteriorated since the beginning of the pandemic. From this point of view, this study aims to investigate if there is a relationship between the net fx reserves of Turkey and COVID-19. For this purpose, daily data is obtained regarding COVID-19 cases in Turkey by receiving case data from the Turkish Ministry of Health and cumulative cases and infection rate data from the Association of Public Health Professionals (HASUDER), and daily net foreign exchange reserves were calculated using the data from the balance sheet of the CBRT, and then tested by ARDL Bounds Test Approach, and analyzed within the framework of the Vector Error Correction Model (VECM). Once a long-run relationship was detected between the variables, a Granger Test was performed through the VECM Model to question the presence of a short-run relationship. Then, the stability of the coefficients was tested by CUSUM and CUSUMQ tests. As a result of the analyzes carried out;

- It was found that the number of COVID-19 cases detected, the cumulative number of cases and the rate of infection are cointegrated with the net foreign exchange reserves in the long run.
- It was found that the net foreign exchange reserve is a Granger cause of the cumulative number of cases, rate of infection, and the number of detected cases. It was empirically determined that the increase in the COVID-19 is caused by, inter alia, the lack of *"sufficient"* resources to prevent the spread of the pandemic, detect and treat the cases, and avoid mass unemployment and bankruptcy caused by the promotion of isolation and social distance during the course of the pandemic.
- A positive correlation was found between the cumulative number of cases, the number of cases, and the net foreign exchange reserve. And a negative correlation was found between the infection rate and the net foreign exchange reserve. The analysis detected that, when the net foreign exchange reserve increases by 1%, the rate of infection decreases by 719.90%. To put it another way, a decrease in the net foreign exchange reserve brings along a serious increase in the rate of infection.

- To question the surprisingly positive relationship between the net foreign exchange reserve and the number of cumulative cases and the number of cases, the net foreign exchange reserve was included in the analysis as an independent variable this time and a negative relationship was found between the variables.

The positive relationship between the quantity of detected cases, the cumulative quantity of cases, and the net foreign exchange reserve is surprising. The relationship between the variables will be tested in another study by the NARDL Long-run Asymmetry Test. This study is a contribution to the literature that has not yet been formed as it is one of the first empirical studies on COVID-19, and it is also important for decision-makers. New data to be announced and future studies to be conducted will be important regarding the pandemic, which has not been brought under control yet and which involves concerns for a second wave.

REFERENCES

Acemoğlu, D., Chernozhukov, V., Werning, I., and Whinston, M.D. (2020). Optimal Targeted Lockdowns in a Multi-Group SIR Model. *NBER Working Paper* No. 27102. DOI: 10.3386/w27102

Ai, T., Yang, Z., Hou, H., Zhan, C., Chen, C., Lv, W., Tao, Q., Sun, Z., and Xia, L. (2020, Feb 20). Correlation of Chest CT and RT-PCR Testing in Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases. DOI:10.1148/radiol.2020200642

Alfaro, L., Chari, A., Greenland, A.N., and Schott, P.K. (2020). Aggregate and Firm-Level Stock Returns During Pandemics, in Real Time. *NBER Working Paper* No. 26950. DOI: 10.3386/w26950

Alhazzani, W. et al. (2020). Surviving Sepsis Campaign: Guidelines on the Management of Critically Ill Adults with Coronavirus Disease 2019 (COVID-19). *Intensive Care Med (2020),* 46, 854–887. DOI:10.1007/s00134-020-06022-5

Alon, T.M., Doepke, M., Olmstead-Rumsey, J., and Tertilt, M. (2020). The Impact of COVID-19 on Gender Equality. *NBER Working Paper* No. 26947. DOI: 10.3386/w26947

Alstadsæter, A., Bratsberg, B., Eielsen, G., Kopczuk, W., Markussen, S., Raaum, O., and Røed, K. (2020). The First Weeks of the Coronavirus Crisis: Who Got Hit, When and Why? Evidence from Norway. *NBER Working Paper* No. 27131. DOI: 10.3386/w27131

Alvarez, F., Argente, D. and Lippi, F. (2020). A Simple Planning Problem for COVID-19 Lockdown. University of Chicago, *Becker Friedman Institute for Economics Working Paper* (2020-34).

Andrei, M. (2020, March 26). Iceland's Testing Suggests 50% of COVID-19 Cases are Asymptomatic. *50ZME Science*. Retrieved from https://www.zmescience.com/medicine/iceland-testing-covid-19-0523/

Arentz, M., Yim, E., Klaff, L., Lokhandwala, S., Riedo, F.X., Chong, M., and Lee, M. (2020). Characteristics and Outcomes of 21 Critically Ill Patients With COVID-19 in Washington State. *JAMA*, 323(16),1612-1614. DOI:10.1001/jama.2020.4326

Atkeson, A. (2020). How Deadly Is COVID-19? Understanding The Difficulties With Estimation Of Its Fatality Rate. *NBER Working Paper* 26965. DOI: 10.3386/w26965

Avery, C., Bossert, W., Clark, A., Ellison, G., and Ellison, S.F. (2020). Policy Implications of Models of the Spread of Coronavirus: Perspectives and Opportunities for Economists. *NBER Working Paper* 27007. DOI: 10.3386/w27007

Bai, Y., Yao, L., Wei, T., Tian, F., Jin, D-Y., Chen, L., and Wang, M. (2020). Presumed Asymptomatic Carrier Transmission of COVID-19. *JAMA,* 323(14), 1406–1407. DOI:10.1001/jama.2020.2565

Baker, S.R., Bloom, N., Davis, S.J., and Terry, S.J. (2020). Covid-Induced Economic Uncertainty. *NBER Working Paper No.*26983. DOI: 10.3386/w26983

Baker, S.R., Bloom, N., Davis, S.J., Kost, K.J., Sammon, M.C., and Viratyosin, T. (2020). The Unprecedented Stock Market Impact of COVID-19. *NBER Working Paper* 26945. DOI: 10.3386/w26945

Baker, S.R., Farrokhnia, R.A., Meyer, S., Pagel, M., and Yannelis, C. (2020, a). How Does Household Spending Respond to an Epidemic? Consumption During the 2020 COVID-19 Pandemic. *NBER Working Paper* No. 26949. DOI: 10.3386/w26949

Baker, S.R., Farrokhnia, R.A., Meyer, S., Pagel, M., and Yannelis, C. (2020, b). Income, Liquidity, and the Consumption Response to the 2020 Economic Stimulus Payments. *NBER Working Paper* No. 27097. DOI:10.3386/w27097

Baldwin, R., and Weder di Mauro, B. (2020). Economics in the Time of COVID-19, *VoxEU CEPR Press*. Retrieved from https://voxeu.org/debates/economics-time-covid-19

Barrero, J.M., Bloom, N., and Davis, S.J. (2020). COVID-19 Is Also a Reallocation Shock. *NBER Working Paper* No. 27137. DOI: 10.3386/w27137

Bartik, A.W., Bertrand, M., Cullen, Z.B., Glaeser, E.L., Luca, M., and Stanton, C.T. (2020). How Are Small Businesses Adjusting to COVID-19? Early Evidence from a Survey. *NBER Working Paper* 26989. DOI: 10.3386/w26989

Bendavid, E., Mulaney, B. Sood, N., Shah, S., Ling, E., Bromley-Dulfano, R., Lai, C., Weissberg, Z., Saavedra, R., Tedrow, J. et al. (2020). COVID-19 Antibody Seroprevalence in Santa Clara County, California. MedRxiv.

Berger, D., Herkenhoff, K. and Mongey, S. (2020). An Seir Infectious Disease Model with Testing and Conditional Quarantine. Working Paper, Federal Reserve Bank of Minneapolis.

Bernanke, B. and Yellen, J. (2020, Mar 18). The Federal Reserve Must Reduce Long-Term Damage from Coronavirus. Retrieved from https://www.ft.com/content/01f267a2-686c-11ea-a3c9-1fe6fedcca75

Breusch, T.S., and Pagan, A.R. (1979). A Simple Test for Heteroscedasticity and Random Coeffcient Variation. *Econometrica,* 47, 1287–1294.

Brown, R. L., Durbin, J., and Evans, J. M. (1975). Techniques for Testing the Constancy of Regression Relationships Over Time (with discussion). *Journal of the Royal Statistical Society* B, 37, 149–92.

Caballero, R.J. and Şimşek, A. (2020). A Model of Asset Price Spirals and Aggregate Demand Amplification of a "Covid-19" Shock. NBER Working Paper No. 27044. DOI:10.3386/w27044

CDC. Principles of Epidemiology in Public Health Practice, Third Edition. An Introduction to Applied Epidemiology and Biostatistics. Retrieved from https://www.cdc.gov/csels/dsepd/ss1978/lesson1/section11.html

Chen, H., Guo, J., Wang, C., Luo, F., Yu, X., Zhang, W., Li, J., Zhao, D., Xu, D., Gong, Q., Liao, J., Yang, H., Hou, W., and Zhang, Y. (2020). Clinical Characteristics and Intrauterine Vertical Transmission Potential of COVID-19 Infection in Nine Pregnant Women: a Retrospective Review of Medical Records. *The Lancet*, 395(10226), 809-815. DOI:10.1016/S0140-6736(20)30360-3

Chen, J., Liu, D., Liu, L., Liu, P., Xu, Q., Xia, L., Ling, Y., Huang, D., Song, S., Zhang, D., Qian, Z., Li, T., Shen, Y., and Lu, H. (Mar 2020). A Pilot Study of Hydroxychloroquine in Treatment of Patients with Moderate COVID-19. *J Zhejiang Univ (Med Sci),* 49(2), 215-219. DOI: 10.3785/j.issn.1008-9292.2020.03.03

Chen, L., Xiong, J., Baı, L. and Shi, Y. (2020). Convalescent Plasma as a Potential Therapy for COVID-19. The Lancet Infectious Diseases, 20(4), 398-400. DOI:10.1016/S1473-3099(20)30141-9

Chinazzi, M., Davis, J.T., Ajelli, M., Gioannini, C., Litvinova, M., Merler, S., Piontti, A.P., Mu, K., Rossi, L., Sun, K., Viboud, C., Xiong, X., Yu, H., Halloran, M.E., Longini Jr., I.M., and Vespignani, A. (2020). The Effect of Travel Restrictions on the Spread of the 2019 Novel Coronavirus (COVID-19) Outbreak. *Science,* 368 (6489), 395-400. DOI: 10.1126/science.aba9757

Coibion, O., Gorodnichenko, Y., and Weber, M. (2020, a). Labor Markets During the COVID-19 Crisis: A Preliminary View. *NBER Working Paper* No. 27017. DOI: 10.3386/w27017

Coibion, O., Gorodnichenko, Y., and Weber, M. (2020, b). The Cost of the Covid-19 Crisis: Lockdowns, Macroeconomic Expectations, and Consumer Spending. *NBER Working Paper* 27141. DOI:10.3386/w27141

Cucinotta, D. and Vanelli, M. (2020). WHO Declares COVID-19 a Pandemic. *Acta Bio-medica: Atenei Parmensis,* 91(1), 157-160. DOI: 10.23750/abm.v91i1.9397

Çiğdem, G. (2020). Multidisipliner Yaklaşımla İktisadi Kriz Olgusu. Ankara: Gazi Kitapevi.

Ding, W., Levine, R., Lin, C., and Xie, W. (2020). Corporate Immunity to the COVID-19 Pandemic. *NBER Working Paper* No. 27055. DOI: 10.3386/w27055

Dingel, J.I., and Neiman, B. (2020). How Many Jobs Can be Done at Home? *NBER Working Paper* No. 26948. DOI:10.3386/w26948

Dong, Y., Mo, X., Hu, Y., Qi, X., Jiang, F., Jiang, Z. and Tong, S. (2020). Epidemiology of COVID-19 Among Children in China. *Pediatrics,* 145 (6) e20200702. DOI: https://doi.org/10.1542/peds.2020-0702

European Center for Disease Prevention and Control (ECDC). Communicable Disease Threats Report, 17-23 May 2020, Week 21. Retrieved from https://www.ecdc.europa.eu/sites/default/files/documents/Communicable-disease-threats-report-23-may-2020.pdf

Eichenbaum, M.S., Rebelo, S., and Trabandt, M. (2020). The Macroeconomics of Epidemics. *NBER Working Paper No. 26882.* DOI: 10.3386/w26882

Fahlenbrach, R., Rageth, K., and Stulz, R.M. (2020). How Valuable is Financial Flexibility when Revenue Stops? Evidence from the COVID-19 Crisis. *NBER Working Paper* No. 27106. DOI:10.3386/w27106

Faria e Castro, M. (2018). Fiscal Multipliers and Financial Crises. *Working Papers* 2018-23, Federal Reserve Bank of St. Louis. DOI: 10.20955/wp.2018.023

Fernández-Villaverde, J. and Jones, C.I. (2020). Estimating and Simulating a SIRD Model of COVID-19 for Many Countries, States, and Cities. *NBER Working Paper* 27128. DOI: 10.3386/w27128

Flaxman, S., Mishra, S., and Gandy, A.E.A. (2020, March 30). Estimating the Number of Infections and the Impact of Non-Pharmaceutical Interventions on Covid-19 in 11 European Countries. *Imperial College London.* DOI: /10.25561/77731

Fornaro, L., and Wolf, M. (2020). Covid-19 Coronavirus and Macroeconomic Policy. Retrieved from http://www.crei.cat/wp-content/uploads/2020/03/C19.pdf

Gattinoni, L., Chiumello, D., Caironi, P., Busana, M., Romitti, F., Brazzi, L., and Camporota, L. (2020). COVID-19 Pneumonia: Diferent Respiratory Treatments for Diferent Phenotypes? *Intensive Care Med.* DOI:10.1007/s00134-020-06033-2

Gautret, P., Lagier, J.-C., Parola, P., Hoang, V.T., Meddeb, L., Mailhe, M., Doudier, B., Courjon, J., Giordanengo, V., Vieira, V.E., Dupont, H.T., Honoré, S., Colson, P., Chabrière, E., Scola, B., Rolain, J.-M., Brouqui, P., Raoultac, D. (Mar 2020). Hydroxychloroquine and Azithromycin as a Treatment of COVID-19: Results of an Open-Label Non-Randomized Clinical Ttrial. *International Journal of Antimicrobial Agents* (2020). DOI:10.1016/j.ijantimicag.2020.105949

Guo, T., Fan, Y., Chen, M., Wu, X., Zhang, L., He, T., Wang, H., Wan, J., Wang, X., and Lu, Z. (2020, Mar 27). Cardiovascular Implications of Fatal Outcomes of Patients With Coronavirus Disease 2019 (COVID-19). *JAMA Cardiol.* DOI:10.1001/jamacardio.2020.1017

Girton, L., and Roper, D. (1977). A Monetary Model of Exchange Market Pressure Applied to the Postwar Canadian Experience. *American Economic Review,* 67(4), 537-548.

Godfrey, L.G. (1978). Testing for Multiplicative Heteroscedasticity. *Journal of Econometrics,* 8, 227–236.

Goldstein, J.R., and Lee, R.D. (2020). Demographic Perspectives on Mortality of Covid-19 and Other Epidemics. *NBER Working Paper* 27043. DOI:10.3386/w27043

Gregory, V., Menzio, G., and Wiczer, D.G. (2020). Pandemic Recession: L or V-Shaped? *NBER Working Paper* No. 27105. DOI:10.3386/w27105

Guerrieri, V., Lorenzoni, G., Straub, L., and Werning, I. (2020). Macroeconomic Implications of Covid-19: Can Negative Supply Schocks Cause Demand Shortages? *NBER Working Paper* No.26918. DOI: 10.3386/w26918

Halk Sağlığı Uzmanları Derneği (HASUDER). Kümülatif Vaka Sayısı ve Enfeksiyon Hızı. Retrieved from https://korona.hasuder.org.tr/hasuder-yeni-koronavirus-covid-19-haber-postasi-18-05-2020/

Harris, J.E. (2020). The Coronavirus Epidemic Curve is Already Flattening in New York City. *NBER Working Paper* 26917. DOI: 10.3386/w26917

Hassan, T.A., Hollander, S., Lent, L.V., and Tahoun, A. (2020). Firm-level Exposure to Epidemic Diseases: Covid-19, SARS, and H1N1. *NBER Working Paper* 26971. DOI: 10.3386/w26971

Hortaçsu, A., Liu, J., and Schwieg, T. (2020). Estimating the Fraction of Unreported Infections in Epidemics with a Known Epicenter: an Application to COVID-19. *NBER Working Paper* 27028. DOI: 10.3386/w27028

Hu, Z., Song, C., Xu, C., Jin, G., Chen, Y., Xu, X., Ma, H., Chen, W., Lin, Y., Zheng, Y., Wang, J., Hu, Z., Yi, Y., and Shen, H. (2020). Clinical Characteristics of 24 Asymptomatic Infections with COVID-19 Screened Among Close Contacts in Nanjing, China. *Sci China Life Sci,* 63, 706–711. DOI:10.1007/s11427-020-1661-4

Jorda, O., Singh, S.S., and Taylor, A.M. (2020). Longer-Run Economic Consequences of Pandemics. *NBER Working Paper No. 26934*. DOI: 10.3386/w26934

Kahn, L.B., Lange, F., and Wiczer, D.G. (2020). *NBER Working Paper* No. 27061. DOI: 10.3386/w27061

Klok, F.A., Kruip, M.J.H.A., van der Meer, N.J.M., Arbous, M.S., Gommers, D.A.M.P.J., Kant, K.M., Kaptein, F.H.J., Paassen, J.v., Stals, M.A.M., Huisman, M.V., Endeman, H. (2020). Incidence of Thrombotic Complications in Critically ill ICU Patients with COVID-19. *Thrombosis Research,* 191, 145-147. DOI:10.1016/j.thromres.2020.04.013

Korolev, I. (2020, Apr 20). Identification and Estimation of the Seird Epidemic Model for COVID-19*. SSRN Working paper.* Retrieved from https://ssrn.com/abstract=3569367 or http://dx.doi.org/10.2139/ssrn.3569367

Krueger, D., Uhlig, H., and Xie, T. (2020). Macroeconomic Dynamics and Reallocation in an Epidemic. *NBER Working Paper* No. 27047. DOI:10.3386/w27047

Kuchler, T., Russel, D., and Stroebel, J. (2020). The Geographic Spread of COVID-19 Correlates with Structure of Social Networks as Measured by Facebook. *NBER Working Paper* 26990. DOI: 10.3386/w26990

Lai, C.-C., Shih, T.-P., Ko, W.-C., Tang, H.-J., and Hsueh, P.-R. (2020). Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and Coronavirus Disease-2019 (COVID-19): The Epidemic and the Challenges. International Journal of Antimicrobial Agents, 55(3). DOI:10.1016/j.ijantimicag.2020.105924

Lauer, S.A., Grantz, K.H., Bi, Q., Jones, F.K., Zheng, Q., Meredith, H.R., Azman, A.S., Reich, N.G., and Lessler, J. (2020). The Incubation Period of Coronavirus Disease 2019 (COVID-19) From Publicly Reported Confirmed Cases: Estimation and Application. DOI:10.7326/M20-0504

Li, R., Pei, S., Chen, B., Song, Y., Zhang, T., Yang, W. and Shaman, J. (2020). Substantial Undocumented Infection Facilitates the Rapid Dissemination of Novel Coronavirus (Sarscov2). Science.

Li, B., Yang, J., Zhao, F., Zhi, L., Wang, X., Liu, L., Bi, Z., and Zhao, Y. (2020). Prevalence and Impact of Cardiovascular Metabolic Diseases on COVID-19 in China. *Clinical Research in Cardiology,* 109, 531–538. DOI:10.1007/s00392-020-01626-9

Lin, P.Z., and Meissner, C.M. (2020). A Note on Long-Run Persistence of Public Health Outcomes in Pandemics. *NBER Working Paper* 27119. DOI:10.3386/w27119

Liu, Z., Magal, P., Seydi, O., and Webb, G. (2020a). Predicting the Cumulative Number of Cases for the Covid-19 Epidemic in China from Early Data. arXiv preprint arXiv:2002.12298 .

Liu, Z., Magal, P., Seydi, O., and Webb, G. (2020b). Understanding Unreported Cases in the Covid-19 Epidemic Outbreak in Wuhan, China, and the Importance of Major Public Health Interventions. *Biology*, 9(3), 50.

Liu, Y., Yan, L.-M., Wan, L., Xiang, T.-X., Le, A., Liu, J.-M., Peiris, M., Poon, L.L., and Zhang, W. (2020). Viral Dynamics in Mild and Severe Cases of COVID-19. *The Lancet Infectious Diseases*. 20(6), 656-657. DOI:10.1016/S1473-3099(20)30232-2

Livingston, E. and Bucher, K. (2020). Coronavirus Disease 2019 (COVID-19) in Italy. *JAMA,* 323(14), 1335. DOI:10.1001/jama.2020.4344

Loayza, N.V., and Pennings, S. (2020). Macroeconomic Policy in the Time of COVID-19:A Primer for Developing Countries. *Research and Policy Briefs No.28. World Bank, Washington, DC.* © World Bank. https://openknowledge.worldbank.org/handle/10986/33540

Ludvigson, S.C., Ma, S., and Ng, S. (2020). Covid19 and the Macroeconomic Effects of Costly Disasters. *NBER Working Paper* No. 26987. DOI:10.3386/w26987

Manski, C.F., and Molinari, F. (2020). Estimating the COVID-19 Infection Rate: Anatomy of an Inference Problem. *NBER Working Paper* 27023. DOI: 10.3386/w27023

Mehta, P., McAuley, D. F., Brown, M., Sanchez, E., Tattersall, R. S., Manson, J. J., and HLH Across Speciality Collaboration, UK (2020). COVID-19: consider cytokine storm syndromes and immunosuppression. *The Lancet*, 395(10229), 1033–1034. DOI:10.1016/S0140-6736(20)30628-0

Mizumoto, K., Kagaya, K., Zarebski, A., and Chowell, G. (2020). Estimating the Asymptomatic Proportion of Coronavirus Disease 2019 (COVID-19) Cases on Board the Diamond Princess Cruise Ship, Yokohama, Japan, 2020 . *Euro Surveill.* 25(10): pii=2000180. DOI:10.2807/1560-7917.ES.2020.25.10.2000180

Mongey, S., Pilossoph, L. and Weinberg, A. (2020). Which Workers Bear the Burden of Social Distancing Policies? *NBER Working Paper* No. 27085. DOI: 10.3386/w27085

Montenovo, L., Jiang, X., Rojas, F.L., Schmutte, I.M., Simon, K.I., Weinberg,, B.A., and Wing, C. (2020). Determinants of Disparities in Covid-19 Job Losses. *NBER Working Paper* No. 27132. DOI: 10.3386/w27132

Musetti, A., Maluquer, C., Albasanz-Puig, A., Gudiol, C., Moreno-Gonzalez, G., Corradini, P. and Sureda, A. (2020). Handling the COVID-19 Pandemic in the Oncological Setting. *The Lancet Haematology*, 7(5), 365-366. DOI:10.1016/S2352-3026(20)30108-3

Nishiura, H., Kobayashi, T., Miyama, T., Suzuki, A., Jung, S., Hayashi, K., Kinoshita, R., Yang, Y., Yuan, B., Akhmetzhanov, A.R., et al. (2020). Estimation of the Asymptomatic Ratio of Novel Coronavirus Infections (Covid-19). medRxiv.

Nishiura, H., Linton, N.M., and Akhmetzhanova, A.R. (2020). Serial Interval of Novel Coronavirus (COVID-19) Infections. *International Journal of Infectious Diseases,* 93, 284-286. DOI:10.1016/j.ijid.2020.02.060

Onder, G., Rezza, G., and Brusaferro, S. (2020). Case-Fatality Rate and Characteristics of Patients Dying in Relation to COVID-19 in Italy. *JAMA,* 323(18), 1775-1776. DOI:10.1001/jama.2020.4683

Ozili, P.K., and Arun, T.G. (2020). Spillover of COVID-19: Impact on the Global Economy. *SSRN Electronic Journal*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3562570

Pan, F., Ye, T., Sun, P., Gui, S., Liang, B., Li, L., Zheng, D., Wang, J., Hesketh, R.L., Yang, L., and Zheng, C. (2020). Time Course of Lung Changes at Chest CT during Recovery from Coronavirus Disease 2019 (COVID-19). DOI:10.1148/radiol.2020200370

Pesaran, M.H., Shin, Y., and Smith, R.J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics*, 16(3), 289-326.

Peto, J. (2020). Covid-19 Mass Testing Facilities Could End the Epidemic Rapidly. *BMJ 2*020; 368. DOI:10.1136/bmj.m1163

Pindyck, R.S. (2020). COVID-19 and the Welfare Effects of Reducing Contagion. *NBER Working Paper* No. 27121. DOI: 10.3386/w27121

Poyiadji, N., Shahin, G., Noujaim, D., Stone, M., Patel, S. and Griffith, B. (2020). COVID-19–Associated Acute Hemorrhagic Necrotizing Encephalopathy: CT and MRI Features. DOI:10.1148/radiol.2020201187

Qin, C., Zhou, L., Hu, Z., Zhang, S., Yang, S., Tao, Y., Xie, C., Ma, K., Shang, K., Wang, W., and Tian, D.-S. (2020). Dysregulation of Immune Response in Patients With Coronavirus 2019 (COVID-19) in Wuhan, China. *Clinical Infectious Diseases,* ciaa248. DOI:10.1093/cid/ciaa248

Remuzzi, A. and Remuzzi, G. (2020). COVID-19 and Italy: What Next*? The Lancet,* 395 (10231), 1225-1228. DOI:10.1016/S0140-6736(20)30627-9

Richardson, S., Hirsch, J.S., Narasimhan, M., et al. (2020). Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With COVID-19 in the New York City Area. *JAMA,* 2020, 323(20), 2052-2059. DOI:10.1001/jama.2020.6775

Rojas, F.L., Jiang, X., Montenovo, L., Simon, K.I., Weinberg, B.A., and Wing, C. (2020). Is the Cure Worse than the Problem Itself? Immediate Labor Market Effects of COVID-19 Case Rates and School Closures in the U.S. *NBER Working Paper* No. 27127. DOI:10.3386/w27127

Rothan, H.A. and Byrareddy, S.N. (2020). The Epidemiology and Pathogenesis of Coronavirus Disease (COVID-19) Outbreak. *Journal of Autoimmunity,* 109, DOI:10.1016/j.jaut.2020.102433

Ruan, Q., Yang, K., Wang, W., Jiang, L., and Song, J. (2020). Clinical Predictors of Mortality Due to COVID-19 Based on an Analysis of Data of 150 Patients from Wuhan, China*. Intensive Care Med,* 46, 846–848. DOI:10.1007/s00134-020-05991-x

Sanders, J.M., Monogue, M.L., Jodlowski, T.Z., and Cutrell, J.B. (2020). Pharmacologic Treatments for Coronavirus Disease 2019 (COVID-19). *JAMA,* 323(18), 1824-1836. DOI:10.1001/jama.2020.6019

Shen, C., Wang, Z., Zhao, F., Yang, Y., Li, J., Yuan, J., Wang, F., Li, D., Yang, M., Xing, L., Wei, J., Xiao, H., Yang, Y., Qu, J., Qing, L., Chen, L., Xu, Z., Peng, L., Li, Y., Zheng, H., Chen, F., Huang, K., Jiang, Y., Liu, D., Zhang, Z., Liu, Y., and Liu, L. (2020). Treatment of 5 Critically Ill Patients With COVID-19 With Convalescent Plasma. *JAMA,* (16)323, 1582-1589. DOI:10,1001 / jama.2020.4783

Shi, H., Han, X., Jiang, N., Cao, Y., Alwalid, O., Gu, J. Fan, Y., Zheng, C. (2020). Radiological Findings from 81 Patients with COVID-19 Pneumonia in Wuhan, China: a Descriptive Study. *The Lancet Infectious Diseases,* 20(4), 425-434. DOI:10.1016/S1473-3099(20)30086-4

Shi, S., Qin, M., Shen, B., Cai, Y., Liu, T., Yang, F., Gong, W., Liu, X., Liang, J., Zhao, Q., Huang, H., Yang, B., and Huang, C. (2020, Mar 25). Association of Cardiac Injury With Mortality in Hospitalized Patients With COVID-19 in Wuhan, China. *JAMA Cardiol*. DOI:10.1001/jamacardio.2020.0950

Singhal, T. (2020). A Review of Coronavirus Disease-2019 (COVID-19). *The Indian Journal of Pediatrics,* 87, 281–286. Retrieved from https://link.springer.com/article/10.1007/s12098-020-03263-6

Sohrabi, C., Alsafi, Z., O'Neill, N., Khan, M. Kerwan, A., Al-Jabir, A., Losifidis, C., and Agha, R. (2020). World Health Organization Declares Global Emergency: A review of the 2019 Novel Coronavirus (COVID-19). *International Journal of Surgery,* 76, 71-76. DOI:10.1016/j.ijsu.2020.02.034

Stock, J. (2020). Data Gaps and the Policy Response to the Novel Coronavirus. *NBER Working Paper* No. 26902. DOI:10.3386/w26902

Surico, P., and Galeotti, A. (2020). The Economics of a Pandemic: The Case of Covid-19. Retrieved from https://icsb.org/wp-content/uploads/2020/03/LBS_Covid19_final.pdf.pdf.pdf.pdf-1.pdf.pdf

Tian, S., Hu, N., Lou, J., Chen, K., Kang, X., Xiang, Z., Chen, H., Wang, D. Liu, N., Liu, D. Cheng, G. Zhang, Y., Li, D., Li, J., Lian, H., Niu, S., Zhang, L., Zhang, J. (2020). Characteristics of COVID-19 Infection in Beijing. *Journal of Infection,* 80(4), 401-406. DOI:10.1016/j.jinf.2020.02.018

T.C. Sağlık Bakanlığı, Retrieved from https://covid19.saglik.gov.tr/

Touret, F., and Lamballerie, X. (2020). Antiviral Research, 177, May 2020, 104762, DOI:10.1016/j.antiviral.2020.104762

Wang, H. and Zhang, L. (2020). Risk of COVID-19 for Patients with Cancer. *The Lancet Oncology,* 21(4), E181, 2020 DOI:10.1016/S1470-2045(20)30149-2

WHO, Retrieved from https://covid19.who.int/

WHO, HIV/AIDS, Global Health Observatory (GHO) Data, Retrieved from https://www.who.int/gho/hiv/en/

Worldometer, Distribution of Cases, Retrieved from https://www.worldometers.info/coronavirus/worldwide-graphs/#total-cases

Worldometer, Reported Cases and Deaths by Country, Territory, or Conveyance. Retrieved from https://www.worldometers.info/coronavirus/?utm_campaign=homeAdvegas1?%22%20%5Cl%22countries

Wu, J. T., Leung, K., and Leung, G.M. (2020). Nowcasting and Forecasting the Potential Domestic and International Spread of the 2019-ncov Outbreak Originating in Wuhan, China: a Modelling Study. The Lancet, 395(10225), 689–697.

Xu, X., Han, M., Li, T., Sun, W., Wang, D., Fu, B., Zhou, Y., Zheng, X., Yang, Y., Li, X., Zhang, X., Pan, A., and Wei, H. (2020). Effective Treatment of Severe COVID-19 Patients with Tocilizumab. *PNAS,* 117 (20) 10970-10975. DOI:10.1073/pnas.2005615117

Zhao, S., Lin, Q., Ran, J., Musa, S.S., Yang, G., Wang, W., Lou, Y., Gao, D., Yang, L., He, D., et al. (2020). Preliminary Estimation of the Basic Reproduction Number of Novel Coronavirus (2019-ncov) in China, from 2019 to 2020: A Data-Driven Analysis in the Early Phase of the Outbreak. *International Journal of Infectious Diseases,* 92, 214–217.

Zhonghua Liu Xing Bing Xue Za Zhi (2020). Epidemiology Working Group for NCIP Epidemic Response, *Chinese Center for Disease Control and Prevention,* 41(2), 145–151. DOI:10.3760/cma.j.issn.0254-6450.2020.02.003

Zhou, F., Yu, T., Du, R., Fan, G., Liu, Y., Liu, Z., Xiang, J., Wang, Y., Song, B., Gu, X., Guan, L., Wei, Y., Wu, X., Xu, J., Tu, S., Zhang, Y., Chen, H., and Cao, B. (2020). Clinical Course and Risk Factors for Mortality of Adult Inpatients with COVID-19 in Wuhan, China: a Retrospective Cohort Study. *The Lancet,* 395, 10229, 1054-1062. DOI:10.1016/S0140-6736(20)30566-3

Zu, Z.Y., Jiang, M.D., Xu, P.P., Chen, W., Ni, Q.Q., Lu, G.M., and Zhang, L.J. (2020). Coronavirus Disease 2019 (COVID-19): A Perspective from China. DOI:10.1148/radiol.2020200490

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

A COMPARISON OF THE CITY LIFE QUALITY INDEX FOR EUROPEAN CITIES USING THE WASPAS AND VIKOR METHODS

DOI: 10.17261/Pressacademia.2020.1217
JBEF- V.9-ISS.2-2020(4)-p.97-117

Hakan Altin
Aksaray University, Faculty of Economics and Administrative Sciences, Department of Business, Aksaray, Turkey.
hakanaltin@aksaray.edu.tr , ORCID: 0000-0002-0012-0016

Date Received: April 10, 2020 **Date Accepted:** June 9, 2020

To cite this document
Altın, H., (2020). A comparison of the city life quality index for European cities using the Waspas and Vikor methods. Journal of Business, Economics and Finance (JBEF), V.9(2), p.97-117.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2020.1217

ABSTRACT

Purpose- The main purpose of this study was to compare the results of the city life quality index using the WASPAS and VIKOR methods, two of the multi-criteria decision-making methods.
Methodology- For this, in the first stage, a decision matrix was created. In the second stage, the ranking results obtained from WASPAS and VIKOR methods were compared with each other. In the final stage, the results obtained from the methods were compared with the results of the life quality index ranking.
Findings- When the findings were examined, there was a strong positive relationship between the methods used and the values obtained. Accordingly, there was a positive relationship between the WASPAS and VIKOR methods, demonstrating that the two methods can be used interchangeably. The same strong relationship was also valid for the life quality index.
Conclusion- Accordingly, the life quality index calculations and the WASPAS and VIKOR calculations provided very similar results. The results were found to be statistically significant**.**

Keywords: Multicriteria decision-making (MCDM), WASPAS, VIKOR, lambda, sensitivity analysis.
JEL Codes: C00, C02, G11

1. INTRODUCTION

Multi-criteria decision-making (MCDM) methods and their success in evaluating different alternatives in terms of various criteria for the possible selection of the optimal alternative have become increasingly important in analyzing and solving complex problems based on real life. MCDM methods eliminate measurement problems such as the existence of different measurement units and different alternatives between the criteria under the presence of more than one immeasurable and contradictory criteria. MCDM methods primarily aim to evaluate and rank the available alternatives. In this way, decision making problems can be solved with various MCDM methods.

Decision-making is an inherent process, whether complex or simple. Many of the complex real-life problems involve conflicting and multi-criteria processes. Procedures for determining the optimal solution for an MCDM problem include calculating the benefits of alternatives and listing these benefits. The solution alternative with the greatest benefit is considered the most suitable solution. Due to the complex nature of the problem and the contradictory nature of the criteria, a solution for a problem that provides a compromise helps the decision maker reach a final decision. An MCDM problem is expressed using a decision matrix.

The main purpose of the study is to compare the results of the city life quality index using the WASPAS and VIKOR methods, two of the multi-criteria decision-making methods. For this purpose, in the first stage, a decision matrix was created. In the second

stage, the ranking results obtained from WASPAS and VIKOR methods were compared with each other. In the final stage, the results obtained from the methods were compared with the results of the life quality index ranking.

2. LITERATURE

The literature review consists of two parts. First, the Waspas Method. The second is the Vikor method.

2.1. The WASPAS Method

Chakraborty and Zavadskas (2014) examined decision-making problem in the manufacturing process. To survive in today's global competitive environment, it is now imperative for manufacturing organizations to make quick and accurate decisions regarding the efficient use of scarce resources. There are several multi-criteria decision-making (MCDM) methods to help these organizations choose the optimal path for decisive action. The Weighted Aggregated Sum Product Assessment or the WASPAS method was used as an effective MCDM tool in the study. It is observed that this method has the capacity to rank alternatives correctly in all the selection issues considered. In addition, the effect of the lambda (λ) parameter on the ranking performance of the WASPAS method was examined for the effectiveness of the method and the accuracy of the ranking. Accordingly, they found that a better performance was obtained at higher lambda values.

Zavadskas et al. (2014) evaluated the WASPAS method in his study. Different methods were proposed within the framework of the utility theory for multi-criteria decision-making. Among the proposed methods, the weighted sum and the weighted product models (WSM and WPM) are well known and widely used. The WASPAS method has been proposed to increase the accuracy of the WSM and the WPM. In the proposed WASPAS-IVIF method, they expressed uncertainty about determining the evaluations of decision-makers regarding alternative performance according to the importance of the criteria and/or criteria with intuitionistic fuzzy interval numbers. Thus, they combined the strength of IVIF in handling uncertainty with the improved accuracy of WASPAS, making it a method that can be used in real-world applications.

Madić et al. (2014) discussed the process of machining in manufacturing. Choosing the most suitable machining process for a specific machining application is difficult, requiring consideration of a number of technological and economic criteria. Therefore, the process is considered a multi-criteria decision-making (MCDM) method. Using the recently developed WASPAS method, the study focused on a multi-criteria economic analysis of various machining processes. A binary comparison matrix was applied to determine the relative importance of the criteria considered. In addition, the effect of the λ parameter on the ranking performance of the WASPAS method was examined for the effectiveness of the method and the accuracy of the ranking. The choice of a specific machining process is a crucial task in the manufacturing environment, and this task can be accomplished with the WASPAS method.

In their study, Chakraborty et al. (2015) investigated the applicability and usefulness of the WASPAS method as a decision-making tool in five cases, finding that the rankings obtained with the WASPAS method closely match those obtained by past researchers for all problems. The most appropriate λ values were calculated for each problem evaluated. Then, the ranking performance of the WASPAS method was examined according to the changing λ values. The accuracy of the WASPAS method, which will help its widespread application as an effective MCDM tool, was proven. Since the WASPAS method is, by its nature, based on simple and powerful mathematics, it can be successfully applied to any decision-making problem.

Zavadskas et al. (2015a) attempted to verify the applicability and effectiveness of the WASPAS method in solving five non-traditional machining (NTM) selection problems. They found that the WASPAS method was able to optimally solve both single response and multi-response optimization problems of NTM operations. The main advantage of the WASPAS method is that it can define the optimal parametric combination of the NTM process. Determining the optimal values of λ further increases the accuracy and effectiveness of this method in the decision-making process. It was proven that WASPAS can be used as a simple and robust optimization tool.

Zavadskas et al. (2015b) conducted environmental sustainability assessment in their study. In recent years, sustainability principles have gained importance in all areas of life. Since the household and construction wastes of manufactured products cannot be easily removed, they are one of the biggest problems for urban areas. This issue has increased the demand for system technologies for the life cycle of wastes and the development of proper disposal methods. The construction of a waste incinerator is a complex process that includes all factors of the principles of sustainability. Multi-criteria decision-making methods (MCDM) offer powerful and flexible techniques for solving many sustainability problems. In the study, WASPAS-SVNS, a new extension of the WASPAS

method, was proposed, a method that can solve the location problem for waste incineration plants due to the requirements of sustainability factors.

Ghorabaee, et al. (2016) examined the environmental performance of suppliers which. affects the overall environmental performance of the supply chain. Therefore, the selection of green suppliers is a strategic decision-making problem for gaining a competitive edge. The green supplier selection problem is often considered an MCDM issue. In this study, an extended WASPAS method for the solution of the problem was proposed. In the proposed approach, some changes were made in the classical normalization and WPM measurement process, and the results demonstrated that the proposed approach had good efficiency and stability.

Karabašević et al. (2016) examined the topic of personnel selection. Human resources management generally involves different activities that have an impact on improving the efficiency and effectiveness of the employees' performance and work and in directing employees to achieve company goals. Finding and employing qualified personnel is especially important in ensuring the adequate human potential of the management of human resources. They suggested that the proposed SWARA-WASPAS approaches were adaptable, applicable, and easy to use for personnel selection. Furthermore, with some modifications, the SWARA-WASPAS approach could be used in other areas.

Urosevic et al. (2017) examined the issue of personnel selection in the tourism industry based on the SWARA and WASPAS methods. Tourism is one of the leading economic sectors in the world and represents a major source of employment, and employees are one of the industry's most important strategic resources. In today's business conditions, the highest level of competence has become an important factor in an organization achieving success and competitiveness in the market. From the numerical example used, it could be concluded that the proposed SWARA WASPAS approaches were adaptable and easily applicable and could be used to solve problems of personnel selection. In addition, the proposed approach could be used to solve problems in other areas.

Keshavarz et al. (2017) examined the evaluation of third-party logistics (3PL) providers, an important issue for businesses that try to reduce their capital expenditure and logistics costs as well as to improve operational efficiency and customer service. In the study evaluating a suitable 3PL provider, a new integrated approach based on CRITIC and WASPAS method was proposed, and the results proved the reliability and effectiveness of the ranking results.

In their study, Stanujkić, and Karabašević (2018) proposed a new method based on the use of intuited fuzzy numbers to ensure that the WASPAS method could be used to solve many more decision-making problems. The effectiveness and usability of the proposed approach were discussed using the example of a website assessment. Websites play a crucial role in modern companies. Based on the numerical example used in the study, the WASPAS method proved to be highly effective and feasible for website assessment.

Deveci, et al. (2018) proposed a WASPAS- and TOPSIS-based method for the selection of a car sharing station. Car sharing is an important element of the increasingly common sharing economy in the world. For this reason, companies operating in the industry want to increase their capacity and market share by adding new vehicle sharing stations. The proposed method involved a case study that determined the best location for a new car-sharing station among four alternatives, and the method was reported to be a more accurate decision-making tool for problems with a high level of uncertainty.

Stojić et al. (2018) examined the issue of supplier selection. The decision-making process requires certain factors to be pre-defined and implemented, especially when it comes to complex areas such as supply chain management. The most important issue that determines the subsequent flow of the supply chain is choosing the most suitable supplier. In the study, the relative values of the weight coefficients of the criteria were calculated using the AHP method. Then, the evaluation and ranking of the suppliers were carried out using the WASPAS method. The results were compared with different multi-criteria decision-making methods. The proposed model allowed the evaluation of alternatives despite the lack of quantitative or precise information in the information management process.

2.2. VIKOR

Opricovic and Tzeng (2004) conducted a comparative analysis of VIKOR and TOPSIS in their study. The MCDM methods of VIKOR and TOPSIS are both based on an aggregate function that represents proximity to ideal. The VIKOR method presents the ranking index based on the measure of proximity to the ideal solution. The TOPSIS method uses two reference points but does not take

into account the relative importance of distances from these points. While the VIKOR method uses linear normalization, the TOPSIS method uses vector normalization. The normalized value in the VIKOR method does not depend on the evaluation unit of a criterion function. Comparative analysis showed that these two methods used different normalizations and offered different aggregate functions for ranking.

Tong et al. (2007) investigated the optimization of multiple response processes in their study. Taguchi Methods, mostly used in engineering, are experimental methods used in industry to increase quality. These methods were developed to optimize single-reaction processes. In many cases, multiple responses need to be optimized simultaneously because some product designs, especially in the integrated circuit industry, are becoming increasingly complex to meet customers' demands. Although several procedures have been developed in recent years to optimize multiple response processes, the quality measurement indices do not take into consideration the differences in losses in the relative quality of the multiple responses. When multiple responses are considered, engineers often optimize based on their subjective experience. In this study, a systematic procedure was developed to apply VIKOR, a MCDM compromise ranking method, to optimize the multiple response process. The method can be used in multiple response processes.

Datta et al. (2010) used the concept of utility and the VIKOR method for supplier selection in their study. The results were compared with the gray relation technique. The results of the techniques used were very compatible with each other. The estimated supplier selection of the gray relation theory exactly matched the forecast of the VIKOR method. However, the result of the concept of utility was slightly different from the results of other techniques. However, all techniques provided reliable information for choosing the optimal outcome. The study displays the effectiveness of these MCDM techniques in solving such a vendor selection problem.

Devi (2011) used an expanded VIKOR method to solve a robot-selection problem. Decision making is the process of finding the optimal option among feasible alternatives. In classical multi-criteria decision-making methods, the ratings and weights of the criteria are fully known. VIKOR is a useful method for MCDM problems, especially when the decision maker cannot express or know his/her preferences at the beginning of the system design. The resulting compromise solution is acceptable to decision makers because compromise provides maximum group utility and minimum individual regret levels. The compromise solution here was a viable solution closest to the ideal solution, compromise referring to an agreement created with mutual privileges.

Bazzazi, et al. (2011) applied the modified VIKOR method in his study. In a highly qualified decision-making problem, a decision maker needs to choose the optimal alternative that meets the evaluation criteria among a range of solutions. It is often difficult to find an alternative that meets all the criteria at the same time, so a good compromise solution is preferred. The VIKOR method was developed for multi-criteria optimization of complex systems. This method focuses on ranking and selecting a number of alternatives in the presence of conflicting criteria. It offers a multi-criterion ranking index based on the measure of proximity to the ideal solution. The study provided an assessment model based on deterministic data to deal with the subjective perceptions of people in their decision processes and the uncertainty in their experiences.

Liu and Wu (2012) examined the competency assessment process of human resources with the VIKOR method. While the importance levels of the criteria were determined by the entropy method, they evaluated the issues of the ideal solution and the negative ideal solution produced by VIKOR. For the purpose of the assessment, they calculated a ratio value for each evaluation object and then listed them. They demonstrated the evaluation procedures and validity of the model. In addition, they developed different evaluation index systems for different personnel for positions such as production personnel, technical personnel, and management personnel.

Ju and Wang (2013) proposed a new method based on the traditional VIKOR method idea to solve multi-criteria group decision-making problems. Due to time pressure, lack of information or data, and the limited expertise of decision makers in the problem area, the criteria values and weights given by decision makers often vary. The method has the feature of preventing data corruption and loss that had previously occurred in information processing. It has a feature that can be used to solve engineering and management problems, and to make the optimal decision in all other areas, and a compromise solution can also be obtained. The VIKOR method is simple and easy to perform.

Rezaie et al. (2014) examined the performance of companies operating in the cement industry. In today's competitive environment, a firm's performance assessment and comparison with other companies provide important information to all stakeholders and companies so as to achieve their investment goals. In the study, an approach based on FAHP and VIKOR methods

was presented. In its initial phase, the FAHP method was used to determine the weight of the criteria that directed the subjective decisions by the decision makers. Then, the VIKOR method was used to rank companies, a method that can evaluate the operation of a company and detect its competitiveness and weakness.

Opricovic, (2016) conducted a comparative analysis of the DEA-CCR model and the VIKOR method. The DEA model helps to determine the weights needed to maximize the efficiency of decision-making units. The basis of the DEA model is the evaluation of alternative decision-making units in terms of their efficiency in converting inputs into outputs. The multi-criteria decision-making method VIKOR uses a common set of weights that express the decision maker's preferences. In contrast, the CCA model of DEA does not do that. The weights used in the VIKOR method do not have an evident economic significance, but their use provides an opportunity to model real aspects of decision making, such as the structure of choice. When DEA and VIKOR were compared, it was observed that DEA was similar to VIKOR, but the results were different.

Zhang and Xing (2017) used the probabilistic VIKOR method to evaluate green supply chain initiatives in their study. To achieve sustainable economic and environmental protection goals, more and more companies are planning to implement green supply chain (GSC) initiatives in their products. Adoption of GSC initiatives also affects the operational performance of companies. Therefore, firms must carefully evaluate their performance when implementing GSC initiatives. To make such an assessment, they have developed a new probabilistic VIKOR approach in which various probabilistic values such as a probabilistic group utility measurement, a probabilistic individual regret measurement, and a probabilistic compromise measurement are calculated. The applied method provides a compromise solution based on these three measures.

3. RESEARCH OBJECTIVE AND SCOPE

The main purpose of this study was to compare the results of the city life quality index with the WASPAS and VIKOR methods. The quality of life index, in which a high score is desirable, is an estimate of the overall quality of life that takes into account the issues of the purchasing power index, in which a high score is desirable, the pollution index (low is desirable), the property price to income ratio (low is desirable), the cost of living index (low is desirable), the safety index (high is desirable), the health care index (high is desirable), the traffic commute time index (low is desirable), and the climate index (high is desirable). The WASPAS and VIKOR methods were used to determine the optimal solution for multi-criteria decision-making problems. The CRITIC and ENTROPY methods were used as objective weighting techniques in determining the importance of the criteria. These two techniques provided remarkably similar results to each other. In addition, weights did not have an evident significance, and the benchmark values and the weights were often varied. Therefore, the significance degrees (weights) of the criteria were calculated as 16.67%.

A decision matrix was created in the first stage of the multi-criteria decision-making methods. The 86 x 6 decision matrix consists of 86 alternatives and six criteria. The criteria in the objective function were designated as C1, purchasing power index (max); C2, safety index (max); C3, health care index (max); C4, cost of living index (min); C5, traffic commute time index (min); and C6, pollution index (min). The data used in this study were gathered from the Numbeo website.

4. DATA AND METHODOLOGY

Mathematical forms are given for the methods used in this section.

4.1. Weighted Aggregated Sum Product Assessment Product Method (WASPAS)

Chakraborty et al. (2015, pp.3-5) and Zavadskas et al. (2015, pp.78-79) were utilized for the mathematical form of the model.

The WASPAS method is a combination of the two well-known multi-criteria decision-making methods, the weighted sum model (WSM) and the weighted product model (WPM). Its implementation first begins with the development of a decision (evaluation) matrix.

$$X = \left[x_{ij} \right]_{m \times n}$$

Here, xij is the performance of the alternative i according to the criterion j. M indicates the number of alternatives, and n indicates the number of criteria. To make performance measurements comparable and dimensionless, all elements in the decision matrix were normalized using the following two equations:

$$\bar{x}_{ij} = \frac{x_{ij}}{\max_i x_{ij}} \text{ for beneficial criteria} \quad (1)$$

$$\bar{x}_{ij} = \frac{\min_i x_{ij}}{x_{ij}} \text{ for non-beneficial criteria,} \quad (2)$$

Here, the overlined xij is the normalized value of xij.

In the WASPAS method, a common optimism criterion is sought based on the dual optimality criteria. The first criterion of optima, that is, a weighted average success criterion, is similar to the WSM method. It is a multi-criteria decision-making (MCDM) approach applied to evaluate a range of alternatives based on a range of decision criteria. According to the WSM method, the total relative importance of the first alternative is calculated as follows:

$$Q_i^{(1)} = \sum_{j=1}^{n} \bar{x}_{ij} w_j \quad (3)$$

wj, is the (relative importance) weight of the criterion j.

The total relative importance of the second alternative according to the WPM method is calculated using the following equation:

$$Q_i^{(2)} = \prod_{j=1}^{n} (\overline{x_{ij}})^{wj} \quad (4)$$

Then, the following equation is recommended for a common general criterion of the weighted aggregate of additive and multiplicative methods.

$$Q_i = 0,5Q_i^{(1)} + 0,5Q_i^{(2)} = 0,5\sum_{j=1}^{n} \bar{x}_{ij} w_j + 0,5\prod_{j=1}^{n} (\overline{x_{ij}})^{wj} \quad (5)$$

In the WASPAS method, to increase the ranking accuracy and effectiveness of the decision-making process, a more general equation is given to determine the total relative importance of the alternative as follows:

$$Q_i = \lambda Q_i^{(1)} + (1-\lambda) Q_i^{(2)} = \lambda \sum_{j=1}^{n} \bar{x}_{ij} w_j + (1-\lambda) \prod_{j=1}^{n} (\overline{x_{ij}})^{wj}, \ \lambda = 0, 0.1, ..., 1 \quad (6)$$

Applicable alternatives are now ranked according the Q values, and the best alternative has the highest Q value. Equation 6 becomes the WSM method when the λ value is 0 while the WASPAS method converts to WPM and λ is 1. It was applied to solve MCDM problems with increased ranking accuracy, having the ability to achieve the highest prediction accuracy.

For a particular decision-making problem, the following formula was used to determine the optimal values of λ when searching for the most extreme function.

$$\lambda = \frac{\sigma^2(Q_i^{(2)})}{\sigma^2(Q_i^{(1)}) + \sigma^2(Q_i^{(2)})} \quad (7)$$

Variances can be estimated by using the equations below:

$$\sigma^2(Q_i^{(1)}) = \sum_{j=1}^{n} w_j^2 \sigma^2(\overline{x_{ij}}) \quad (8)$$

$$\sigma^2(Q_i^{(2)}) = \sum_{j=1}^{n} \left[\frac{\prod_{j=1}^{n} (\overline{x_{ij}})^{wj} w_j}{(\overline{x_{ij}})^{wj} (\overline{\overline{x_{ij}}})^{(1-wj)}} \right] \sigma^2(\overline{x_{ij}}) \quad (9)$$

Variance estimations of the normalized first criterion values are calculated as follows:

$$\sigma^2(\overline{x_{ij}}) = (0.05\overline{x}_{ij})^2 \quad (10)$$

4.2. Multi-criteria Optimization and Compromise Solution Method (VIKOR)

The studies by Ju and Wang (2013, pp.3115-3116) and Tong, et al. (2007, pp. 1051-1052) were used for the mathematical form of the model. The basic approach of the VIKOR method is to identify positive and negative ideal points, and the VIKOR method is based on the idea of compromise.

A1, A2, … Am show various alternatives, and C1, C2, … Cn show all alternatives. For an alternative Ai, fij is the value of the jth criterion Cj. The compromise ranking algorithm is as follows. Here, the best f*j and the worst f-j values of all criteria are determined, assuming that the criterion j represents a utility:

$$f_j^+ = \max_{1 \le i \le m} f_{ij}, \; j = 1, 2, ..., n,$$

$$f_j^- = \min_{1 \le i \le m} f_{ij}, \; j = 1, 2, ..., n.$$

The (Si) utility criterion and the (Ri) regret criterion are estimated using the equations (11) and (12):

$$S_i = \sum_{j=1}^{n} \left[w_j (f_j^+ - f_i^{\,j}) / (f_j^+ - f_j^-) \right], \; i = 1, 2, ..., m, \quad (11)$$

$$R_i = \max_{1 \le j \le n} \left[w_j (f_j^+ - f_{ij}) / f_j^+ - f_j^-) \right], \; i = 1, 2, ..., m, \quad (12)$$

where $w_j (j = 1, 2, ..., n)$

These are the criteria weights representing the decision maker's relative preference for the importance of the criteria. The values for ranking alternatives (Qi) are calculated using Equation 3,

$$Q_i = v(S_i - S^*) / (S^- - S^*) + (1 - v)(R_i - R^*) / (R^- - R^*), \; i = 1, 2, ..., m, \quad (13)$$

Here, the letter v is a weight reference and

$$S^* = \min_{1 \le i \le m} S_i,$$

$$S^{-} = \max_{1 \le i \le m} S_i,$$

$$R^{*} = \min_{1 \le i \le m} R_i,$$

$$R^{-} = \max_{1 \le i \le m} R_i .$$

While v is provided as the weight of the maximum group utilization strategy, (1-v) is the weight of individual regret. So, when v is greater (v> 0.5), the Qi index tends to follow the rule of the majority.

Alternatives are ranked in ascending order according to the S, R, and Q values. The results show three ranking lists.

If the following two conditions are met, a compromise solution can be proposed with the optimal alternative (A(1)) according to the (minimum) measure Q. Thus,

Con_1 = acceptable advantage:

$$Q(A^{(2)}) - Q(A^{(1)}) \ge DQ, \quad (14)$$

Here (A(2)), is the second-ranked alternative in the ranking list by Q,

$$DQ = 1/(n-1)$$

and n is the number of alternatives.

Con_2 = acceptable stability in decision making:

Also, the alternative (A(1)) should be optimally ranked by S and/or R.

This compromise solution is evaluated in a decision-making process, which can be the maximum group utilization strategy. Compromise is achieved as "majority vote" v> 0.5 or "consensus" v ≈ 0.5 or "veto" v <0.5. Here v is the weight of the maximum group utility decision-making strategy.

If one of the conditions is not met, for example, when condition 2 is not met, a set of compromise solutions consisting of its alternatives or any other alternatives is recommended, such as: (A(1)), (A(2)), …, (A(M)). The alternatives (A (1)) and (A(2)) are included in the compromised common solution. If condition 1 is not provided, all alternatives are included in the optimal solution set. The upper limit M is determined by the equation

$Q(A^{(M)}) - Q(A^{(1)}) < DQ$ The positions of the alternatives are close to each other.

5. FINDINGS AND DISCUSSIONS[1]

The solutions of the methods used in this section are included.

5.1. WASPAS Solution

In the first stage of the WASPAS method, the decision matrix was created. The decision matrix is shown in Appendix 1 and is an 86 x 6 matrix consisting of 86 alternatives and 6 criteria. In the second stage, the normalized decision matrix line (Xij) was obtained. For this reason, it was used by utilizing Equations 1 and 2. In the third stage, the WSM, a weighted average success criterion was calculated. Accordingly, Equation 3 was used. In the fourth stage, the total relative importance of the alternative was calculated according to the WPM method. Accordingly, Equation 4 was used. In the fifth stage, the common general criterion of the weighted

[1] There are ranked matrix operations on the basis of multi-criteria decision-making methods. The matrix used in the study is an 86 x 6 matrix. Since the matrices obtained from the application take up much space in the study, some of the matrices are included in the appendix section. Also, solution matrices are shortened in the solution section.

aggregate of additive and multiplicative methods was calculated. For this purpose, Equation 5 was used. The QW values obtained showed the values to be used in the ranking of success. In the final stage, a more general equation could be used to determine the total relative importance of the alternative, Equation 6. However, the fact that the alternatives in the decision matrix used consisted of time series data made it unnecessary to use this equation. Weighted common general criteria and ranking values are presented in Table 1.

Table 1: Ranking Values Selected According to WASPAS Method (QW)

City	QW	Rank
Paris, France	1.77	1
Antwerp, Belgium	1.74	2
London, United Kingdom	1.74	3
Brussels, Belgium	1.69	4
Milan, Italy	1.69	5
Rome, Italy	1.65	6
Manchester, United Kingdom	1.62	7
Zurich, Switzerland	1.61	8
Bucharest, Romania	1.61	9
Turin, Italy	1.60	10
Geneva, Switzerland	1.59	11
Barcelona, Spain	1.57	12
Tirana, Albania	1.57	13
Madrid, Spain	1.57	14
Lyon, France	1.57	15

5.1.1 WASPAS Lambda (λ) Value

The effect of the lambda (λ) parameter on the ranking performance of the WASPAS method was examined. The determination of (λ) values further increased the accuracy and effectiveness of this method in the decision-making process. The value (λ) ranged from 0 to 1. Accordingly, higher performance results were obtained at higher (λ) values. In the study, (λ) value was estimated by using the standard deviation and variance values of Q1, and Q2. (λ) was found to be 0.71.

$$\lambda = \frac{0,13^2}{0,21^2 + 0,13^2} = 0,71$$

5.2. VIKOR Solution

In the first stage, the decision matrix is created. In the second stage, the normalized decision matrix is calculated. In the third stage, the weighted normalized decision matrix is calculated. In the fourth stage, Si and Ri values are calculated. For this purpose, Equations 11 and 12 are used. In the final stage, the QV ranking value is estimated. For this purpose, Equation 13 is used. The QV ranking values are displayed in Table 2.

Table 2: Ranking Values (QV) Selected According to VIKOR Method

City	QV	Rank AZ	City	QV	Rank ZA
Vienna, Austria	0.03	1	Tirana, Albania	1.00	1
Helsinki, Finland	0.06	2	Kharkiv, Ukraine	0.94	2
Munich, Germany	0.09	3	Dnipro, Ukraine	0.92	3
Düsseldorf, Germany	0.09	4	Moscow, Russia	0.90	4
Eindhoven, Netherlands	0.09	5	Odessa (Odesa), Ukraine	0.89	5
Edinburgh, UK	0.10	6	Novosibirsk, Russia	0.89	6
The Hague (Den Haag), Netherlands	0.11	7	Budapest, Hungary	0.86	7
Valencia, Spain	0.16	8	Rome, Italy	0.86	8
Rotterdam, Netherlands	0.17	9	Yekaterinburg, Russia	0.85	9
Copenhagen, Denmark	0.19	10	Skopje, North Macedonia	0.85	10
Utrecht, Netherlands	0.20	11	Kiev (Kiev), Ukraine	0.84	11
Luxembourg, Luxembourg	0.20	12	Athens, Greece	0.82	12
Cambridge, UK	0.21	13	Lodz, Poland	0.82	13
Reykjavik, Iceland	0.22	14	Belgrade Serbia	0.81	14
Tallinn, Estonia	0.22	15	Dublin, Ireland	0.81	15

5.2.1. VIKOR Condition Tests

For the accuracy of the obtained ranking, the requirements of Condition 1 and Condition 2 were examined. The results obtained with the VIKOR method were reliable because they were provided in both conditions. The respective calculations are as follows

Con_1 = acceptable advantage:

$$DQ = \frac{1}{(86-1)} = 0,01$$

$$Q(A^{(2)}) - Q(A^{(1)}) \geq DQ$$

$$0,06 - 0,03 \geq 0,01$$

Con_2 = acceptable stability in decision making:

Since it is ranked first in the Qi ranking with the smallest value and first in the Si and Ri rankings with the smallest value, it provides all the conditions.

6. SENSITIVITY ANALYSIS

The performance values estimated to carry out the sensitivity analysis were examined with the Spearman correlation approach. This relationship is presented in Table 3 where it may be seen that there is a strong positive relationship between the methods used and the values obtained. Accordingly, there is a positive relationship between WASPAS and VIKOR. This result demonstrates that the two methods can be used interchangeably. The same strong relationship is also valid for the life quality index. Accordingly,

the life quality index calculations and WASPAS and VIKOR calculations provided remarkably similar results. The results were found to be statistically significant.

Table 3: Relationship Between Performance Values

		Correlations			
			QW	**QV**	**Index**
Spearman's rho	QW	Correlation Coefficient	1.000	.999**	.841**
		Sig. (2-tailed)	.	.000	.000
		N	86	86	86
	QV	Correlation Coefficient	.999**	1.000	.842**
		Sig. (2-tailed)	.000	.	.000
		N	86	86	86
	Index	Correlation Coefficient	.841**	.842**	1.000
		Sig. (2-tailed)	.000	.000	.
		N	86	86	86
**. Correlation is significant at the 0.01 level (2-tailed).					

7. CONCLUSION

Multi-criteria decision-making (MCDM) forms the basis of modern decision science and operational research involving multiple decision alternatives. The purpose of MCDM is to find the most desired alternatives in a range of available alternatives based on the selected criteria. Generally, real-world problems are complex, and it is impossible to make the most appropriate decision considering only one criterion. Decision-making problems usually include four basic elements. These are alternatives that can be substituted for each other, assessment criteria, result matrices for alternatives, and the decision regarding the degree of importance of the criteria.

The weighted aggregated sum product assessment (WASPAS) method is a combination of the weighted sum model (WSM) and the weighted product model (WPM). It is widely accepted as an effective decision-making tool due to its mathematical simplicity and ability to provide more accurate results compared to the WSM and WPM methods. The VIKOR method focuses on ranking and selecting a number of alternatives and identifies compromise solutions to a problem. The compromise solution here is a viable solution closest to the ideal solution. Thus, the maximum group utility and the least individual regret is provided for decision makers in the VIKOR method.

As explained above, MCDM methods primarily aim to evaluate and rank available alternatives. However, there may be several situations where different MCDM methods provide distinct results. In other words, the rankings of the same alternatives may change depending on the methods adopted. This situation can be explained by the different mathematical calculations used in the considered methods.

When the findings were examined, there was a strong positive relationship between the methods used and the values obtained. Accordingly, there was a positive relationship between WASPAS and VIKOR. This result demonstrated that the two methods could be used interchangeably. The same strong relationship was also valid for the life quality index. Accordingly, the life quality index calculations, and WASPAS and VIKOR calculations provided remarkably similar results. The results were found to be statistically significant.

REFERENCES

Bazzazi, A. A., Osanloo, M., and Karimi, B. (2011). Deriving preference order of open pit mines equipment through MADM methods: Application of modified VIKOR method. Expert Systems with Applications, 38(3), 2550-2556.

Chakraborty, S., and Zavadskas, E. K. (2014). Applications of WASPAS method in manufacturing decision making. Informatica, 25(1), 1-20.

Chakraborty, S., Zavadskas, E. K., and Antucheviciene, J. (2015). Applications of WASPAS Method as a Multi-Criteria Decision-Making Tool. Economic Computation and Economic Cybernetics Studies and Research, 49(1).

Datta, S., Mahapatra, S. S., Banerjee, S., and Bandyopadhyay, A. (2010). Comparative study on application of utility concept and VIKOR method for vendor selection.

Deveci, M., Canıtez, F., and Gökaşar, I. (2018). WASPAS and TOPSIS Based Interval Type-2 Fuzzy MCDM Method for a Selection of a Car-sharing Station. Sustainable Cities and Society, 41, 777-791.

Devi, K. (2011). Extension of VIKOR method in intuitionistic fuzzy environment for robot selection. Expert Systems with Applications, 38(11), 14163-14168.

Ghorabaee, M. K., Zavadskas, E. K., Amiri, M., and Esmaeili, A. (2016). Multi-criteria evaluation of green suppliers using an extended WASPAS method with interval type-2 fuzzy sets. Journal of Cleaner Production, 137, 213-229.

Ju, Y., and Wang, A. (2013). Extension of VIKOR Method for Multi-Criteria Group Decision Making Problem with Linguistic İnformation. Applied Mathematical Modelling, 37(5), 3112-3125.

Karabašević, D., Stanujkić, D., Urošević, S., and Maksimović, M. (2016). An approach to personnel selection based on SWARA and WASPAS methods. Bizinfo (Blace) Journal of Economics, Management, and Informatics, 7(1), 1-11.

Keshavarz Ghorabaee, M., Amiri, M., Kazimieras Zavadskas, E., and Antuchevičienė, J. (2017). Assessment of third-party logistics providers using a CRITIC–WASPAS approach with interval type-2 fuzzy sets. Transport, 32(1), 66-78.

Liu, P., and Wu, X. (2012). A Competency Evaluation Method of Human Resources Managers Based on Multi-Granularity Linguistic Variables and VIKOR Method. Technological and Economic Development of Economy, 18(4), 696-710.

Madić, M., Gecevska, V., Radovanović, M., and Petković, D. (2014). Multi-criteria economic analysis of machining processes using the WASPAS method. Journal of Production Engineering, 17(2), 1-6.

Opricovic, S. (2016). A comparative analysis of the DEA-CCR model and the VIKOR method. Yugoslav Journal of Operations Research, 18(2).

Opricovic, S., and Tzeng, G. H. (2004). Compromise solution by MCDM methods: A comparative analysis of VIKOR and TOPSIS. European Journal of Operational Research, 156(2), 445-455.

Rezaie, K., Ramiyani, S. S., Nazari-Shirkouhi, S., and Badizadeh, A. (2014). Evaluating performance of Iranian cement firms using an integrated fuzzy AHP–VIKOR method. Applied Mathematical Modelling, 38(21-22), 5033-5046.

Stanujkić, D., and Karabašević, D. (2018). An extension of the WASPAS method for decision-making problems with intuitionistic fuzzy numbers: a case of website evaluation. Operational Research in Engineering Sciences: Theory and Applications, 1(1), 29-39.

Stojić, G., Stević, Ž., Antuchevičienė, J., Pamučar, D., and Vasiljević, M. (2018). A novel rough WASPAS approach for supplier selection in a company manufacturing PVC carpentry products. Information, 9(5), 121.

Tong, L. I., Chen, C. C., and Wang, C. H. (2007). Optimization of multi-response processes using the VIKOR method. The International Journal of Advanced Manufacturing Technology, 31(11-12), 1049-1057.

Urosevic, S., Karabasevic, D., Stanujkic, D., and Maksimovic, M. (2017). An Approach to Personnel Selection in the Tourism Industry Based on the SWARA and the WASPAS Methods. Economic Computation and Economic Cybernetics Studies and Research, 51(1).

Zavadskas, E. K., Antucheviciene, J., Hajiagha, S. H. R., and Hashemi, S. S. (2014). Extension of weighted aggregated sum product assessment with interval-valued intuitionistic fuzzy numbers (WASPAS-IVIF). Applied Soft Computing, 24, 1013-1021.

Zavadskas, E. K., Chakraborty, S., Bhattacharyya, O., and Antuchevciene, J. (2015b). Application of WASPAS method as an optimization tool in non-traditional machining processes. Information Technology and Control, 44(1), 77-88.

Zavadskas, E., Baušys, R., and Lazauskas, M. (2015a). Sustainable assessment of alternative sites for the construction of a waste incineration plant by applying WASPAS method with single-valued neutrosophic set. Sustainability, 7(12), 15923-15936.

Zhang, X., and Xing, X. (2017). Probabilistic linguistic VIKOR method to evaluate green supply chain initiatives. Sustainability, 9(7), 1231.

Appendix 1: Decision Matrix

Rank	City	Quality of Life Index	Purchasing Power Index	Safety Index	Health Care Index	Cost of Living Index	Traffic Commute Time Index	Pollution Index
1	Zurich, Switzerland	197.90	123.04	83.16	73.69	126.87	33.72	17.77
2	Eindhoven, Netherlands	191.09	92.82	74.64	73.04	73.02	25.76	22.24
3	The Hague (Den Haag), Netherlands	190.25	93.36	74.01	76.99	70.02	32.97	23.28
4	Copenhagen, Denmark	187.79	90.41	74.95	78.64	83.95	28.52	20.89
5	Vienna, Austria	184.55	83.75	76.10	78.85	64.64	26.85	18.38
6	Reykjavik, Iceland	183.00	75.49	77.74	66.70	85.28	20.17	15.52
7	Luxembourg, Luxembourg	182.95	102.68	71.85	73.71	81.29	33.24	22.22
8	Helsinki, Finland	182.42	88.85	77.24	77.60	71.80	31.63	12.78
9	Edinburgh, UK	179.99	82.93	68.53	81.32	67.21	29.32	26.31
10	Geneva, Switzerland	179.52	108.89	71.41	68.89	121.85	25.88	29.26
11	Belfast, UK	177.73	93.41	59.20	71.08	59.44	38.13	27.61
12	Düsseldorf, Germany	177.41	96.71	69.02	72.21	65.20	30.31	31.28
13	Munich, Germany	176.68	90.68	82.56	78.37	71.85	33.22	24.77
14	Valencia, Spain	175.32	74.93	74.50	81.71	51.30	28.00	44.14
15	Utrecht, Netherlands	174.95	80.36	71.82	74.00	76.02	31.00	30.01
16	Glasgow, UK	172.91	94.17	56.12	80.56	62.92	33.12	35.07
17	Tallinn, Estonia	172.91	66.65	77.45	71.11	52.07	26.68	21.91
18	Frankfurt, Germany	172.82	100.20	58.24	74.51	68.30	25.11	37.59
19	Cambridge, UK	172.37	75.93	78.10	73.79	70.04	33.56	32.56
20	Rotterdam, Netherlands	171.55	84.26	65.33	76.36	69.13	28.19	40.17
21	Gothenburg, Sweden	170.53	85.14	53.86	68.57	68.23	26.24	20.03
22	Amsterdam, Netherlands	169.89	83.94	67.34	69.63	78.32	29.75	31.13
23	Stuttgart, Germany	169.89	100.60	72.01	71.06	65.97	34.95	41.56

24	Leeds, UK	169.89	97.77	58.34	82.58	60.69	31.95	46.86
25	Cork, Ireland	169.18	74.27	65.37	57.68	75.30	34.30	23.20
26	Hamburg, Germany	167.58	92.11	56.04	75.11	68.61	34.74	30.13
27	Berlin, Germany	166.86	101.89	58.98	69.99	62.93	34.18	39.55
28	Ljubljana, Slovenia	166.47	59.65	78.68	66.24	54.98	27.84	23.24
29	Vilnius, Lithuania	165.39	60.91	72.09	71.09	43.52	27.76	23.75
30	Bristol, UK	164.80	87.10	62.10	73.54	69.11	28.59	44.05
31	Oslo, Norway	162.86	85.77	63.37	75.07	86.38	32.23	25.88
32	Kaunas, Lithuania	160.59	55.29	60.93	73.15	43.46	23.58	26.89
33	Cologne, Germany	159.61	93.18	57.37	73.94	65.22	37.72	42.59
34	Stockholm, Sweden	159.09	84.64	55.54	67.05	74.37	36.49	18.94
35	Zagreb, Croatia	159.02	52.63	78.04	65.63	48.80	31.43	31.18
36	Brno, Czech Republic	158.88	63.14	73.32	74.26	42.11	26.14	44.35
37	Prague, Czech Republic	157.48	62.67	75.79	74.20	44.71	32.41	35.11
38	Lyon, France	157.07	82.93	56.79	77.00	72.09	33.90	47.35
39	Timisoara, Romania	155.77	59.25	76.36	71.42	34.07	23.88	56.42
40	Porto, Portugal	155.22	43.51	63.41	74.62	48.49	28.72	36.02
41	Antwerp, Belgium	154.63	84.20	65.22	80.53	70.31	37.15	61.23
42	Madrid, Spain	152.14	68.92	70.08	79.28	58.57	35.23	51.79
43	Lisbon, Portugal	151.99	46.61	72.10	71.49	49.34	36.28	34.85
44	Cluj-Napoca, Romania	150.67	51.03	79.49	64.17	35.94	28.91	43.40
45	Birmingham, United Kingdom	150.24	80.27	42.19	73.75	66.89	32.17	47.87
46	Manchester, United Kingdom	148.05	89.64	44.97	78.16	65.83	40.10	53.40
47	Bratislava, Slovakia	147.39	61.40	68.63	57.17	47.55	30.89	41.12
48	Brussels, Belgium	144.24	89.32	48.73	74.18	69.75	37.17	62.30
49	Riga, Latvia	143.77	50.65	61.46	60.68	48.24	32.48	38.65
50	Nizhny Novgorod, Russia	143.43	35.93	69.57	76.82	32.55	29.10	34.03
51	Bologna, Italy	141.64	59.02	55.14	77.88	68.41	32.04	55.73

52	Barcelona, Spain	138.54	63.13	55.35	77.67	57.48	30.22	64.91
53	Dublin, Ireland	137.56	69.79	50.27	51.53	77.45	40.51	40.55
54	Varna, Bulgaria	137.09	46.10	68.24	62.58	36.44	31.46	61.37
55	Novi Sad, Serbia	136.49	42.48	59.66	47.35	34.46	17.17	45.88
56	Minsk, Belarus	135.66	33.75	75.48	62.59	34.55	30.35	41.56
57	London, United Kingdom	131.29	87.10	47.45	69.97	77.67	45.17	58.50
58	Age, Romania	128.94	46.23	71.98	56.75	34.92	34.62	61.50
59	Turin, Italy	127.77	62.44	48.06	69.52	65.36	29.62	70.02
60	Warsaw, Poland	125.49	55.58	71.73	55.75	40.59	35.94	64.22
61	Sofia, Bulgaria	123.72	53.15	57.75	57.17	38.94	30.96	69.14
62	Thessaloniki, Greece	123.46	37.33	59.71	56.19	56.17	26.94	64.10
63	Gdansk, Poland	122.93	51.48	64.19	48.20	38.72	30.93	59.59
64	Wroclaw, Poland	121.94	52.04	67.53	51.89	37.72	33.63	67.79
65	Poznan, Poland	121.06	46.91	69.56	51.08	37.03	30.97	66.32
66	Athens, Greece	120.39	41.49	50.87	55.94	56.14	37.98	57.33
67	Budapest, Hungary	119.76	48.54	63.74	47.23	41.20	39.14	54.70
68	Milan, Italy	119.46	54.32	56.86	71.80	75.63	37.13	66.19
69	Lviv, Ukraine	119.45	31.02	57.65	58.94	29.92	33.05	54.57
70	Bucharest, Romania	118.93	52.97	72.67	54.31	38.17	42.17	75.39
71	Cracow, Poland	117.45	54.96	68.56	52.48	38.58	30.97	76.05
72	Paris, France	116.13	66.03	47.98	78.46	85.06	42.38	64.28
73	Lodz, Poland	113.34	49.00	54.29	50.44	36.41	31.70	73.96
74	Rome, Italy	112.24	56.15	47.94	58.90	69.46	42.77	66.66
75	Sarajevo, Bosnia and Herzegovina	110.75	42.07	51.10	53.87	37.99	28.84	71.18
76	Belgrade Serbia	109.16	35.43	62.47	53.88	38.09	35.85	63.45
77	Kharkiv, Ukraine	108.93	31.24	51.84	46.61	30.10	37.82	55.77
78	Odessa (Odesa), Ukraine	108.86	34.00	47.24	51.57	31.22	35.78	64.25
79	Kiev (Kiev), Ukraine	106.77	39.34	52.89	55.55	32.82	43.11	66.05
80	Saint Petersburg, Russia	106.39	42.09	60.92	58.91	35.64	47.53	62.51
81	Skopje, North Macedonia	103.35	34.87	56.04	55.93	34.81	28.60	82.90

82	Moscow, Russia	102.93	49.62	60.04	61.35	40.04	52.40	59.41
83	Dnipro, Ukraine	96.62	33.58	47.11	51.29	29.99	32.21	82.36
84	Tirana, Albania	90.31	27.96	61.08	49.28	37.38	41.58	87.21
85	Yekaterinburg, Russia	87.08	44.02	52.75	50.78	30.96	38.49	76.86
86	Novosibirsk, Russia	85.50	34.57	51.94	53.35	30.64	40.10	68.98

Appendix 2: WASPAS

City	QW	Rank
Paris, France	1.77	1
Antwerp, Belgium	1.74	2
London, United Kingdom	1.74	3
Brussels, Belgium	1.69	4
Milan, Italy	1.69	5
Rome, Italy	1.65	6
Manchester, United Kingdom	1.62	7
Zurich, Switzerland	1.61	8
Bucharest, Romania	1.61	9
Turin, Italy	1.60	10
Geneva, Switzerland	1.59	11
Barcelona, Spain	1.57	12
Tirana, Albania	1.57	13
Madrid, Spain	1.57	14
Lyon, France	1.57	15
Stuttgart, Germany	1.56	16
Bologna, Italy	1.55	17
Moscow, Russia	1.54	18
Leeds, UK	1.54	19
Cologne, Germany	1.54	20
Cracow, Poland	1.52	21
Warsaw, Poland	1.50	22
Bristol, UK	1.49	23
Saint Petersburg, Russia	1.48	24
Berlin, Germany	1.48	25
Birmingham, United Kingdom	1.47	26
Yekaterinburg, Russia	1.47	27

Rotterdam, Netherlands	1.46	28
Wroclaw, Poland	1.46	29
Dublin, Ireland	1.46	30
Skopje, North Macedonia	1.45	31
Cambridge, UK	1.45	32
Sofia, Bulgaria	1.45	33
Lodz, Poland	1.44	34
Athens, Greece	1.44	35
Valencia, Spain	1.43	36
Glasgow, UK	1.43	37
Kiev (Kiev), Ukraine	1.43	38
Munich, Germany	1.42	39
Oslo, Norway	1.42	40
Utrecht, Netherlands	1.42	41
Luxembourg, Luxembourg	1.42	42
Amsterdam, Netherlands	1.42	43
Thessaloniki, Greece	1.42	44
Frankfurt, Germany	1.41	45
Poznan, Poland	1.41	46
Dnipro, Ukraine	1.41	47
Age, Romania	1.41	48
Hamburg, Germany	1.40	49
Düsseldorf, Germany	1.40	50
Varna, Bulgaria	1.40	51
Novosibirsk, Russia	1.39	52
Belgrade, Serbia	1.39	53
Sarajevo, Bosnia and Herzegovina	1.39	54
Budapest, Hungary	1.38	55
The Hague (Den Haag), Netherlands	1.38	56
Copenhagen, Denmark	1.37	57
Belfast, UK	1.37	58
Gdansk, Poland	1.36	59
Timisoara, Romania	1.36	60
Edinburgh, UK	1.35	61
Brno, Czech Republic	1.33	62
Prague, Czech Republic	1.31	63

Eindhoven, Netherlands	1.31	64
Odessa (Odesa), Ukraine	1.31	65
Lisbon, Portugal	1.31	66
Bratislava, Slovakia	1.31	67
Cork, Ireland	1.30	68
Stockholm, Sweden	1.29	69
Cluj-Napoca, Romania	1.27	70
Riga, Latvia	1.27	71
Zagreb, Croatia	1.25	72
Helsinki, Finland	1.25	73
Lviv, Ukraine	1.24	74
Vienna, Austria	1.24	75
Kharkiv, Ukraine	1.24	76
Porto, Portugal	1.23	77
Minsk, Belarus	1.20	78
Gothenburg, Sweden	1.19	79
Reykjavik, Iceland	1.19	80
Ljubljana, Slovenia	1.19	81
Tallinn, Estonia	1.17	82
Vilnius, Lithuania	1.14	83
Nizhny Novgorod, Russia	1.13	84
Kaunas, Lithuania	1.10	85
Novi Sad, Serbia	1.07	86

Appendix 3: VIKOR

City	QV	Rank	City	QV	Rank
Vienna, Austria	0.03	1	Tirana, Albania	1.00	1
Helsinki, Finland	0.06	2	Kharkiv, Ukraine	0.94	2
Munich, Germany	0.09	3	Dnipro, Ukraine	0.92	3
Düsseldorf, Germany	0.09	4	Moscow, Russia	0.90	4
Eindhoven, Netherlands	0.09	5	Odessa (Odesa), Ukraine	0.89	5
Edinburgh, UK	0.10	6	Novosibirsk, Russia	0.89	6
The Hague (Den Haag), Netherlands	0.11	7	Budapest, Hungary	0.86	7
Valencia, Spain	0.16	8	Rome, Italy	0.86	8
Rotterdam, Netherlands	0.17	9	Yekaterinburg, Russia	0.85	9

Copenhagen, Denmark	0.19	10	Skopje, North Macedonia	0.85	10
Utrecht, Netherlands	0.20	11	Kiev (Kiev), Ukraine	0.84	11
Luxembourg, Luxembourg	0.20	12	Athens, Greece	0.82	12
Cambridge, UK	0.21	13	Lodz, Poland	0.82	13
Reykjavik, Iceland	0.22	14	Belgrade Serbia	0.81	14
Tallinn, Estonia	0.22	15	Dublin, Ireland	0.81	15
Stuttgart, Germany	0.23	16	Lviv, Ukraine	0.80	16
Amsterdam, Netherlands	0.25	17	Gdansk, Poland	0.80	17
Bristol, UK	0.27	18	Saint Petersburg, Russia	0.79	18
Brno, Czech Republic	0.29	19	Thessaloniki, Greece	0.78	19
Frankfurt, Germany	0.30	20	Birmingham, United Kingdom	0.78	20
Vilnius, Lithuania	0.30	21	Sarajevo, Bosnia and Herzegovina	0.78	21
Prague, Czech Republic	0.30	22	London, United Kingdom	0.77	22
Leeds, UK	0.30	23	Paris, France	0.77	23
Madrid, Spain	0.32	24	Novi Sad, Serbia	0.75	24
Oslo, Norway	0.32	25	Turin, Italy	0.73	25
Ljubljana, Slovenia	0.33	26	Bucharest, Romania	0.73	26
Timisoara, Romania	0.34	27	Manchester, United Kingdom	0.72	27
Belfast, UK	0.34	28	Poznan, Poland	0.72	28
Berlin, Germany	0.34	29	Wroclaw, Poland	0.71	29
Glasgow, UK	0.35	30	Cracow, Poland	0.71	30
Kaunas, Lithuania	0.38	31	Brussels, Belgium	0.67	31
Hamburg, Germany	0.39	32	Minsk, Belarus	0.64	32
Cologne, Germany	0.40	33	Sofia, Bulgaria	0.64	33
Antwerp, Belgium	0.42	34	Milan, Italy	0.64	34
Gothenburg, Sweden	0.42	35	Age, Romania	0.63	35
Lyon, France	0.43	36	Geneva, Switzerland	0.61	36
Zagreb, Croatia	0.43	37	Varna, Bulgaria	0.60	37
Cluj-Napoca, Romania	0.44	38	Warsaw, Poland	0.59	38
Stockholm, Sweden	0.45	39	Riga, Latvia	0.57	39
Bratislava, Slovakia	0.49	40	Zurich, Switzerland	0.57	40
Cork, Ireland	0.49	41	Nizhny Novgorod, Russia	0.55	41
Barcelona, Spain	0.51	42	Porto, Portugal	0.54	42
Bologna, Italy	0.51	43	Lisbon, Portugal	0.52	43
Lisbon, Portugal	0.52	44	Bologna, Italy	0.51	44
Porto, Portugal	0.54	45	Barcelona, Spain	0.51	45

Nizhny Novgorod, Russia	0.55	46	Cork, Ireland	0.49	46
Zurich, Switzerland	0.57	47	Bratislava, Slovakia	0.49	47
Riga, Latvia	0.57	48	Stockholm, Sweden	0.45	48
Warsaw, Poland	0.59	49	Cluj-Napoca, Romania	0.44	49
Varna, Bulgaria	0.60	50	Zagreb, Croatia	0.43	50
Geneva, Switzerland	0.61	51	Lyon, France	0.43	51
Age, Romania	0.63	52	Gothenburg, Sweden	0.42	52
Milan, Italy	0.64	53	Antwerp, Belgium	0.42	53
Sofia, Bulgaria	0.64	54	Cologne, Germany	0.40	54
Minsk, Belarus	0.64	55	Hamburg, Germany	0.39	55
Brussels, Belgium	0.67	56	Kaunas, Lithuania	0.38	56
Cracow, Poland	0.71	57	Glasgow, UK	0.35	57
Wroclaw, Poland	0.71	58	Berlin, Germany	0.34	58
Poznan, Poland	0.72	59	Belfast, UK	0.34	59
Manchester, United Kingdom	0.72	60	Timisoara, Romania	0.34	60
Bucharest, Romania	0.73	61	Ljubljana, Slovenia	0.33	61
Turin, Italy	0.73	62	Oslo, Norway	0.32	62
Novi Sad, Serbia	0.75	63	Madrid, Spain	0.32	63
Paris, France	0.77	64	Leeds, UK	0.30	64
London, United Kingdom	0.77	65	Prague, Czech Republic	0.30	65
Sarajevo, Bosnia and Herzegovina	0.78	66	Vilnius, Lithuania	0.30	66
Birmingham, United Kingdom	0.78	67	Frankfurt, Germany	0.30	67
Thessaloniki, Greece	0.78	68	Brno, Czech Republic	0.29	68
Saint Petersburg, Russia	0.79	69	Bristol, UK	0.27	69
Gdansk, Poland	0.80	70	Amsterdam, Netherlands	0.25	70
Lviv, Ukraine	0.80	71	Stuttgart, Germany	0.23	71
Dublin, Ireland	0.81	72	Tallinn, Estonia	0,22	72
Belgrade Serbia	0.81	73	Reykjavik, Iceland	0,22	73
Lodz, Poland	0.82	74	Cambridge, UK	0,21	74
Athens, Greece	0.82	75	Luxembourg, Luxembourg	0,20	75
Kiev (Kiev), Ukraine	0.84	76	Utrecht, Netherlands	0,20	76
Skopje, North Macedonia	0.85	77	Copenhagen, Denmark	0,19	77
Yekaterinburg, Russia	0.85	78	Rotterdam, Netherlands	0,17	78
Rome, Italy	0.86	79	Valencia, Spain	0,16	79
Budapest, Hungary	0.86	80	The Hague (Den Haag), Netherlands	0,11	80
Novosibirsk, Russia	0.89	81	Edinburgh, UK	0,10	81

Odessa (Odesa), Ukraine	0.89	82	Eindhoven, Netherlands	0,09	82
Moscow, Russia	0.90	83	Düsseldorf, Germany	0,09	83
Dnipro, Ukraine	0.92	84	Munich, Germany	0,09	84
Kharkiv, Ukraine	0.94	85	Helsinki, Finland	0,06	85
Tirana, Albania	1.00	86	Vienna, Austria	0,03	86

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

FINANCIAL DEVELOPMENT, ECONOMIC GROWTH AND WELFARE: EVIDENCE FROM EMERGING COUNTRIES

DOI: 10.17261/Pressacademia.2020.1218
JBEF- V.9-ISS.2-2020(5)-p.118-131

Ahmed Musabeh[1], Koutibah Alrifai[2], Mohammed Kalloub[3]
[1]Kadir Has University, Ph.D. Finance and Banking, Istanbul, Turkey.
ahmedmusabeh88@gmail.com, ORCID: 0000-0003-2923-6204
[2]Istanbul Commerce University, Ph.D. Candiadate in Business Administration, Istanbul, Turkey.
qs-93@hotmail.com, ORCID: 0000-0002-4637-5348
[3]Ankara Yildirim Beyazit University, Ph.D. Candidate in Public Finance, Ankara, Turkey.
mohmd.kalloub@gmail.com, ORCID: 0000-0001-9153-1146

Date Received: April 9, 2020 **Date Accepted:** June 12, 2020

To cite this document
Musabeh, A., Alrifai, K., Kalloub, M., (2020). Financial development, economic growth and welfare: evidence from emerging countries. Journal of Business, Economics and Finance (JBEF), V.9(2), p.118-131.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2020.1218

ABSTRACT

Purpose- This study investigates how financial development has affected the economic growth and welfare for four emerging economies, namely Brazil, Turkey, Hungary, and, Poland over the period 2000-2013.
Methodology- In this research, we employed a panel dataset for the four countries using five different indicators for financial development separately. Which are (financial development index, domestic credit to the private sector, stock exchange market capitalization, and Lerner Index).
Findings- The results confirmed that financial development has a positive impact on economic growth, and there is a difference between Turkey, Brazil, Poland, and Hungary in terms of the impact size of financial development on economic growth. The highest and most energetic effect was on Turkey then on Poland, then on Hungary, and finally on Brazil
Conclusion- This study found that GDP growth is highly correlated with financial development. Thus, countries may undertake different steps to increase the efficiency of their financial sectors and therefore enhance their economic growth.

Keywords: Financial development, economic growth, economic welfare, panel data, emerging economies.
JEL Codes: F14, F21, F40

1. INTRODUCTION

Both financial development and economic growth have become an important topic in modern economies and received a great deal of attention in previous decades. It also became one of the most critical emerging research topics in the economics and finance fields in developing countries, mainly. According to Schumpeter (1934), accelerating the accumulation of capital is a vital driver to enhance economic growth, and the importance of the relationship between financial development Schumpeter and economic growth lies in the role of financial development in reducing transaction, information and monitoring cost of financial transactions. Moreover, a well-performing financial market has a more exceptional ability to generate higher savings and investment. Based on Beck and Levine (2004), the development in the financial sector includes some procedures such as amelioration in the production of information about investments, putting investments under surveillance. Also, it involved better management of risk and diversification, saving motivation and reciprocity of goods and services. Thus, financial institutions have a significant role in supporting the investment sector by providing the needed credit for the private sector, which in turn has a positive effect on overall investment. So, financial institutions have a significant role to play in economic growth and national income by enhancing investment in general and technological innovations in particular (Arac And Ozcan 2014). In this context, Patrick (1966) suggested that financial firms are crucial to enhance the financial structure and support national income growth. On the other hand, there was always a spirited debate on how active financial development is in promoting economic growth.

Where some economists think that the correlation between financial development and economic growth is not significant, and other economists argue that financial ingredients are vital as they promote economic growth (Hassan et al., 2011).

Based on the above and due to the value of the financial sector. This study examines the effect of financial development on economic growth and welfare. However, what makes this study unique is employing five indicators for financial development which are (financial development index, domestic credit to the private sector, stock exchange market capitalization, Lerner Index,). And applying this study for four different countries from different regions, which are two upper-middle-income countries (Brazil and Turkey) in particular, as they have almost similar economic and demographic characteristics and two high- income countries (Hungary and Poland). This diversification in selected countries, mainly to support our results about the influence of financial development and economic growth.

This study consists of four main sections. The first section contains a short introduction and the potentials of this work. The second section of this paper presents a brief review of the literature for the impact of financial development on economic growth and welfare. The third section analyzes the relationship between financial development and economic growth using a panel data analysis for 14 years (2000-2013). And finally, the fourth section provides results and a conclusion of the study

2. LITERATURE REVIEW

There is a vast body of literature conducted to assess the relationship between financial development and economic growth. Almost all the outcomes indicated that a positive correlation between financial development and Economic growth does exist. For instance, several studies involve Valickova et al., (2015), Kazar and Kazar, (2016), Durusu-Ciftci et al., (2017) examined the impact of financial development in promoting national income growth. Results revealed that financial development has a positive and sound effect on GDP per capita growth in developed countries. Moreover, Nyasha and Odhiambo (2014) examined the empirical and theoretical relationship between financial development and growth within the economy, and findings showed that there is a strong relationship between most indexes of the stock market and the growth in GDP per capita. On the other hand, Choong and Chan, (2011) argue that the connection between financial sector development and growth in GDP per capita is significant in all countries because the evolution of the financial system has an impact on GDP per capita through enhancing efficient allocation of resources which causes economic growth.

Moreover, Calderon and Liu (2003), in their study about the impact of financial development on economic growth, found that financial development has positively affected economic growth in 109 countries between 1960-1994. It is also found that the development of the financial sector can positively affect inward FDI and thus indirectly support growth in 67 countries 37 of them are financially developed in Latin America and Asia (Hermes and Lensink, 2010).

As an instance for high income and upper-middle-income countries, many studies have been carried out in the European Union EU about the connection between financial development and national income growth. Dudian and Popa (2013), searched the link between financial development and economic growth. Outcomes showed that there was a robust connection between financial development and economic growth. Also, Athanasios and Antonios (2010) investigated the relationship between economic growth and financial development. Results confirmed the causality relationship between economic growth and the efficiency of the banking sector. Studies have been carried out in developing countries as well, and this time from Asia, many studies have been conducted to check the connection between financial development and economic growth. Lenka (2015), Xiang and Dongye (2016), and Lenka and Sharma (2017) studied the relationship between financial inclusion and growth. Results showed that financial inclusion and growth have a co-integration connection between growth and financial development. Several studies include Bittencourt (2012), Rosalia (2013) inspected the relation between financial development and economic growth in Latin America, the result indicated that financial development indeed has an essential part in procreating economic growth. A study by Stefani (2007) investigated the causal relationship between financial development and economic growth in Brazil, and results confirmed that there is a strong relationship between financial development and economic growth. Yucel (2009), Arca and Ozcan (2014), in Turkey have investigated the connection between the development of the financial sector and the growth of the economy in Turkey over different periods. Findings indicated that there is a strong relationship between financial development and economic growth in Turkey. Furthermore, Mercan and Göçer (2013) investigated the influence of financial development on GDP per capita growth; the findings indicated that the GDP per capita growth would increase if financial institutions can offer credit demands to market, which means that financial development affects economic growth.

However, unlike the most of current literature, few studies in the late of 20th century have rejected the causality hypothesis between financial development and economic growth, but rather they either found weak statistical evidence between financial

development and growth such as Demitriades and Hussien (1996) as evidence vary from country to another. Or found that quantity or volume of financial development doesn't matter while efficiency matters more in Latin America (De Gregorio And Guidotti, 1995), this view is attributed to the poor financial systems in the past and the small size and the weak role played by financial system previously compared with financial sector currently.

3. Data and Methodology

To achieve the aim of this study, panel data analysis for 14 years (2000-2013) for a sample of four countries of emerging countries, namely Turkey, Brazil, Hungary, is used. These four countries are relatively comparable as they share many characteristics, such as financial measures, level of income, and size of geographical area (see World Bank World Development Indicators). For example, the Turkish economy has recently become successful due to adopting a sound financial policy. After the crisis in 2001 and with IMF financial assistance (Yeldan and Ünüvar, 2016), a new economic structure was built and made a remarkable change in the economy. On the other hand, Brazil has adopted a sound financial system, which in turn contributed positively to the financial sector's performance. In general, this study will analyze the relationship between economic growth and five financial development indicators separately, besides employing several control variables in the model.

3.1. Variables Discerption and Selection

In this section, we give a summary of the variables used in our analysis. Our dependent variable is GDP per capita as an indicator of economic growth and welfare, while independent variables are divided into two main categories, financial development indicators and control variables, as shown below.

Dependent variable

Economic growth and welfare: There is no consensus on one indicator to measure both economic growth and welfare. On the one hand, welfare represents the quality of living standards and consumption of a variety of items such as education, health, and leisure. On the other hand, GDP per capita is the main indicator of economic growth, which in turn represents better living standards and higher purchasing power. We believe that there is no better indicator than GDP per capita growth to capture welfare and economic growth together as they are strongly correlated to income level. Thus, we will employ GDP per capita as a proxy for economic growth and welfare.

Independent variables

Financial Development: There is no clear-cut definition of financial development, but many sources defined it as improvements that occur in financial procedures, information, and volume of financial services. This development is measured by enhancements in services provided by the financial system regardless if they occur by institutions or financial markets. These indicators which have been used previously to measure financial development are defined below:

Table 1: List of Financial Development Variables

Variable	Description	Source
Overall financial development index	This index summarizes how developed financial institutions and financial markets are in terms of their depth, access, and efficiency.	IMF
Domestic credit to the private sector (% of GDP):	Indicate to financial resources provided to the private sector by financial institutions, such as purchases of nonequity securities, through loans, and trade credits.	World Bank
Stock exchange market capitalization to GDP (%):	The overall value of listed shares in a stock exchange market illustrated as a ratio of country GDP.	World Bank
Credit to Government (%):	Refer to the ratio of credit by domestic money banks to government.	World bank
Lerner Index	It is a measure of market power in the banking market and correlates output pricing and marginal costs, in which the prices are calculated as overall bank revenue over assets.	World Bank

However, to ensure the reliability of our analysis, we have considered a variety of control variables to capture the effect of other macroeconomic factors. Table 2. shows the Lists of other independent control variables that have been employed in our estimation and presents their definition and source.

Table 2: List of Control Variables

Variable	Description	Source
Trade openness	The openness of trade is the aggregation of imports, exports, services, and goods measured as a share of gross domestic product.	World bank
Financial openness	The financial openness refers to the state approach for investments by foreign corporations within its authority.	(Chinn – Ito KAOpen Index):
Terms of Trade	It is calculated as a ratio of the export unit value indicates to the import unit value indicates, weighted relative to the base year.	World bank
VIX (global volatility)	The Volatility Index (VIX Index) is a gauge of market anticipations of near-term fluctuation conveyed by S&P 500 stock index option prices.	CBOE Dataset
Human capital	it is a measure of the yearly average of schooling, and supposed rate of return to education	PWT9
Real Broad Effective Exchange Rate	It is determined as weighted averages of exchange rates fixed by relative consumer prices, which is estimated to the country's currency.	FRED
z-SCORE[1]	It captures the probability of default of a country's banking system.	Central Banks
Inflation Rate	a ratio of the customer price index	World bank
Regulatory Quality	Regulatory Quality shows an image of the capacity of the government to modulate and implement sound policy rules that promote and permit private sector development.	World Governance Indicators

3.2. Model

our analysis is based on a multiple regression model using GDP per capita as a dependent variable; on the other hand, a set of independent variables have been utilized to conduct the analysis. Moreover, to ensure the quality and minimize the bias, we have employed five different indicators for financial development in five separate analyses. Our model is indicated by Equation(1).

$$Y = b_0 + b_1x_1 + b_2x_2 + \dots + b_ix_i + e \quad (1)$$

Where:

Y: represents GDP per Capita as a dependent variable.
b_0 : is the intercept/ Constant
b : independent variable's vector
x : predictor variable

And to ensure the validity of the results, Table 3. shows that there is no multicollinearity among the independent variables, and for a test of stationarity, the Levin-Lin-Chu unit-root test indicates that p-value for all variables (in the level) is less than 0.05, which means no unit root problem see table 4.

[1] It is estimated as (ROA+(equity/assets))/sd(ROA); sd(ROA) is the standard deviation of ROA. ROA, equity, and assets are country-level aggregate figures Calculated from underlying bank-by-bank unconsolidated

Table 3: The Correlation Matrix between Variables

	Trade openness	Financial openness	Exchange rate	Term of trade	HC	VIX	Inflation	Zscore
Trade openness	1.0000							
Financial openness	0.6058	1.0000						
Exchange rate	0.4121	0.3648	1.0000					
Term of trade	-0.2968	-0.1845	-0.1650	1.0000				
HC	0.4655	0.6380	0.4116	-0.1644	1.0000			
VIX	-0.0196	-0.0159	0.0395	0.0243	-0.0322	1.0000		
Inflation	-0.2166	-0.3937	-0.3948	0.0347	-0.5042	0.1624	1.0000	
Zscore	-0.6688	-0.4366	-0.4122	0.1253	-0.5595	-0.1035	-0.1660	1.0000

Table 4: Panel Unit Root Tests (Levels)

Levin-Lin-Chu unit-root test	P-Value
GDP per capita	0.0019
Trade openness	0.0017
Financial openness	0.0307
Exchange rate	0.0047
Term of trade	0.0053
HC	0.0501
inflation	0.0003
VIX	0.0000
Zscor	0.0099
Overall DF	0.0363
Lenrer Index	0.0020
Domestic credit	0.0264
Market capitalization	0.0501
Credit to Government	0.0105

3.3. Empirical Results

According to the correlation matrix, which is used to examine the correlation between variables. Table 3. displays that none of the variables are highly correlated, regarding Unit root test of stationarity of the variables used in the model. Table 4. shows that based on the LLC test all variables are stationary at level. Our analysis results for the impact of financial development on growth and welfare are listed in the Appendix, table 5. shows the effect of financial development index within the four countries on their economic growth, results reveal that financial development has a positive impact on economic growth in the four countries. Thus, the enhancement in the financial system was reflected positively on national welfare. Table 6. shows that easy access to credit (domestic credit) has a significant positive effect on growth in GDP per capita for the four countries over the given period. However, Table 7. presents the estimation for the stock market capitalization variable and GDP per capita, and the results show that the stock market capitalization indicator has a decisive role in economic growth and national welfare. However, Table 9. shows estimation about the effect of the credit to the government on the economic growth, and the results show that credit volume to the government has a significant negative impact upon the economic growth and welfare in the four countries, as the government increases its borrowing this might lead to increases in the interest rate, and consequently crowd investments out which will negatively affect the economy.About the impact of control variables, the study confirmed that there is a significant positive correlation between human capital, financial openness, and economic growth and welfare. However, the results indicated

that there is a negative and significant relationship between inflation rate and economic growth in the studied sample. While,regarding the impact of regulatory quality on economic growth, findings show the positive impact of regulatory quality on economic growth and welfare. On the other hand, the terms to trade impact upon the growth in the economy is not clear as strong statistical evidence was not found, while the openness to trade and z-score indicators are not significant, as we notice from the information set of the estimations above. Concerning differences among the four countries, Tables 10. and 11. show the effect of Financial development on GDP per capita, the difference in the impact of financial development on GDP per capita growth between the four countries is illustrated, where the highest effect is in Turkey, then in Poland, Hungary, and Brazil respectively.

4. CONCLUSION

This paper examined the impact of financial development on economic growth and welfare. The study constructed a panel dataset from reliable resources, while results have shown that financial development has a good and positive impact on economic growth. Also, the results have shown that there is a difference between Turkey, Brazil, Poland, and Hungary in terms of the impact size of financial development on economic growth. The highest and strongest effect was in Turkey then in Poland, then Hungary, and finally in Brazil. The causes of the difference between these countries is attributed for the financial sector; the more efficient and modern the financial system, the more economic growth, and welfare are. According to results, it has been noticed that developing countries may gain more significant benefit from improving their financial sector. And in the light of our findings as a policy suggestion, this study found that there is a high correlation between GDP growth and financial development. Thus, countries may undertake different steps to increase the efficiency of their financial sectors and, therefore, contribute to economic growth. These steps include; firstly, strengthen information exchanging network between financial institutions as it reduces potential risks and provides to higher credit flows, a second recommendation is a commitment to international financial bodies rules. We also recommend enhancing financial inclusion as it helps increase the financial base and credit circulation as well. To sum up, a well-developed financial sector is expected to promote economic growth where governments should focus on developing their financial sector to increase their economic growth and welfare.

REFERENCES

Abida, Z., Sghaier, I. M., And Zghidi, N. (2015). Financial development and economic growth: evidence from North African countries. *Economic Alternatives*, *2*, 17-33.

Antonios, A. (2010). Financial development and economic growth: A comparative study between 15 European Union member-states. *International Research Journal of Finance and Economics*, *35*, 143-149.

Anzoategui, D., Rocha, R., And Soledad Martinez Peria, M. (2010). Bank competition in the Middle East and Northern Africa region. *The World Bank*.

Araç, A., and Kutalmış Özcan, S. (2014). The Causality between Financial Development and Economic Growth: The Case of Turkey. *Journal of Economic Cooperation & Development*, *35*(3).

Athanasios, V., And Antonios, A. (2010). The effect of stock and credit market development on economic growth: an empirical analysis for Italy. *International Research Journal of Finance and Economics, 41(3), 33-42.*

Baltagi, B. (2008). Econometric analysis of panel data. John Wiley & Sons.

Beck, T., And Levine, R. (2004). Stock markets, banks, and growth: Panel evidence. *Journal of Banking & Finance, 28(3), 423-442.*

Calderón, C., And Liu, L. (2003). The direction of causality between financial development and economic growth. *Journal of development economics*, *72*(1), 321-334.

Choong, C., And Chan, S. (2011). Financial development and economic growth: *A review. African Journal of Business Management, 5(6), 2017-2027.*

Craven, B. D., And Islam, S. M. (2011). Ordinary least-squares regression (pp. 224-228). Sage Publications

De Gregorio, J., And Guidotti, P. E. (1995). Financial development and economic growth. *World development*, *23*(3), 433-448.

Demetriades, P. O., & Hussein, K. A. (1996). Does financial development cause economic growth? Time-series evidence from 16 countries. *Journal of Development Economics*, *51*(2), 387-411.

Dudian, M., And Popa, R. A. (2013). Financial development and economic growth in Central and Eastern Europe. *Theoretical and Applied Economics, 20(8), 59-68.*

Durusu-Ciftci, D., Ispir, M. S., & Yetkiner, H. (2017). Financial development and economic growth: Some theory and more evidence. *Journal of Policy Modeling, 39(2), 290-306.*

Erinç Yeldan, A., And Ünüvar, B. (2016). An assessment of the Turkish economy in the AKP era. *Research and policy on Turkey, 1(1), 11-28.*

Hassan, M. K., Sanchez, B., and Yu, J. S. (2011). Financial development and economic growth: New evidence from panel data. *The Quarterly Review of economics and finance, 51(1), 88-104.*

Hermes, N., And Lensink, R. (2003). Foreign direct investment, financial development and economic growth. *The journal of development studies*, *40*(1), 142-163.

Hsiao, C. (2014). Analysis of panel data (No. 54). Cambridge university press.

Kaushal, L. A., And Pathak, N. (2015). The causal relationship among economic growth, financial development and trade openness in the Indian economy. *International Journal of Economic Perspectives*, *9*(2), 5-22.

Kazar, A., and Kazar, G. (2016). Globalization, financial development and economic growth. *International Journal of Economics and Financial Issues*, *6*(2), 578-587.

Lenka, S. K. (2015). Measuring financial development in India: A PCA approach. *Theoretical & Applied Economics*, *22*(1).

Lenka, S. K., & Sharma, R. (2017). Does financial inclusion spur economic growth in India?. *The Journal of Developing Areas*, *51*(3), 215-228.

Levine, R. (2000) Financial intermediation and growth: Causality and causes without outliers. Portuguese Economic Journal, 8(1), 15–22.

Mercan, M., And Göçer, İ. (2013). The effect of financial development on economic growth in BRIC-T countries: Panel data analysis. *Journal of Economic and Social Studies*, *3*(1), 199.

Nyasha, S., And Odhiambo, N. M. (2015). The impact of banks and stock market development on economic growth in South Africa: an ARDL-bounds testing approach. *Contemporary Economics*, *9*(1), 93-108.

Patrick, H. T. (1966). Financial development and economic growth in underdeveloped countries. *Economic development and Cultural change*, *14*(2), 174-189.

Rosalia, M. R. G. (2013). Impact of Financial Development on Economic growth.

Schumpeter, J. [1934], *The Theory of Economic Development*, Translated by Redvers Opie, Harvard University Press, Cambridge, MA.

Stefani, P. (2007). Financial development and economic growth in brazil: 1986-2006. Economics Bulletin, 3(69), 1-13.

Tsaurai, K. (2018). What Are the Determinants of Stock Market Development in Emerging Markets?. *Academy of Accounting and Financial Studies Journal*.

Valickova, P., Havranek, T., And Horvath, R. (2015). Financial development and economic growth: A meta-analysis. *Journal of Economic Surveys*, *29*(3), 506-526.

Xiang, L., And Dongye, Y. (2016). Research on the Relationship between Financial Development and Economic Growth: Based on an Empirical Analysis of Shenzhen. *Journal of Applied Finance and Banking*, *6*(4), 17.

.

Table 5: The Estimation of the Effect of the Financial Development Overall on the Growth in GDPP-PC

VARIABLES	(1) loggdppc	(2) loggdppc	(3) loggdppc	(4) loggdppc	(5) loggdppc	(6) loggdppc	(7) loggdppc	(8) loggdppc
Financial Development overall	2.165***	2.460***	0.807**	0.799**	0.635**	0.580**	0.629**	0.429*
	(0.387)	(0.418)	(0.382)	(0.363)	(0.246)	(0.262)	(0.250)	(0.243)
Financial openness	0.563***	0.564***	0.0613	0.0686	0.229**	0.221**	0.225**	0.144
	(0.166)	(0.163)	(0.137)	(0.130)	(0.0918)	(0.0933)	(0.0946)	(0.0926)
Trade openness	0.00537**	-0.0141	-0.0124	-0.00924	-0.0181***	-0.0173***	-0.0181***	-0.0226***
	(0.00193)	(0.0117)	(0.00829)	(0.00800)	(0.00537)	(0.00555)	(0.00544)	(0.00530)
Term of trade	0.000860	-0.00604	-0.0177***	-0.0142***	-0.0131***	-0.0127***	-0.0132***	-0.0176***
	(0.00278)	(0.00491)	(0.00387)	(0.00396)	(0.00253)	(0.00263)	(0.00258)	(0.00289)
c.tradeopen#c.termoftred		0.000199*	0.000127	0.000109	0.000216**	0.000206**	0.000216**	0.000262**
		(0.000118)	(8.43e-05)	(8.06e-05)	(5.54e-05)	(5.78e-05)	(5.61e-05)	(5.47e-05)
HC			1.718***	1.494***	1.415***	1.453***	1.421***	1.435***
			(0.250)	(0.255)	(0.173)	(0.184)	(0.177)	(0.164)
Inflation				-0.00360**	-0.00326***	-0.00303**	-0.00330***	-0.00224*
				(0.00150)	(0.00111)	(0.00117)	(0.00114)	(0.00113)
Regulation quality					0.576***	0.574***	0.574***	0.591***
					(0.0732)	(0.0739)	(0.0750)	(0.0699)
z_score						0.00413		
						(0.00639)		
Democracy index							0.000273	-0.000453
							(0.00121)	(0.00115)
Exchange rate								0.00375**
								(0.00138)
Constant	7.797***	8.335***	6.316***	6.507***	6.140***	6.000***	6.131***	6.332***
	(0.301)	(0.434)	(0.425)	(0.413)	(0.275)	(0.351)	(0.281)	(0.271)
Observations	56	56	56	56	52	52	52	52
R-squared	0.791	0.803	0.903	0.914	0.964	0.964	0.964	0.970
Number of country	4	4	4	4	4	4	4	4
country FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	NO	NO

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.

Table 6: The Estimation of the Effect of the Domestic Credit on the Growth in GDPP-PC

VARIABLES	(1) loggdppc	(2) loggdppc	(3) loggdppc	(4) loggdppc	(5) loggdppc	(6) loggdppc	(7) loggdppc	(8) loggdppc
Domestic Cr	0.0113***	0.0126***	0.00961***	0.00931***	0.00466***	0.00461***	0.00480***	0.00409***
	(0.000880)	(0.000835)	(0.00142)	(0.00129)	(0.00137)	(0.00137)	(0.00143)	(0.00135)
Financial openness	0.459***	0.484***	0.310***	0.283***	0.311***	0.306***	0.319***	0.236***
	(0.102)	(0.0904)	(0.104)	(0.0946)	(0.0829)	(0.0833)	(0.0860)	(0.0855)
Trade openness	0.00724***	-0.0182***	-0.0157**	-0.0121**	-0.0168***	-0.0165***	-0.0167***	-0.0228***
	(0.00115)	(0.00629)	(0.00606)	(0.00557)	(0.00470)	(0.00472)	(0.00475)	(0.00494)
Term of trade	0.00272	-0.00602**	-0.0111***	-0.00782***	-0.00984***	-0.00949***	-0.00963***	-0.0149***
	(0.00177)	(0.00265)	(0.00296)	(0.00283)	(0.00234)	(0.00238)	(0.00242)	(0.00294)
c.tradeopen#c.termoftred		0.000253***	0.000196***	0.000169***	0.000218***	0.000215***	0.000218***	0.000279***
		(6.19e-05)	(6.14e-05)	(5.60e-05)	(4.76e-05)	(4.80e-05)	(4.81e-05)	(4.99e-05)
HC			0.682***	0.528***	1.004***	1.027***	0.979***	1.028***
			(0.210)	(0.194)	(0.184)	(0.187)	(0.196)	(0.183)
Inflation				-0.00396***	-0.00387***	-0.00360***	-0.00380***	-0.00268**
				(0.00113)	(0.00108)	(0.00112)	(0.00110)	(0.00110)
Regulation quality					0.441***	0.436***	0.439***	0.475***
					(0.0834)	(0.0837)	(0.0842)	(0.0795)
z_score						0.00508		
						(0.00585)		
Democracy index							-0.000474	-0.00121
							(0.00120)	(0.00115)
Exchange rate								0.00359***
								(0.00130)
Constant	8.128***	8.973***	8.075***	8.149***	6.967***	6.840***	7.010***	7.150***
	(0.206)	(0.275)	(0.381)	(0.345)	(0.364)	(0.393)	(0.384)	(0.361)
Observations	64	64	60	60	56	56	56	56
R-squared	0.907	0.928	0.941	0.953	0.967	0.968	0.967	0.972
Number of country	4	4	4	4	4	4	4	4
country FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	NO	NO

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7: The Estimation of the Effect of the Stock Market Capitalization on the Growth in GDP-PC

VARIABLES	(1) loggdppc	(2) loggdppc	(3) loggdppc	(4) loggdppc	(5) loggdppc	(6) loggdppc	(7) loggdppc	(8) loggdppc
Stock M	0.00259	0.00229	0.00406***	0.00364***	0.00329***	0.00349***	0.00342***	0.00281***
	(0.00258)	(0.00268)	(0.00138)	(0.00131)	(0.000777)	(0.000849)	(0.000783)	(0.000927)
Financial openness	0.958***	0.946***	0.102	0.0883	0.240***	0.240***	0.217**	0.189**
	(0.195)	(0.198)	(0.136)	(0.128)	(0.0795)	(0.0801)	(0.0815)	(0.0843)
Trade openness	0.0112***	0.0169	-0.00768	-0.00390	-0.0188***	-0.0192***	-0.0193***	-0.0218***
	(0.00220)	(0.0133)	(0.00752)	(0.00726)	(0.00452)	(0.00460)	(0.00453)	(0.00495)
Term of trade	0.00810***	0.0100*	-0.0171***	-0.0135***	-0.0138***	-0.0142***	-0.0143***	-0.0164***
	(0.00340)	(0.00558)	(0.00380)	(0.00385)	(0.00223)	(0.00234)	(0.00227)	(0.00282)
c.tradeopen#c.termoftred		-5.79e-05	9.26e-05	6.53e-05	0.000232***	0.000237***	0.000237***	0.000263***
		(0.000134)	(7.48e-05)	(7.15e-05)	(4.56e-05)	(4.66e-05)	(4.56e-05)	(5.00e-05)
HC			1.801***	1.610***	1.541***	1.529***	1.566***	1.542***
			(0.167)	(0.173)	(0.103)	(0.105)	(0.105)	(0.106)
Inflation				-0.00399**	-0.00331***	-0.00347***	-0.00347***	-0.00297**
				(0.00151)	(0.00103)	(0.00107)	(0.00104)	(0.00111)
Regulation quality					0.599***	0.602***	0.587***	0.597***
					(0.0623)	(0.0630)	(0.0629)	(0.0631)
z_score						-0.00376		
						(0.00604)		
Democracy index							0.00127	0.000684
							(0.00110)	(0.00120)
Exchange rate								0.00184
								(0.00151)
Constant	7.425***	7.250***	6.179***	6.304***	5.980***	6.070***	5.953***	6.098***
	(0.392)	(0.565)	(0.304)	(0.291)	(0.175)	(0.228)	(0.176)	(0.211)
Observations	64	64	60	60	56	56	56	56
R-squared	0.637	0.639	0.904	0.916	0.971	0.971	0.971	0.972
Number of country	4	4	4	4	4	4	4	4
country FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	NO	NO

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: The Estimation of the Effect of the Lerner Index on the Growth in GDP-PC

VARIABLES	(1) loggdppc	(2) loggdppc	(3) loggdppc	(4) loggdppc	(5) loggdppc	(6) loggdppc	(7) loggdppc	(8) loggdppc
Lerner index	0.256	0.240	0.463***	0.349**	0.109	0.0758	0.117	0.0569
	(0.255)	(0.258)	(0.148)	(0.158)	(0.113)	(0.136)	(0.114)	(0.107)
Financial openness	0.960***	0.939***	0.143	0.138	0.286***	0.286***	0.275***	0.189**
	(0.194)	(0.199)	(0.132)	(0.129)	(0.0926)	(0.0934)	(0.0958)	(0.0929)
Trade openness	0.0108***	0.0182	-0.00654	-0.00322	-0.0155***	-0.0151***	-0.0158***	-0.0228***
	(0.00220)	(0.0130)	(0.00739)	(0.00746)	(0.00524)	(0.00536)	(0.00530)	(0.00544)
Term of trade	0.00865***	0.0110**	-0.0147***	-0.0121***	-0.0119***	-0.0115***	-0.0121***	-0.0177***
	(0.00337)	(0.00536)	(0.00368)	(0.00387)	(0.00257)	(0.00271)	(0.00263)	(0.00307)
c.tradeopen#c.termoftred		-7.41e-05	8.40e-05	5.78e-05	0.000200***	0.000195***	0.000202***	0.000273***
		(0.000130)	(7.36e-05)	(7.34e-05)	(5.28e-05)	(5.42e-05)	(5.34e-05)	(5.49e-05)
HC			1.709***	1.586***	1.516***	1.527***	1.529***	1.489***
			(0.167)	(0.178)	(0.120)	(0.124)	(0.124)	(0.115)
Inflation				-0.00303*	-0.00357***	-0.00349***	-0.00364***	-0.00249*
				(0.00168)	(0.00125)	(0.00128)	(0.00127)	(0.00124)
Regulation quality					0.597***	0.598***	0.589***	0.613***
					(0.0757)	(0.0765)	(0.0775)	(0.0719)
z_score						0.00348		
						(0.00785)		
Democracy index							0.000707	-0.000417
							(0.00131)	(0.00126)
Exchange rate								0.00419***
								(0.00143)
Constant	7.419***	7.195***	6.169***	6.244***	5.914***	5.829***	5.899***	6.248***
	(0.392)	(0.557)	(0.301)	(0.297)	(0.205)	(0.283)	(0.209)	(0.226)
Observations	64	64	60	60	56	56	56	56
R-squared	0.637	0.640	0.905	0.911	0.959	0.960	0.960	0.967
Number of country	4	4	4	4	4	4	4	4
country FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	NO	NO

Table 9: The Estimation of the Effect of the Credit to the Government on the Growth in GDP-PC

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	loggdppc	loggdppc	loggdppc	loggdppc	loggdppc	loggdppc	loggdppc	loggdppc
Credit gov	-0.0208***	-0.0206***	-0.0111***	-0.0106***	-0.00468*	-0.00467	-0.00501*	-0.00398*
	(0.00574)	(0.00582)	(0.00365)	(0.00341)	(0.00244)	(0.00282)	(0.00249)	(0.00233)
Financial openness	1.086***	1.072***	0.361**	0.328**	0.357***	0.357***	0.346***	0.247**
	(0.165)	(0.172)	(0.142)	(0.133)	(0.0950)	(0.0993)	(0.0964)	(0.0955)
Trade openness	0.0124***	0.0162	-0.00246	0.00105	-0.0136**	-0.0136**	-0.0138***	-0.0211***
	(0.00203)	(0.0118)	(0.00734)	(0.00697)	(0.00508)	(0.00514)	(0.00511)	(0.00535)
Term of trade	0.0106***	0.0118**	-0.0115***	-0.00802**	-0.0102***	-0.0102***	-0.0104***	-0.0162***
	(0.00310)	(0.00486)	(0.00385)	(0.00379)	(0.00257)	(0.00260)	(0.00259)	(0.00311)
c.tradeopen#c.termoftred		-3.94e-05	5.35e-05	2.91e-05	0.000185***	0.000185***	0.000187***	0.000260***
		(0.000118)	(7.29e-05)	(6.86e-05)	(5.10e-05)	(5.16e-05)	(5.13e-05)	(5.37e-05)
HC			1.602***	1.408***	1.440***	1.441***	1.453***	1.432***
			(0.177)	(0.179)	(0.123)	(0.133)	(0.124)	(0.115)
Inflation				-0.00427***	-0.00397***	-0.00397***	-0.00411***	-0.00282**
				(0.00148)	(0.00116)	(0.00124)	(0.00118)	(0.00118)
Regulation quality					0.574***	0.574***	0.563***	0.584***
					(0.0742)	(0.0752)	(0.0760)	(0.0706)
z_score						6.90e-05		
						(0.00727)		
Democracy index							0.000978	-9.55e-05
							(0.00127)	(0.00123)
Exchange rate								0.00398***
								(0.00137)
Constant	7.566***	7.445***	6.294***	6.430***	6.020***	6.018***	6.006***	6.320***
	(0.358)	(0.511)	(0.310)	(0.293)	(0.209)	(0.292)	(0.210)	(0.223)
Observations	64	64	60	60	56	56	56	56
R-squared	0.701	0.702	0.904	0.918	0.962	0.962	0.962	0.969
Number of country	4	4	4	4	4	4	4	4
country FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	NO	NO

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Compared to Turkey, the Difference between Brazil, Hungary, Poland in terms of the Impact of Financial Development on Growth in GDP-PC

VARIABLES	(1) loggdppc	(2) loggdppc	(3) loggdppc	(4) loggdppc	(5) loggdppc	(6) loggdppc	(7) loggdppc	(8) loggdppc
BRAZIL.FD	-3.709***	-3.722***	-3.169***	-2.836***	-1.376**	-1.367**	-1.483**	-1.485***
	(0.700)	(0.699)	(0.443)	(0.507)	(0.614)	(0.621)	(0.619)	(0.540)
HUNGARY.FD	-4.757***	-4.990***	-2.893***	-2.593***	-1.816***	-1.822***	-1.898***	-1.681***
	(0.591)	(0.633)	(0.470)	(0.518)	(0.601)	(0.608)	(0.604)	(0.529)
POLAND.FD	-2.296***	-2.240***	-0.535	-0.212	0.165	0.210	0.152	0.228
	(0.601)	(0.603)	(0.430)	(0.491)	(0.454)	(0.469)	(0.452)	(0.399)
Overall Financial Development	5.026***	4.935***	2.496***	2.184***	1.453***	1.466***	1.487***	1.208**
	(0.498)	(0.505)	(0.431)	(0.489)	(0.508)	(0.514)	(0.507)	(0.452)
Financial openness	0.466***	0.463***	0.165**	0.163**	0.258***	0.264***	0.242***	0.167**
	(0.111)	(0.111)	(0.0784)	(0.0778)	(0.0753)	(0.0773)	(0.0763)	(0.0712)
Trade openness	0.00795***	0.0171*	0.00861	0.00930	0.000544	0.000444	0.00127	-0.00460
	(0.00141)	(0.00899)	(0.00572)	(0.00570)	(0.00600)	(0.00607)	(0.00602)	(0.00548)
Term of trade	0.00605**	0.00910**	-0.00146	-0.00112	-0.00460	-0.00471	-0.00441	-0.00901***
	(0.00259)	(0.00393)	(0.00277)	(0.00276)	(0.00285)	(0.00289)	(0.00285)	(0.00281)
c.tradeopen#c.termoftred		-9.25e-05	-7.70e-05	-8.29e-05	2.38e-05	2.54e-05	1.56e-05	7.25e-05
		(8.95e-05)	(5.61e-05)	(5.58e-05)	(6.06e-05)	(6.13e-05)	(6.08e-05)	(5.51e-05)
HC			1.450***	1.421***	1.288***	1.265***	1.311***	1.357***
			(0.174)	(0.174)	(0.163)	(0.173)	(0.164)	(0.145)
Inflation				-0.00140	-0.00236**	-0.00253**	-0.00245**	-0.00147
				(0.00106)	(0.00111)	(0.00118)	(0.00111)	(0.00101)
Regulation quality					0.308***	0.305***	0.283***	0.310***
					(0.0904)	(0.0916)	(0.0929)	(0.0795)
z_score						-0.00248		
						(0.00549)		
Democracy index							0.00109	
							(0.000985)	
Exchange rate								0.00359***
								(0.00104)
Constant	7.113***	6.873***	5.346***	5.427***	5.791***	5.869***	5.728***	5.902***
	(0.258)	(0.347)	(0.285)	(0.289)	(0.268)	(0.322)	(0.273)	(0.238)
Observations	56	56	56	56	52	52	52	52
R-squared	0.922	0.924	0.971	0.972	0.978	0.978	0.979	0.983
Number of COUNTRY_NEW	4	4	4	4	4	4	4	4
country FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	NO	NO

Table 11: Compered to Turkey, the Difference between Brazil, Hungary, Poland in terms of the Impact of Private Credit on Growth in GDP-PC

VARIABLES	(1) loggdppc	(2) loggdppc	(3) loggdppc	(4) loggdppc	(5) loggdppc	(6) loggdppc	(7) loggdppc	(8) loggdppc
BRAZIL.	-0.00159	-0.000839	-0.0120***	-0.00800***	-0.00656**	-0.00620**	-0.00628**	-0.00930***
	(0.00234)	(0.00224)	(0.00308)	(0.00269)	(0.00260)	(0.00263)	(0.00285)	(0.00204)
HUNGARY	-0.0124***	-0.00860***	-0.00808***	-0.00604***	-0.00530***	-0.00547***	-0.00521***	-0.00706***
	(0.00191)	(0.00233)	(0.00194)	(0.00166)	(0.00175)	(0.00176)	(0.00181)	(0.00137)
POLAND.	0.00387*	0.00501**	0.00549***	0.00765***	0.00615***	0.00586***	0.00629***	0.00444***
	(0.00207)	(0.00201)	(0.00170)	(0.00148)	(0.00153)	(0.00156)	(0.00165)	(0.00121)
Privet cr	0.0129***	0.0135***	0.00837***	0.00789***	0.00526***	0.00567***	0.00541***	0.00464***
	(0.00115)	(0.00111)	(0.00133)	(0.00111)	(0.00138)	(0.00144)	(0.00151)	(0.00106)
Financial openness	0.488***	0.476***	0.238**	0.256***	0.308***	0.306***	0.315***	0.165**
	(0.0886)	(0.0842)	(0.0900)	(0.0747)	(0.0782)	(0.0783)	(0.0842)	(0.0650)
Trade openness	0.00857***	-0.0106	0.00283	0.000984	-0.00269	-0.00292	-0.00305	-0.00625
	(0.00105)	(0.00741)	(0.00654)	(0.00544)	(0.00534)	(0.00535)	(0.00559)	(0.00412)
Term of trade	0.000175	-0.00655*	0.000731	0.000245	-0.00162	-0.00161	-0.00176	-0.00583**
	(0.00239)	(0.00343)	(0.00361)	(0.00300)	(0.00289)	(0.00289)	(0.00298)	(0.00233)
c.tradeopen#c.termoftred		0.000183**	-4.49e-06	2.46e-05	6.51e-05	6.87e-05	6.93e-05	9.89e-05**
		(7.01e-05)	(6.63e-05)	(5.52e-05)	(5.45e-05)	(5.47e-05)	(5.78e-05)	(4.20e-05)
HC			1.187***	0.868***	1.086***	1.049***	1.052***	1.279***
			(0.222)	(0.196)	(0.216)	(0.220)	(0.260)	(0.168)
Inflation				-0.00403***	-0.00382***	-0.00354***	-0.00382***	-0.00198**
				(0.000851)	(0.000915)	(0.000963)	(0.000926)	(0.000773)
Regulation quality					0.236***	0.224***	0.233***	0.263***
					(0.0794)	(0.0805)	(0.0810)	(0.0608)
z_score						0.00475		
						(0.00504)		
Democracy index							-0.000275	
							(0.00112)	
Exchange rate								0.00465***
								(0.000844)
Constant	8.331***	9.008***	5.876***	6.668***	6.169***	6.208***	6.265***	5.807***
Privet cr	(0.238)	(0.344)	(0.650)	(0.564)	(0.584)	(0.586)	(0.707)	(0.450)
Observations	64	64	60	60	56	56	56	56
R-squared	0.946	0.952	0.968	0.979	0.981	0.981	0.981	0.989
Number of COUNTRY_NEW	4	4	4	4	4	4	4	4
country FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	NO	NO

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

THE IMPACT OF INCUBATORS ON ENTREPRENEURIAL PROCESS IN TURKEY: A GUIDE FOR STARTUPS

DOI: 10.17261/Pressacademia.2020.1219
JBEF- V.9-ISS.2-2020(6)-p.132-142

Muge Birden[1], Murat Bastug[2], Selim Yazici[3]
[1]Istanbul University, Department of Business Administration, Management and Strategy PhD. Candidate, Istanbul, Turkey.
muge.birden@ogr.iu.edu.tr , ORCID: 0000-0002-1042-3635
[2]Nisantasi University, Vocational School, Department of Business Management, Istanbul, Turkey.
murat.bastug@nisantasi.edu.tr , ORCID: 0000-0002-6406-2468
[3]Istanbul University, Faculty of Political Sciences, Department of Business Administration, Istanbul, Turkey.
selim@istanbul.edu.tr , ORCID: 0000-0001-7953-2496

Date Received: April 16, 2020 **Date Accepted:** June 12, 2020

To cite this document
Birden,M., Bastug, M., Yazici, S. (2020). The impact of incubators on entrepreneurial process in Turkey: a guide for startups. Journal of Business, Economics and Finance (JBEF), V.9(2), p.132-142.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2020.1219

ABSTRACT

Purpose The purpose of this study is to analyze the impact of the incubators on entrepreneurial processes in Turkey.
Methodology- We divided incubators in the sample universe into four different categories that are business based, university-private based, university-based and municipality incubators. We deciphered semi-structured and the face-to-face interviews, which were conducted in the incubation determined by the expert opinion, and interpreted the findings in the light of the purpose of the study.
Findings- We can conclude that there is a significant increase in the number of incubation centers and startups in Turkey where incubators help develop startups by providing advisory and administrative support services.
Conclusion- In general, the financial reasons and the need for convenient access make this criterion a vital one. However, it is also significant in terms of its proximity to the business center and the transportation network of the city, and its high accessibility for mentors.

Keywords: Incubator, incubator models, entrepreneurship, entrepreneurship process, Turkey.
JEL Codes: L26, M13

1. INTRODUCTION

Incubator means a container in which a weak or a premature baby can be kept alive through the controlled air and temperature conditions (Cambridge Dictionary, 2019). On the other hand, in business English, an incubator means an organization that helps people to start new companies, especially the ones involved with advanced technology (Cambridge Dictionary, 2019).

The business incubator is a new concept in enterprise and economic development, which benefits from extensive, mostly old, structures to house new small businesses (Fry, 1987). Defining and explaining the concept of “incubator” became a challenging task during the adaptation period of the original idea to meet the needs of the economy-related areas (Kuratko and LaFollette, 1987). Allen and Nyrop (1985) point out that it is common to hear the term used to encompass enterprises ranging from low-rent buildings providing space for more than one tenant to generic business assistance programs that operate throughout a community, the so-called “incubators without walls.” However, if incubators are everything to everyone, they assume no place as a unique enterprise development tool.

One of the key aspects of this relatively recent phenomenon is the concentration of firms and resources in a single area (Lumpkin and Ireland, 1988). Within this context, the main aim is to organize a business incubator accordingly to provide cost-sparing, time-saving, and skill-developing services in a centralized and controlled platform (Allen and Rahman, 1985). As Galante (1987) states, incubators are ". . . large buildings operated to nurture young companies by giving low-lease space, shared office services and administration advice."

According to Kuratko and LAFollette (1987), research studies (Humprey Institute, 1984; Allen and Nyrop, 1985; Allen and Rahman, 1985) have identified four main types of incubators:

Publicly-sponsored: These type of incubators are organized and managed through city economic development departments, urban renewal authorities, or regional planning and development commissions. Job creation is the main object of publicly-sponsored incubators.

Nonprofit-sponsored: These are organized and managed through industrial development associations of private industry, chambers of commerce, or community-based organizations with broad community support and a favorable record in real estate development. Urban development is the objective of nonprofit-sponsored incubators.

University-related: Many of these university-organized and managed facilities are spinoffs of academic research projects. Most of these are considered science and technology incubators. The goal of university-related incubators is to transfer the findings of basic research and development into new products or technologies, thus creating economic growth.

Privately-sponsored: These are organized and managed by private corporations. Their goal is, of course, to make a profit and, in some cases, to make a contribution to the community or the company by finding the right business partner from the first hand. Most often, though, it is a business, and thus, the goal is to make a profit.

Some researchers have attempted to conceptualize incubator formation and, to a limited extent, the process of incubation (Hackett and Dilts, 2004). Building on the survey data collected by Temali and Campbell (1984), and Campbell et al. (1985) develop a framework offering the first apparent linkage of the incubator-incubation concept to the business development process of incubatees, which mean companies registered under an incubator and in service for a period of time. This framework proposes four areas where incubators and incubation processes create value: the diagnosis of business needs, the selection and monitored application of business services, the provision of financing, and the provision of access to the incubator network. Apparently, with this framework, Campbell et al. have normatively defined the incubation process. This definition is practical since, for the first time, it thoroughly elaborates on how different components of, and activities within, the incubators are applied to help transform an idea into a feasible business. However, the framework fails to explain unsuccessful ventures (it assumes that all incubator tenants succeed), and to embrace all incubators but not limited to private ones (Hackett and Dilts, 2004).

2. THEORETICAL FRAMEWORK

The incubator development addresses the question of "what is an incubator?" and is engaged in descriptive and normative theorizing about the incubator-incubation concept. The primary formal hypothesis put forward to explain incubators is as follows: After controlling or eliminating extraneous factors that lead to early-stage failure in small businesses (poor management, inability to find early-stage financing, high overhead, etc.), the projected increased survival rate of new ventures should lead to increased employment and an expanded tax base (Brooks, 1986). This theory was utilized to address the gap between conceiving the new business concept and instantiating the firm. Brooks (1986) argues that the concepts of the incubator and incubation processes were necessary to narrow this gap. Transaction Cost Economics (TCE) can also be considered as another viewpoint to bridge the gap. Within the TCE view, a firm gains a competitive advantage by relentlessly lowering the costs of doing business (Williamson, 1975). From this point of view, the essential function of an incubator is to bridge the gap by reducing the startup and other operating expenditures of incubatees by providing shared office space and other services at a low cost. This situation frees the incubatee administration team to focus on forming the business and the market. A related hypothesis suggests that incubators aim at assisting entrepreneurs in developing their business enterprises in a supportive business environment. Without an incubator, most entrepreneurs would either not be in business or struggle to remain in business (Plosila and Allen, 1985).

This hypothesis is a "market failure argument" and is complemented by research that regards incubators as mechanisms for empowering a firm "to master the competitive factors linked with effectiveness within particular industry settings" (Lumpkin and Ireland, 1988). Whereas such presumptions are both intuitively compelling and hard to disprove, many incubatees report that they would have established their firms even if the incubators had not existed (Culp, 1996). These reports should not be necessarily taken as a proof against the incubator-incubation concept; however, as the courage and motivation required to launch a new enterprise may also be associated with unreasonable levels of confidence concerning personal capabilities and success (Nye, 1991).

Even though the incubator configuration studies were theoretical, inductive compilations of variables of the incubator-incubation phenomenon, this approach implicitly rests on Structural Contingency Theory (Hackett and Dilts, 2004). The primary assumption of structural contingency theory is that the configuration of an organization and the external environment must achieve "fit" to

obtain "success" (Ketchen et al., 1993). Even though most configuration studies do not test for success, structural contingency theory provides a theoretical underpinning for the mostly asserted need for the incubator to be tailored to meet local needs and standards. (Hackett and Dilts, 2004).

Rice (2002) explicitly grounds the collaborative incubator manager–incubatee relationship in the interdependent co-production condition. These condition models the co-creation aspects of the value-adding incubation process. It suggests that incubator managers must carry out business assistance intervention sessions for incubatees at strategically allocated time intervals and need to prepare an appropriate environment to make them to take advantage of advice and insights resulting from the intervention (Rice, 2002). This viewpoint is significant as it diverts our attention away from the incubator facility and makes us focus on the incubation process itself. It also reminds us of the significance of evaluating the core competencies of an incubator before entering and deciding if an incubator and an incubatee are a good fit. If there is no fit, the interdependent co-production may result in inappropriate, value subtracting incubation processes (Hackett and Dilts, 2004).

Commercialization usually happens within an innovation community rather than a single organization (Lynn et al., 1996). Hansen et al. (2000) employ Network Theory (Nohria and Eccles, 1992) to contend that primary value-added feature of networked incubators is the set of systemic forms carefully structuring and transferring knowledge throughout the incubator network to create conditions that facilitate the development of incubatees and the commercialization of their innovations. They find that degree of entrepreneurial intensity, economies of scale and scope, and network plan are significant factors for successful incubation processes. The research indicating that network relationship-building is the most significant value-added component of the incubation process underlines the importance of the network plan factor (Lichtenstein, 1992).

Network theory is also practical since it helpfully addresses the argument concerning the location of the incubation process: Rather than locating the process either inside an incubator or in a local community, network theory states that the incubation process includes and transcends the incubator (Hackett and Dilts, 2004).

3. EVOLUTION OF INCUBATORS

The concept of entrepreneurial development centers appears mixed in the description of form, function, purpose, and outcomes. The oldest and most common one is incubators.

3.1. The First Era between 1959 and 1970

The Batavia Industrial Center, which is the first known incubator, was established in 1959 by Joseph L. Mancuso in Batavia, New York. It mainly aimed to create jobs in the region when its local economy was stagnant. It adopted a new methodology for creating prosperous new enterprises (Zehner, Trzmielak, and Gwarda-Gruszczyńska, 2014). In addition to the emergence of the first incubator in the USA, it is a common knowledge that most of them reside in the USA. According to the information revealed by the Global Network of Entrepreneurial Ecosystem Builders (INBIA), there are 1,400 incubators in the USA (INBIA, 2012).

3.2. The Second Era between 1970 and 1990s

Since the first inception in Batavia, the USA, incubators were not so popular until the 1970s (Jamil, Ismail, and Mahmood, 2015). The United Kingdom originated managed workspaces in their modern form in 1975, when British Steel formed a subsidiary called British Steel (Industry) - BSI - to create jobs in steel closure areas. BSI created managed workspaces, sometimes outside of old buildings and sometimes building new ones. BSI also backed many in the UK's network of enterprise agencies, which gave advice to small businesses, and became pioneer in North-West England, notably in St. Helens, which faced technological redundancies in its principal glass-making industry (OECD, 1999).

In Germany, for instance, the University of Berlin established the first incubator in 1983, which aimed at facilitating the transfer of research findings to industry, and France followed in 1985, creating the second one within the Sofia Antipolis Technology Park (Aernoudt, 2004). In the 1990s, the trend was to develop technology incubators around specific industrial and technological clusters such as biotechnology, information technology, environmental technology, or speech technology (Aernoudt, 2004).

Rustam Lalkaka (2001) summarizes the conceptual evolution of the "incubator": "The 'first generation' incubators in the 1980s were essentially offering affordable space and shared facilities to carefully selected entrepreneurial groups. In the 1990s, the need was recognized for supplementing the workspace with counselling, skills enhancement and networking services to access professional support and seed capital, for tenants within the facility and affiliates outside. This has led to the 'second generation' of incubators, although many in the developing countries are still stuck in the original mode. Starting in 1998, a new incubation

model emerged in parallel. This is intended to mobilize ICT and provide a convergence of support, towards creating growth-potential, tech-based ventures."

3.3. The New Era Begins with Accelerators

In 2005, the incubation industry met another new model which is called the "accelerators." The first accelerator was Y Combinator, established in the USA by Paul Graham. They help enterprises identify and establish their initial products, find potential segments of consumers, and secure resources such as capital and employees. Exactly, accelerator programs are limited-duration programs—lasting roughly three months—that help cohort of ventures with the new enterprise processes. They generally supply a small amount of initial capital, including a workspace. They also provide a wide range of networking, training and mentoring opportunities with peer enterprises and mentors who may be prosperous entrepreneurs, graduates from related programs, venture capitalists, business angels, or even corporate executives. Eventually, most programs conclude with a grand event, generally a "demo day" where enterprises come together with a wide crowd of interested investors (Cohen, 2013). Today, accelerator programs have also diversified into industry-vertical focused programs, such as Surge (Houston, TX) which focuses on the acceleration of energy startups, Kaplan EdTech (New York, NY) which focuses on education-related startups, and Healthbox (Chicago and Boston) and Rock Health (San Francisco and Cambridge), which focus on acceleration of healthcare-related startups (Cohen and Hochberg, 2014).

At this level, accelerators have many similarities with incubators, but they differ in several ways. What distinguishes an incubator from other centers is that they provide clients with access to appropriate rental space and flexible leases, shared office services and equipment, technology support services, and assistance in obtaining business financing (NBIA, 2012). However, the main difference is in the limited duration of accelerator programs compared to longer-term support of incubators, angel investments, and other business support programs (Miller and Dalziel, 2018). The other difference is that incubators may acknowledge entrepreneurs that are on the idea stage; however, accelerators generally do not accept entrepreneurs that are on the idea stage.

4. ROLE OF INCUBATORS IN THE ENTREPRENEURIAL PROCESS

Startups stand as fundamental factors for creating jobs, and therefore, they reduce the unemployment rate in the country. Promoting entrepreneurship through incubators is necessary for economic development because incubators play a decisive role in creating successful startups. Choto argues that the task and objective of business incubators are to promote the creation and growth of the entrepreneurial venture (Choto, 2015). As an example, it is known that the number of European incubators has increased dramatically since the start of the financial crisis. Between 2007 and 2013, the number has risen by nearly 400 percent (Telefonica, 2013).

In the first four years, 50% of small businesses fail while 25% of all small businesses fail in the first year (Brain, 2016). On the other side, data from EBN and Impact Hub shows that incubated companies have a 90% survival rate within the incubation period and 87% survival rate after the incubation period (3 years) (EBN; EU|BIC, 2017).

The role of the incubator in the entrepreneurial process is not limited to being a business center with office facilities. Incubators offer training, networking, and consulting to startups. They can also help strengthen the link between capital and entrepreneurs. The Organisation for Economic Co-operation and Development (OECD) contends that entrepreneurs face several challenges in running their businesses, which hinder their full contribution towards economic growth and development, and these challenges are not limited to a lack of training and support, financial challenges, lack of skills, and a lack of entrepreneurial mindset (OECD, 2010). At this stage, business incubators are mostly regarded as providers of resources and services to entrepreneurs, including working, technical expertise, management mentoring, business administration, shared administrative services, networking, and access to new markets (Rao and Gebremichael, 2017).

According to the European Union Regional Policy (European Union, 2010), three stages of incubation are as follows:

Pre-incubation refers to all the activities required to assist the aspiring entrepreneurs in developing their business ideas, models and plans to improve the likelihood of a successful start-up. It typically includes a first evaluation of the idea, preparation and training, and guiding one to one assistance required to create a fertile environment for the client to write a full business plan. Usual examples for pre-incubators are university-affiliated ones.

Incubation relates to the assistance provided to the entrepreneur from the startup to the stage of expansion. It is normally a mid-term cycle that generally lasts for the newly formed company's first three years of operation, in which it is safe to tell that the new enterprise is successful and has a reasonable chance of growing into a fully developed business. The acts usually allowed are

access to credit, direct coaching and mentoring programs, as well as hosting and special training services. Physical incubation is only a subset of the overall incubation cycle although it is a quite valuable service.

Post-incubation is about the activities to be done after the company has attained maturity and is now able to walk on its own feet. In other words, this is the moment that the company will leave the incubator since it has been physically incubated. However, the SMEs might still need different services, such as increasing their sales or improving their efficient processes, internationalization services or implementing innovation through scouting and detection activities. The "post incubators" sometimes classify themselves as "accelerators."

All in all, making small businesses and entrepreneurial ventures contribute to the economy, there is a need for support from the incubators.

5. TYPES OF INCUBATOR IN TURKEY

The incubator system in Turkey is not as old as when we compare with the USA and Europe. When we look at the Turkish legal system, science parks have found their legal status with the enactment of the law on Technology Development Areas in 2001 and its implementation regulation in 2002.

The definition of an incubator, added into the Technology Development Areas Law in 2011, is as follows: "a kind of structure offers entrepreneurial companies office services, equipment support, management support, access to financial resources, critical business and technical support services provided under one roof in one hand, especially to develop young and new enterprises" (KOSGEB, 2012).

According to the implementation, the management company operates as an incubation center to train R&D and innovative companies in the region and to develop young and new enterprises. In Turkey, there are four types of incubators which are business-based, university-based, university-private based, and finally municipality-based ones. We will explain them respectively in the following parts.

5.1. Business-Based Incubators

The American National Business Incubation Association (NBIA) defined business incubation as a dynamic process of business enterprise development. According to NBIA (2012), average incubation cycle times are between two and three years.

Turkey has taken part in the General Entrepreneurship Monitor Data (GEM) Project for the first time in 2006. Therefore, entrepreneurship is not an old term for Turkey (Karadeniz and Özdemir, 2009). With this respect, the useful elements to develop entrepreneurship, such as incubators, are a very new area for Turkey. For example, Cyberpark, as the world's top business incubator affiliated with the university, is the first private technology incubator of Turkey, and it was established as a business and entrepreneurship center in 2003. There are 33 incubatees inside the incubator (Bilkent Cyberpark, 2019).

Incubators such as Workup, Albaraka Garaj, and Fincube analyzed in this study fall into this category. The common feature of the three is that private banks support all of them. Isbank Turkey supports the Workup, Albaraka Turk Participation Bank supports Albaraka Garaj, and finally QNB Finansbank supports the Fincube.

5.2. University-Based Incubators

Universities have a central position in the economic growth of a country. Many universities establish their incubators to contribute to the ecosystem of entrepreneurship and the knowledge transfer to many industries.

Universities would not only depend on educating students, promoting research or even transferring knowledge through patents, research contracts, licenses, and spinoffs but build the mechanisms to facilitate innovation, entrepreneurial culture, developing institutes and entrepreneurial leaders, and ensure the upgraded living standard of people (Audretsch, 2012). Palumbo and Dominici (Palumbo and Dominici, 2013) define university incubators as a university-sponsored incubation system with space provision within the university and behave to promote the development of university spinoffs. Somsuk, Laosirihongthong, and McLean (Somsuk, Laosirihongthong, and McLean, 2012) classified the essential resources for university incubators to promote entrepreneurs into four main categories such as human, financial, organizational, and technological resources.

According to the research, 47 of 193 universities in Turkey have their incubators (Özdemir, 2016). ITU Cekirdek, operating under the Istanbul Technical University ARI Teknokent since 2012, was selected as the 2nd best in Europe and the third-best in the world

by the International UBI Global index, which compares and ranks the entrepreneurship incubation centers of the leading universities in the world. ITU Cekirdek has supported 1,150 startups and 3,450 entrepreneurs so far.

Technology Development Centers (TEKMER) are incubator-like institutions established by KOSGEB in several university campuses in Turkey. TEKMER aims to help people to get trained in scientific and technological fields to become entrepreneurs, to foster the creation of new technology-based enterprises, to support the activities of existing small and medium-sized enterprises, to foster commercialization of R&D efforts, to help efforts of development and diversification of regional economic activities and to strengthen university-industry cooperation (Akçomak, 2003). By providing support and managerial, technical, and administrative consultancy mechanisms, TEKMER aims to create new technology-based firms and to establish a suitable environment for enabling these enterprises to survive (Akçomak, 2003).

While establishing incubators, universities require less financing, infrastructure, and technical capabilities as compared to other knowledge transfer mechanisms such as science and technology parks (Jamil, 2015).

5.3. University-Private Based Incubators

Nowadays, the way to develop technology is to produce knowledge with the works carried out in universities and companies, and then to transform it into technology by putting the information into practice. In this regard, efficient cooperation can only be possible by developing interfaces at the public level and providing necessary incentive regulations. Therefore, a state which plays a facilitating and encouraging role in university and industry cooperation becomes vitally important. University-Industry Collaboration Centers, established within universities, are structures to ensure university and industry cooperation, and their functionality reveals with successes of the studies carried out jointly. These centers aim to contribute to students and the private sector in such areas as government incentives, human resources, education, consultancy services, scientific research, and project management.

Kworks is one of the university-industry collaboration centers in Turkey. The Acceleration Program covers a 12-week intensive mentoring process. The program includes three phases: In the first phase, startups re-evaluate the compliance of their products or services with the market. Teams also verify their business models. In the second phase, startups develop the most intelligible solutions to make their products and services more compatible with the customer and market conditions. The third phase covers an increase in sales and investment seeking processes by introducing solutions to the market. At the end of all these processes, startups graduate with a one-day Demo Day event in which investors and agents in the ecosystem come together (Kworks, 2019).

5.4. Municipality-Based Incubators

Municipality-based incubators are a new type of public-based incubator. They operate to benefit from the features and abilities of the public in science and technological transformation. The only difference between other types of incubators is that they are established within municipalities and supported by them. The number of such incubators might increase in the following years, considering the physical, capital, and material possibilities of municipalities. Currently, there are two municipality-based incubators in Istanbul: Zemin Istanbul (founded and supported by Istanbul Metropolitan Municipality) and Uskudar Idea Art Center.

6. RESEARCH DESIGN, METHODOLOGY AND EMPIRICAL EVIDENCE FROM TURKISH INCUBATORS

The purpose of this study is to analyze the impact of the incubators on entrepreneurial processes in Turkey because it seems that the number of incubations has increased rapidly, and might continue to rise more. The sample universe of this research consists of all the incubators which are operating in Turkey, and we classified them accordingly. We divided all incubators in the sample universe into four different categories, as mentioned in the Section 5. Selected incubators were analyzed by using qualitative research methodology. We used the judgmental sampling method to select an incubator out of each category, and the judicial sampling method to select three startups for each incubator. The opinion of an expert (who was the founder of a research platform called “startups.watch” that empowers interested parties (like investors) to figure out trends, transactions, and what’s next via tracking startup ecosystem) was also taken into consideration in this process. On the other side, we selected the startups according to the incubators’ opinion. The selected incubators and startups are listed in Table 1.

Table 1: The Incubators and Startups Analyzed in the Framework of the Study

INCUBATORS	**STARTUPS**		
WORKUP	Epiqur	Userguiding	Doktorderki

KWORKS	Viravira.co	Vidyou	Lella App
ITU CEKIRDEK	CatchU	FilameX	PardonApp
USKUDAR FIKIR SANAT MERKEZI	Funsef	Notificup	Yemexpress
ALBARAKA GARAJ	Mixoper	Yubi	Zenkronn
FINCUBE	Price&me	Akillisatici.com	Nkolay Ofis

The study has a significant limitation as a result of having included only the incubators operating in Istanbul. We collected data by face-to-face interviews with the officials of the incubators and founders of the startups.

Despite the differences between the types of entrepreneurial development centers, the main components of an incubation model include at least four of the five following services: (1) access to physical resources, (2) office support services, (3) access to capital, (4) process support and (5) networking services (Carayannis and Zedtwitz, 2005).

In this study, we interviewed six incubators' directors from four categories, and 18 start-ups in the incubators in Turkey (Table 1 and Table 2). The interview questions were semi-structured and designed to discover the impact of incubators on the entrepreneurship process in Turkey.

Table 2: A layout of the four incubator types

	Business-based Incubators			**University-private based Incubators**	**University-based Incubators**	**Municipality-based Incubators**
	WORKUP	**ALBARAKA GARAJ**	**FINCUBE**	**KWORKS**	**ITU CEKIRDEK**	**USKUDAR FIKIR SANAT MERKEZI**
The year of establishment	2017	2017	2018	2014	2012	2016
Period	6 months	1 year	4 months	11-12 months	1 year	Max. 18 months
Admission Requirements	Having a technical partner and beyond the idea stage	A technology-based startup that can be integrated into a bank	Specialized in Fintech vertical Having a team and a potential to cooperate with QNB Finansbank	Having a technical partner, a team and a startup moving beyond the idea stage	Being a team to meet the needs of unique value proposition for the startup and to have core competencies to put it on the market	Putting forward an idea which is possible to put into practice, to illustrate and to have a future potential
Facilities	Office, Mentorship, Training, Network, Consultancy and one-on-one support	Office, Mentorship, Training, Network, Consultancy and one-on-one support	Office, Mentorship, Training, Network, Consultancy and one-on-one support	Office, Mentorship, Training, Network, Consultancy and one-on-one support	Office, Mentorship, Training, Network, Consultancy and one-on-one support	Office, Mentorship, Training, Network, Consultancy and one-on-one support
	Institutional Power of IsBank (the first national bank in Turkey)	Institutional Power of Albaraka Turk Participation Bank 50.000 TL grant for free	Institutional Power of QNB Finansbank 5.000 USD grant for free for each startup after one-month probationary period	Institutional Power of Koc Holding	ITU and ITU ARI Teknokent Networking	Institutional Power of the Municipality of Uskudar

The location of the incubation center	Kolektif House	Albaraka Turk Participation Bank	QNB Finansbank	Koc University	Istanbul Technical University	Burhan Felek Mansion
Expectations of Incubators	The startup should develop and contribute to the economy	The startup should sell at least once in that year, pivot its products, reach a certain stage and have growth tendency	Seriousness and determination	The partners of the startup should fully attend the program	Full commitment, attention, good utilization of ITU Cekirdek	Progress of the project and its level of productivity

The similarities and differences among the facilities provided by the incubator types can be easily noticed by considering Table 2. All the incubators offer such fundamental facilities as offices, mentorship, training, network, consultancy and one-on-one support services. The main points the incubators differ from each other are the grants, the strength of their networks, their incubator brand values, the start-up selection processes, and program durations. The shortest-term program is 4 months while the longest one lasts for 18 months.

7. CONCLUSION

This study analyzed the impact of incubation centers in Turkey. In this regard, we deciphered semi-structured and the face-to-face interviews, which were conducted in the incubation determined by the expert opinion, and interpreted the findings in the light of the purpose of the study.

Minimum application requirements for all chosen incubation centers are “a logical idea” “beyond idea stage” and “a team.” However, there may also be other admission requirements specified by the incubation centers. For example, Albaraka Garaj and Fincube, which are examples of business-based structures, prefer startups in the FinTech vertical that are possible to integrate into a bank’s product and service lines.

As we can see from Table 2, the main components of an incubation model include the following services: access to physical resources, office support services, access to capital, process support, and networking services. These facilities can be accepted as primary ones since they are both the minimum services offered by each incubation center and the essential needs for a startup. In return for these primary facilities, the basic expectations of all incubation centers are the same: a startup to complete the period successfully and to become self-sufficient in the following processes. After having analyzed the primary facilities, we can say that the facilities offered by all the incubation centers compromise with the expectations of the startups operating in the centers.

In addition to the core ones, incubation centers also offer other facilities which provide various advantages for enterprises. For example, the institutional power of Isbank is the most prominent advantage of Workup. Similarly, the institutional power of Koc Holding is the main advantage of Kworks, just as the power of the network of ITU Ari Teknokent is for ITU Cekirdek, the institutional power of the Municipality of Uskudar is for Uskudar Fikir Sanat Merkezi, the institutional power of Albaraka Turk Participation Bank and the grant of 50,000 TL for free are for Albaraka Garaj, or the institutional power of QNB Finansbank and the grant of 5.000 USD for free for each startup after one-month probationary period are for the Fincube. As it is known, grants and financial resources are essential for startups in the initial phase. Startups that highly need for financial resources often choose incubation centers providing grants.

Another important criterion in determining the right incubation center for startups is its location. In general, the financial reasons and the need for convenient access make this criterion a vital one. However, it is also significant in terms of its proximity to the business center and the transportation network of the city, and its high accessibility for mentors. Startups prefer the Workup since it is in the Kolektif House, Levent, which is in the middle of the business district in Istanbul. Likewise, startups prefer Kworks for its being located in Mecidiyeköy, a central place in Istanbul, just as ITU Cekirdek is in ITU, Uskudar Fikir Sanat Merkezi is in a central and historical mansion in Uskudar, Albaraka Garaj is in the headquarters of Albaraka Turk Participation Bank, and Fincube is also situated in the headquarters of QNB Finansbank.

Considering the establishment years of the incubation centers and the startups interviewed in the study, we can conclude that most of them were established between the years 2012 – 2018. This fact indicates that there is a significant increase in the number of incubation centers and startups in Turkey. Furthermore, the opportunities and facilities offered by the state are also increasing, thus stimulating the entrepreneurship ecosystem and encouraging all stakeholders in Turkey.

As a result, the incubation centers, analyzed in the study, provide access to physical resources, office space and support services, access to capital, process and legal support, and networking services besides other value-added services.

The most important limitations of the study are that it is only limited to Istanbul (indeed, most of the startups and incubation centers are in Istanbul), that the incubation centers are selected by judicial sampling, and that the number of incubation centers is limited to 6 and the number of startups limited to 18.

In the light of the findings of this qualitative paper, a comprehensive quantitative study which will include all the incubation centers and startups operating in these centers all around Turkey could be a subject for future research.

REFERENCES

Aernoudt, R. (2004). Incubators: Tool for Entrepreneurship? Small Business Economics, 127-135.

Akçomak, S. (2003). Technology Development Centers in Turkey. Middle East Technical University.

Allen, D. N., and Nyrop, K. A. (1986). An Examination of State's Small Business Incubator Initiatives. Institute of Public Administration, Pennsylvania State University.

Allen, D. N., and Rahman, S. (1985). Small business incubators: a positive environment for entrepreneurship. Journal of Small Business Management, 23(3), 12.

Audretsch, D. (2012). From the Entrepreneurial University to the University for the Entrepreneurial Society. The Journal of Technology Transfer, 313-321.

Brain, S. (2016). Startup Business Failure Rate by Industry. Statistic Brain. Retrieved from http://www.statisticbrain.com/:http://www.statisticbrain.com/startup-failure-byindustry

Brooks, O. J. (1986). Economic development through entrepreneurship: incubators and the incubation process. Economic Development Review, 4(2), 24-29.

Cambridge Dictionary. Cambridge Advanced Learner's Dictionary and Thesaurus. Cambridge University Press. Retrieved from https://dictionary.cambridge.org/dictionary/english/incubator

Campbell, C., Kendrick, R. C., and Samuelson, D. S. (1985). Stalking the latent entrepreneur: business incubators and economic development. Economic Development Review, 3(2), 43-49.

Choto, P. (2015). The Impact of Business Incubators on Survivalist Entrepreneurs in the Cape Metropolitian Area. Cape Town: Cape Peninsula University of Technology.

Cohen, S. (2013). What Do Accelerators Do? Insights from Incubators and Angels.

Cohen, S., and Hochberg, Y. (2014). Accelerating Startups: The Seed Accelerator Phenomenon.

Culp, R. P. (1996). A test of business growth through analysis of a technology incubator program (Doctoral dissertation, Georgia Institute of Technology).

EBN; EU|BIC. (2017). Incubating Innovation Accelerating Entrepreneurship.

European Union. (2010). The Smart Guide to Innovation-Based Incubators. European Commision. Retrieved from https://ec.europa.eu/regional_policy/sources/docoffic/2007/working/innovation_incubator.pdf

Fry, F. L. (1987). The role of incubators in small business planning. American Journal of Small Business, 12(1), 51-62.

Galante, S. P. (1987). Business incubators adopting niche strategies to stand out. Wall Street Journal, 13(1).

Hackett, S. M., and Dilts, D. M. (2004). A systematic review of business incubation research. The Journal of Technology Transfer, 29(1), 55-82.

Hansen, M. T., Chesbrough, H. W., Nohria, N., and Sull, D. N. (2000). Networked incubators. Harvard business review, 78(5), 74-84.

NBIA. (2012). Numbers of Entrepreneurship Centers (by Type) in US.

Jamil, F. (2015). University Incubators: A Gateway to an Entrepreneurial Society. Journal of Economics and Sustainable Development, 153-160.

Jamil, F., Ismail, K., and Mahmood, N. (2015). A Review of Commercialization Tools: University Incubators and Technology Parks. International Journal of Economics and Financial Issues, 223-228.

Karadeniz, E., and Ozdemir, O. (2009). Entrepreneurship in Turkey and developing countries: A comparison of activities, characteristics, motivation and environment for entrepreneurship. Mibes Transactions, 3(1), 30-45.

Ketchen Jr, D. J., Thomas, J. B., and Snow, C. C. (1993). Organizational configurations and performance: A comparison of theoretical approaches. Academy of management journal, 36(6), 1278-1313.

KOSGEB. (2012). Turkish Entrepreneurship Strategy and Action Plan.

KOSGEB. (2019). Retrieved from http://en.kosgeb.gov.tr/site/tr/genel/detay/347/about-kosgeb

Kuratko, D. F., and LaFollette, W. R. (1987). Small business incubators for local economic development. Economic Development Review, 5(2), 49.

Kworks. (2019). Retrieved from https://kworks.ku.edu.tr/sss/

Lalkaka, R. (2001). Best Practices in Business Incubation: Lessons (yet to be) Learnt. International Conference on Business Centers: Actors for Economic & Social Development.

Lichtenstein, G. A. (1992). The significance of relationships in entrepreneurship: A case study of the ecology of enterprise in two business incubators.

Lumpkin, J. R., and Ireland, R. D. (1988). Screening practices of new business incubators: the evaluation of critical success factors. American Journal of Small Business, 12(4), 59-81.

Lynn, L. H., Reddy, N. M., and Aram, J. D. (1996). Linking technology and institutions: the innovation community framework. Research policy, 25(1), 91-106.

Miller, C., and Dalziel, M. (2018). How to Benchmark Accelerators and Other Business Support Programs. Business Finland.

Nohria, N., and Eccles, R. G. (1992). Networks and organizations: Structure, form, and action.

Nye, J. V. (1991). Lucky fools and cautious businessmen: on entrepreneurship and the measurement of entrepreneurial failure. The Vital One: Essays in Honor of Jonathan RT Hughes. Research in Economic History, 6, 131-52.

OECD. (1999). Technology Incubators:Nurturing Small Firms. Paris.

OECD. (2010). Lessons from the Global Crisis and the Way Forward to Job Creation and Growth. Paris.

Özdemir, B. (2016). Girişimciliğin Desteği Olarak Üniversite Kuluçka Merkezleri, Türkiye Perspektifi. 2nd International Congress on Economics and Business (s. 115-124). Manisa Celal Bayar Üniversitesi.

Palumbo, F., and Dominici, G. (2013). University Incubator as Catalyst of Resources for Academic Spin-Offs: The Case of Arca Consortium. Recent Advances in Business Management and Marketing, 209-218.

Plosila, W. H., and Allen, D. N. (1985). Small business incubators and public policy: implications for state and local development strategies. Policy Studies Journal, 13(4), 729-734.

Rao, S., and Gebremichael, H. (2017). How Does Business Incubation Affect Growth of Firms? Evidence from Ethiopia. Global Journal for Research Analysis, 547-550.

Rice, M. P. (2002). Co-production of business assistance in business incubators: an exploratory study. Journal of business venturing, 17(2), 163-187.

Somsuk, N., Laosirihongthong, T., and McLean, M. (2012). Strategic Management of University Business Incubators (UBIs): Resource-Based View (RBV) Theory. IEEE International Conference on Management of Innovation & Technology (ICMIT), 611-618.

Telefonica (2013). The Accelerator and Incubator Ecosystem in Europe.

Temali, M., and Campbell, C. (1984). Business incubator profiles: a national survey. Hubert H. Humphrey Institute.

Torun, M., Peconick, L., Sobreiro, V., and Kimura, H. (2018). Assessing Business Incubation: A Review on Benchmarking. International Journal of Innovation Studies.

Willianson, O. E. (1975). Markets and hierarchies: analysis and antitrust implications. New York.

Zehner, W., Trzmielak, D., and Gwarda-Gruszczyńska, E. (2014). Business Incubation in the USA. Researchgate, s. 145-162.

Appendix 1

The questions for the directors of the incubators are as follows
1. What criteria do you look for when you accept a new entrepreneur?
2. What are your expectations from entrepreneurs?
3. What are the facilities you offer to entrepreneurs?
4. What are the challenges you have with entrepreneurs?
5. Are you satisfied with the situation of incubators in Turkey? Can you evaluate this positioning?
6. Can you share your growth targets with your future targets?
The questions for entrepreneurs in the incubators are as follows
1. Why did you choose this incubator? What criteria did you consider?
2. How much did your incubation center increase your potential? Did your startup accelerate after entering the incubation center?
3. What problems do you have in the incubator?
4. What are your expectations from an incubator center?
5. Are you satisfied with the situation of incubators in Turkey? Can you evaluate this positioning?

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

THE RELATIONSHIP BETWEEN TAX BURDEN AND ECONOMIC GROWTH: TURKEY CASE

DOI: 10.17261/Pressacademia.2020.1220
JBEF- V.9-ISS.2-2020(7)-p.143-154

Ozay Ozpence[1], Nedim Mercan[2]
[1]Pamukkale University, Faculty of Economics and Administrative Sciences, Department of Public Finance, Denizli, Turkey.
oozpence@pau.edu.tr, ORCID: 0000-0003-1502-3240
[2]Pamukkale University, Faculty of Economics and Administrative Sciences, Department of Public Finance, Denizli, Turkey
nedimmercann@gmail.com, ORCID: 0000-0002-7604-6828

Date Received: April 22, 2020 **Date Accepted:** June 14, 2020

To cite this document
Ozpence, O., Mercan, N. (2020). The relationship between tax burden and economic growth: Turkey case. Journal of Business, Economics and Finance (JBEF), V.9(2), p. 143-154.
Permenant link to this document: http://doi.org/10.17261/Pressacademia.2020.1220

ABSTRACT

Purpose – In the theoretical framework, the relationship between tax revenues and economic growth, which is the multiplier mechanism, shows that an increase in tax revenues has a negative impact on economic growth. In this study, the relationship between tax burden and economic growth is examined by VAR analysis and Granger causality test.
Methodology – In this study, VAR analysis and Granger Causality test analysis methods are used. In the study, the analysis is done for Turkey. Annual data are used in the study. The analysis covers the years from 1970 to 2018. In the study, firstly VAR analysis is done and then Granger Causality test is performed.
Findings – The findings obtained in the analysis are as follows. In the VAR analysis the tax burden has a negative effect on the 3rd period growth. As a result of the Granger Causality test, it is concluded that tax burden and economic growth are mutual causes of each other.
Conclusion – According to the results obtained, the tax burden affects economic growth negatively. Accordingly, increasing tax rates will not have positive feedback in terms of economic growth, and vice versa, its will have negative effects on economic growth. It would be more positive result, if policy makers reduce their tax rates in practice rather than increasing.

Keywords: Tax Burden, Economic Growth, VAR Analysis, Causality, Tax Policy
JEL Codes: H20, O10, C50

1. INTRODUCTION

States must have a revenue in order to fulfill their public needs. The most important source of revenue of the states is tax revenues and this is the most important feature of taxes. However, in addition to the task of providing public finance, taxes have gradually started to be used for balancing the social and economic order. Economies in the world generally attach great importance to economic growth. But it also gives the same importance to earning an income for growth. Taxes as financing are always important for both developed and developing countries. In the definition of the tax, it is emphasized that it is public revenue and it is also unrequited. How much tax will be collected, how much will be collected from whom and how it will be collected is implemented with different policies for each country.

Taxes as public revenue appear to be a shared financial obligation among all those living under the legal domination of the state (Özpençe and Özpençe, 2007, 3, Özgün et al., 2016, 29 – 30). Economic growth is a sine qua non for the states. In the historical doctrines that started with Mercantilism, they are engaged in the development of growth in the light of various policies. Physiocrats, who say that growth can be by agriculture, oppose the Mercantilist view that growth can be by keeping precious metals in the country. This trend in France explains that taxes should only be charged through agriculture (Higgs, 2001, 19 – 20).

Later, the classical school emerged as the basis of modern economics, defended by important figures such as Smith, Ricardo, Malthus and opposed to the intervention of the state by shaping in the framework of liberal policies in general. According to the classics, the basic condition of growth is to have a productive population. It is accepted by many economists that the free market economy is a better system for growth and therefore argues that the state should not interfere with the market (Özpençe, 2017, 33). Smith who referring to the division of labor, argues that labor will specialize in the division of labor, and this specialization will lead to growth (Smith, 1998, 17 – 19)

In the Keynesian school, growth is handled in the short term and argues that it will happen with the increase in demand. The Harrod - Domar growth model, which is referred to as the long - term version of Keynes, states that the increase in investments, such as Keynes, will create a double effect and result in capacity increase and demand effect. Demand effect will also lead to an increase in investment and consumption expenditures (Doğan, 2014, 369). Solow model, which makes various criticisms of Harrod - Domar growth model, states that growth can be achieved with technical developments (Solow, 1956, 65 – 66, Solow, 1957, 312 – 313). Later, the Intrinsic Growth Model emerged, pioneered by Lucas and Romer, evolving with names like Barro and Grossman - Helpman.

The progress of countries towards continuous development also creates new theories in economic theory (Fine, 2000, 245). In this model, it is stated that Romer and Lucas, technological development, R & D, education investments and human capital investments will provide growth. In addition, Barro states that the investments and expenditures of the public sector in the productive areas will be the factor that provides economic growth (Erdoğan and Canbay, 2016, 36 – 39, Saraç, 2015, 23 – 24, Şiriner and Doğru, 2005, 166 – 167).

It is known that the basis of growth is mainly production, but also growth will be ensured with the increase in production. However, especially after the 1970s, with the globalization, the circulation of production factors becomes free and makes the production process difficult. Especially in developing countries, with the liberalized capital mobility in 1980 and after, growth begins to depend on capital inflows. Since this capital mobility is particularly short-term, growth becomes dependent on high break.

This study explains the concept of the tax burden in Turkey after the first view the relationship between economic growth and the tax burden is then given to literature. Then an econometric study is carried out for Turkey and finally the study is concluded with the results and evaluation part.

2. TAX BURDEN

Taxes are income collected and compulsory according to everyone's financial strength in order to cover public expenditures. Everyone pays the tax directly or indirectly. However, taxes are seen as an income for the state and an expense for the payer. As a matter of fact, it is known that the direct and indirect separation of the taxes and the high indirect tax rates in our country do not give tax according to the financial power of people, in this case it forces low income people.

The fact that taxes are unrequited appears to be a burden or discontent for taxpayers (Neumark, 1937, 257, Pehlivan, 2014, 160). This is because it causes a decrease in the economic power of taxpayers, i.e. their income. Naturally, it is normal for people to see conditions that negatively affect their economic power as a burden. It is possible to classify the tax burden into subjective tax burden and objective tax burden. The subjective tax burden is the pressure felt by taxpayers, and this reflects a psychological effect. The objective tax burden is expressed as the ratio between the tax paid by the taxpayers and their income (İnaltong, 2012, 17).

The tax burden can be expressed as the ratio of taxes paid to the total taxable base, although no specific definition is made (Öztürk and Ozansoy, 2011, 198). Tax burden imposes a burden on taxpayers and is important in terms of achieving large-scale targets such as economic growth and income distribution. Tax rates are one of the most important factors affecting tax burden. The high tax rates and the introduction of new taxes increase the pressure on individuals and lead them to look for ways to tax avasion or evade taxes. In this way, the high tax burden reduces the profits of investors and also adversely affects capital investments (Işık and Kılınç, 2009, 150, İdikut Özpençe and İşler, 2017, 129).

Previously, A. Laffer drew the relationship between tax rates and tax revenues on napkin paper at a restaurant in Washington in 1974, and after a while he wrote its theory. Since A. Laffer wrote this in 1974, the inverse relationship between tax rates and government revenues has been discussed. It is stated that if the tax rates are high, the incomes of the state will decrease and people will evade the tax and it will have negative effects on the growth. Tax rates should be neither 100% nor 0%. Because in

both cases there are negative aspects for both the state and taxpayers (Ballard et al., 1985, 188, Laffer, 2004, 2, Wanniski, 1978, 3 – 4 (https://www.nationalaffairs.com/public_interest/detail/taxes-revenues-and-the-laffer-curve)) (13.12.2017).

The tax burden is grouped under various names. These groupings are briefly defined as follows. Total tax burden is expressed as the ratio of all taxes collected in a country in a given period to GDP in that period. The total tax burden represents the tax capacity that a country pays over a period. The personal tax burden is defined as the ratio of all taxes paid by a person to all income received during that period. In this way, the tax burden in sectors and regions is expressed in the same logic. As of 2001, Marmara region has the highest regional tax burden and Eastern Anatolia region has the lowest tax burden (Günay, 2007, 5, İnaltong, 2012, 17, Tekbaş and Dökmen, 2007, 203).

The tax burden is directly proportional to the tax paid and inversely proportional to the solvency. In this case, if the amount of tax payable increases, the tax burden increases, and as the solvency increases, a decrease in tax burden occurs. In other words, an increase in the amount of tax paid causes an increase in the tax burden, while an increase in the wealth or income of tax payers reduces the tax burden (Öztürk and Ozansoy, 2011, 199, Çiftçi et al., 2012, 83). It is known that the tax burden should be distributed fairly among sectors, regions, individuals and institutions. The fair and balanced distribution of the tax is important in this regard. In this respect, in most countries, the fair distribution of the tax burden is applied within the framework of laws. In our country, this issue is included in article 73 of the constitution (Rakıcı and Vural, 2011, 62 – 65). The fair distribution of the tax burden is also important for voluntary compliance. There are several reasons for voluntary compliance. The first is justice, as previously stated, the second is the belief that taxes are used in the public interest, and the third is the fairness of the tax burden (Çiftçi et al., 2012, 84).

Considering the tax burden for Turkey is seen to be particularly much difference between direct taxes and indirect taxes. The status of Turkey's tax revenues are examined in Table 1. It is also stated its share in tax revenues.

Table 1: Share of Income Tax, Corporate Tax and VAT in Budget Revenues

Years	Tax Income	Income Tax Rev.	Ratio in Tax Rev. (%)	Corporate Tax Rev.	Ratio in Tax Rev. (%)	Total VAT Rev. (Domestic + Import)	Ratio in Tax Rev. (%)	Income Tax + Corporate Tax + VAT Rev.	Ratio in Tax Rev. (%)
2000	26.503.698	6.212.977	23,4	2.356.787	8,9	8.379.554	31,6	16.949.318	64,0
2001	39.735.928	11.579.424	29,1	3.675.665	9,3	12.438.860	31,3	27.693.949	69,7
2002	59.631.868	13.717.660	23,0	5.575.495	9,3	20.400.201	34,2	39.693.356	66,6
2003	84.316.169	17.063.761	20,2	8.645.345	10,3	27.031.099	32,1	52.740.205	62,6
2004	101.038.904	19.689.593	19,5	9.619.359	9,5	34.325.208	34,0	63.634.160	63,0
2005	119.250.807	22.817.530	19,1	11.401.986	9,6	38.280.429	32,1	72.499.945	60,8
2006	151.271.701	31.727.644	21,0	12.447.354	8,2	50.723.560	33,5	94.898.558	62,7
2007	171.098.466	38.061.543	22,2	15.718.474	9,2	55.461.123	32,4	109.241.140	63,8
2008	189.980.827	44.430.339	23,4	18.658.195	9,8	60.066.230	31,6	123.154.764	64,8
2009	196.313.308	46.018.360	23,4	20.701.805	10,5	60.169.248	30,6	126.889.413	64,6
2010	235.714.637	49.385.289	21,0	22.854.846	9,7	75.649.986	32,1	147.890.121	62,7
2011	284.490.017	59.885.000	21,0	29.233.725	10,3	95.550.463	33,6	184.669.188	64,9
2012	317.218.619	69.671.645	22,0	32.111.820	10,1	103.155.875	32,5	204.939.340	64,6
2013	367.517.727	78.726.008	21,4	31.434.581	8,6	123.878.363	33,7	234.038.952	63,7
2014	401.683.956	91.063.306	22,7	35.163.517	8,8	130.538.554	32,5	256.765.377	63,9
2015	465.229.389	105.395.330	22,7	37.009.625	8,0	153.844.174	33,1	296.249.129	63,7
2016	529.607.901	123.686.147	23,4	46.898.425	8,9	168.808.352	31,9	339.392.924	64,1
2017	626.082.415	143.962.939	23,0	57.868.208	9,2	206.679.678	33,0	408.510.825	65,2
2018	738.180.401	175.420.074	23,8	84.132.155	11,4	250.661.593	34,0	510.213.822	69,1

Source: GİB (Gelir İdaresi Başkanlığı), (http://www.gib.gov.tr/sites/default/files/fileadmin/user_upload/VI/CVI3.htm) (16.10.2019).

The share of income tax in total tax revenues is calculated as 22.4% on average. The share of corporate tax in total tax revenues is 9.5% on average. The share of total VAT in tax revenues is calculated as 32.6% on average. When we look at the share of the three big taxes in the total tax revenues, it is seen that the average amount is 64.4%. When Table 1 is evaluated in terms of indirect and direct taxes, it is seen that VAT, income tax and corporate tax are higher than the total share of tax revenues.

The tax burden ratio in Turkey is seen in Table 2 below. In addition, OECD's tax burden average is taken in order to make comparisons.

Table 2: GDP, General Budget Tax Revenues, Tax Burden in Turkey and OECD Tax Burden Average

Years	GDP (Thousand TL)	Tax Revenue (Thousand TL)	Tax Burden (%) (2/1)	OECD Avarage(%)
2002	359.358.871	59.644.416	16,6	33,02
2003	468.015.146	81.783.798	17,5	33,93
2004	577.023.497	100.373.326	17,4	33,89
2005	673.702.943	119.627.198	17,8	33,37
2006	789.227.555	137.480.292	17,4	33,50
2007	880.460.879	152.835.111	17,4	33,57
2008	994.782.858	168.108.960	16,9	33,94
2009	999.191.848	172.440.423	17,3	32,20
2010	1.160.013.978	210.560.388	18,2	32,29
2011	1.394.477.166	253.809.179	18,2	32,59
2012	1.569.672.115	278.780.848	17,8	33,06
2013	1.809.713.087	326.169.164	18,0	33,35
2014	2.044.465.876	352.514.457	17,2	33,59
2015	2.338.647.494	407.818.455	17,4	33,71
2016	2.608.525.749	459.001.741	17,6	34,42
2017	3.110.650.155	536.617.206	17,3	34,24
2018	3.724.387.936	621.536.356	16,7	34,26

Source: a) GİB, (http://www.gib.gov.tr/sites/default/files/fileadmin/user_upload/VI/GBG/Tablo_3.xls.htm) (16.12.2019)
b) OECD, (https://data.oecd.org/tax/tax-revenue.htm) (16.12.2019)

Table 2, there is GDP, tax revenues are the general budget and tax burden in Turkey, while the OECD average tax burden. In terms of years, the lowest tax burden was realized in 2002, while the highest tax burden was realized in 2010 and 2011. Within the framework of these years, there is not much increase and decrease in tax burden. The average tax burden in Turkey between the years 2002-2018 is calculated as 17.45%. This average is lower than the average of all OECD countries (33.46%) in this period. But despite the low of Turkey's tax burden in OECD countries, there is no a fair distribution. The gap between indirect and direct taxes in Turkey explains that the tax burden is not distributed fairly and in a balanced way.

The issue of fair and balanced distribution of the tax burden is expressed even during the II Development Plan. Accordingly, considering the impact of Turkey's current taxation system on the economy, the fair and balanced distribution of the tax burden, increasing the savings amounts in terms of the development of the economy at the desired speed and direction, and distribution is an important factor (Avcı, 1988, 32). One of the reasons why the tax burden in Turkey is lower than the average tax burden of OECD countries is due to the narrow tax base in our country. The fact that taxes are generally take from goods, services and income and also affects the narrowness of the tax base due to the high tax evasion in our country (İlhan, 2007, 7).

3. LITERATURE REVIEW

When the literature is examined, various results of the studies that examine the relationship between economic growth and tax are shown in the Table 3. One of the main reasons why the results are different here are the level of development of the countries and the different economic policies they implement.

In the studies we have analyzed, it is seen that generally time series analysis and panel data analysis methods are used. In the literature, only the relationship between tax burden and economic growth is not examined in the general framework. It is also

involved in studies that address a single specific tax, such as the impact of the indirect tax burden on economic growth. Table 3 in our study is useful to see different analyzes. The reason why different analyses are included in the analysis of tax burden and economic growth is that the issue is multifaceted. When we look at the literature table, Kneller et al. (1999), Lee and Gordon (2005), Arnold (2008), Veronika and Lenka (2012), Demir and Sever (2016) and Stoilava (2017) use panel data analysis. At the same time, Anastassiou and Dritsaki (2005) and Ünlükaplan and Arısoy (2011) use causality tests and Erdoğan et al. (2013) we see that they use cointegration analysis and causality tests. The studies carrying out VAR analysis are Mucuk and Alptekin (2008) and Bacarezza et al. (2013) it can be seen in table 3.

Studies conducted with panel data analysis mostly conclude that the tax burden has a negative effect on economic growth. Unlike these studies, Stoilova (2017), who could not find the same result, concludes that there is a fundamentally positive effect. When we look at the causality test results, it is seen that there is a causality relationship between tax burden and economic growth. In the studies analyzed by VAR analysis, there are studies that have obtained both negative and positive results between tax burden and economic growth. The most effective reason for this is that the economic structures of the countries discussed are different and the periods discussed are different. As a result, developed countries and developing countries are not expected to have the same result. At the same time, cointegration analyzes also determine the existence of a long-term relationship between tax burden and economic growth. Çelikay (2017) can be given as an example. In our study, both the VAR model and causality test analyzes are performed. In our study, as a result, it was partly Bacarezza et al. (2013), Ünlükaplan and Arısoy (2011) and Anastassiou and Dritsaki (2005) have yielded similar results.

Table 3: Empirical Studies on Tax and Economic Growth

Author/ Year of the Study/ Country(s)/ Econometric Method and Years	**Findings**
Kneller et al. (1999)/ 22 OECD Countries/ Pane Data Analysis 1970 – 1995	According to the analysis, it is concluded that distorting taxation affects growth negatively.
Widmalm (2001)/ 23 OECD Countries/ Cross Section Analysis 1965 – 1990	The increase in personal income tax adversely affects economic growth.
Anastassiou and Dritsaki (2005)/ Yunanistan/Granger Causality 1965-2002	As a result of the research, it was determined that there is a causality between economic growth and tax revenue.
Koch et al. (2005)/ South Africa/ Data Envelopment Analysis 1960 – 2002	As a result of the analysis, it is suggested that the decrease in tax burden is related to economic growth and the decrease in indirect taxes is effective in economic growth.
Lee and Gordon (2005)/ 70 Countries/ Panel Data, Cross Section Analysis and Regression Analysis 1970 – 1997	The 10% decrease in corporate tax will increase economic growth by 1% and 2%.
Arnold (2008)/ 21 OECD Countries/ Panel Data Analysis 1971 – 2004	In the analysis, it is concluded that income tax has a negative effect on more economic growth than consumption tax and wealth tax.
Mucuk and Alptekin (2008)/ Turkey/ VAR Analysis 1975 – 2006	As a result of cointegration test, the variables move together and as a result of causality test, it is concluded that there is a one-way relationship from direct taxes to economic growth.
Ünlükaplan and Arısoy (2011)/ Turkey/ Granger Causality, Cointegration Analysis and Impact - Response Analysis 1968 – 2006	According to the results of cointegration, a relationship was found between the tax burden and real GNP. According to the causality test, economic growth and tax burden are the cause of each other in the long run. According to the impact response analysis, an external shock on the tax burden creates a static effect.
Veronika and Lenka (2012)/ 27 EU Countries/ Panel Data 1998 – 2010	In the analysis, it has been concluded that the increase in corporate tax adversely affects economic growth in the long run.
Bacarezza et al. (2013)/ 17 Latin American Countries and 81 Latin American Country / VAR Analysis and Panel Data Analysis 1990 – 2009	In Latin American countries, there is generally no significant negative relationship between income tax and economic growth, and in 81 countries there is a negative relationship between income tax and economic growth. It has been suggested that reducing corporate tax may affect the economy positively.

Erdoğan et al. (2013)/ Turkey/ Cointegration and Causality Analysis 1998 – 2011	A long-term relationship was found between indirect taxes and economic growth. In addition, a one-way causality has been identified from indirect tax revenues to economic growth in the short and long term.
Saraç (2015)/ Turkey/ Markov Regime Change Technique 1969 – 2013	In the periods of contraction and expansion of the economy, the increase in direct taxes negatively and indirect taxes increase positive affects economic growth.
Demir and Sever (2016)/ 11 OECD Countries/ Panel Data 1980 – 2014	In the long term, a one-unit increase in direct taxes leads to a decrease in the income level of 0.13 units. In the short term, a one-unit increase in total taxes leads to a decrease in the income level of 0.17 units.
Çelikay (2017)/ Turkey/ ARDL Boundary Test Approach 1924 – 2014	The 1% increase in GDP per capita has a positive effect of approximately 0.07% on the tax burden in the long term.
Stoilova (2017)/ EU Countries (28)/ Panel Data Regression 1996 – 2013	The tax structure based on excise taxes, personal income and property tax positively affects economic growth.

4. MODEL AND METHODOLOGY

This study examines the relationship between tax burden and economic growth. The data used in the study were taken from GIB and OECD database. Data on tax burden (Total Taxes / GDP) and economic growth cover the period from 1970 to 2018. The data obtained are annual data. VAR analysis and Granger causality test are used in the study. VAR analysis is a method that shows the effects of the variables used on each other. Brief representation of the data used in the study is as follows.

Economic growth: GDP

Tax burden: TB

Var (Vector Autoregresive Model) analysis method was developed by Sims in 1980. It addresses the variables at hand in a whole without any constraints on the model. It examines the relationships between macroeconomic variables. It is a model used to analyze the dynamic effects of a random shock in variables on other variables. This method is one of the most widely used methods because it gives dynamic relationships without any constraints to the structural model (Mucuk and Alptekin, 2008, 162 – 163, Özgen and Güloğlu, 2004, 95 – 97).

Accordingly, it is possible to formulate the VAR model in our study as standard as follows:

$$GDP_t = \alpha 0 + \sum_{p=1}^{k} \beta_{1p} \Delta TB_{t-p} + \sum_{p=1}^{k} \mu_{1p} GDP_{t-p} + \varepsilon_{1t}$$

$$\Delta TB_t = \alpha 0 + \sum_{p=1}^{k} \mu_{2p} GDP_{t-p} + \sum_{p=1}^{k} \beta_{1p} \Delta TB_{t-p} + \varepsilon_{2t}$$

k: Lag Length, Δ: Gap Parameter

t: Time, μ: GDP Stability Coefficient

p: Lag Coefficient, Ɛ: Error Term

β: Tax Burden Stability Coefficient,

4.1. Ampirical Findings

In an economic analysis, first of all, it is checked whether the data to be used is stationary. The most commonly used methods to test whether the time series are stationary are known as Augmented Dickey - Fuller (ADF) developed by Dickey and Fuller (1979), and Phillips - Perron (PP) unit root tests developed by Phillips Perron (1988). In order for the time series to be used to give more meaningful results, the parameters should not contain a unit root. In other words. H0 is rejected in the hypothesis test.

ADF and PP tests give almost the same results. The PP test is a recommended error correction model for the ADF during the testing process. Hypotheses are presented as follows (Güvenek et al., 2010: 7):

H0: p = 0 the series is not static, there is a unit root in the series.

H1: p < 0 the series is stationary, there is no unit root in the series.

The time series should be stationary in the generated models. If time series is not stationary, it can lead to spurious regression. The fact that time series are stationary causes the analysis to be more meaningful and more consistent. As Granger and Newbold

(1974) stated in their study, the problem of spurious regression occurs when analyzed with non-static time series. In this case, the results obtained are not real results and do not reflect the correct result (Gujarati, 2001, 726).

In the analysis, descriptive statistics related to the study are evaluated first. Then, ADF and PP tests are used to examine the stagnation of economic growth and tax burden series.

Table 4: Descriptive Statistics of Economic Growth and Tax Burden

Statistics / Variables	GDP	Tax Burden
Mean	4.5617	17.6467
Median	5.1666	16.2940
Maximum	11.1135	25.8990
Minimum	-5.9623	9.0610
Standart Deviation	4.1196	5.7934
Skewness	-0.8522	0.1364
Kurtosis	3.1774	1.3594
Jarque Bera	5.7516	5.4166

When Table 4 is examined, it is seen that descriptive statistics of variables are included. When we look at the Skewness coefficient, it is skewed to the right in the growth data and left to skewed in the tax burden data. When we look at the kurtosis coefficient, it is seen that the variables have a basic and normal distribution respectively.

Table 5 contains the results of the stationarity analysis of the tax burden and economic growth variables in the model of the study according to the Augmented Dickey - Fuller (ADF) and Philips - Peron (PP) unit root tests.

Table 5: Unit Root Tests and Results

Augmented Dickey – Fuller (ADF) Test					
Variables		**Constant**		**Constant + Trend**	
		t- Stat.	Prob.	t- Stat.	Prob.
Level	GDP	-6.5307	0.0000*	-6.4636	0.0000*
	TB	-0.7449	0.8248	-1.8180	0.6797
First Differens	TB	-6.5782	0.0000*	-6.4966	0.0000*
Philips – Peron (PP) Testi					
Variables		**Constant**		**Constant + Trend**	
		t- Stat.	Prob.	t- Stat.	Prob.
Level	GDP	-6.5263	0.0000*	-6.4567	0.0000*
	TB	-0.7459	0.8246	-1.9766	0.5983
First Differens	TB	-6.5786	0.0000*	-6.4952	0.0000*

*1% meaning level does not contain unit roots.

Table 5 shows the ADF and PP test results. According to these results, while the GDP level is stable, the tax burden is stable at the meaning level of 1% when the first difference is received. Both variables were not stable at the same level. In this case, cointegration analysis is not possible and the analysis is continued with VAR model. In the VAR model, stationary states of the series are used. Therefore, the GDP level value is included in the analysis and the tax burden is included in the analysis by taking the first difference.

Information criteria for determining the lag length of the model are given in Table 6. In the model, the minimum number of lag without autocorrelation and changing variance problems is 4.

Table 6: Determination of Lag Length

Lag	LR	FPE	AIC	SC	HQ
0	NA	19.97148	8.67004	8.75278*	8.70037*
1	0.66553	23.76434	8.84345	9.09169	8.93444
2	8.49449	22.89373	8.80434	9.21807	8.95599
3	4.94578	24.14410	8.85351	9.43274	9.06582
4	16.0381*	18.09664*	8.55798*	9.30270	8.83095

In the following figure 1, it is seen that in the case of the stagnation and the appropriate delay of the variables (4), all inverse roots are located in the unit circle. As here, the fact that whole inverse units roots are in the circle indicates that the model is stable.

Figure 1: Inverse Roots Unit Circle

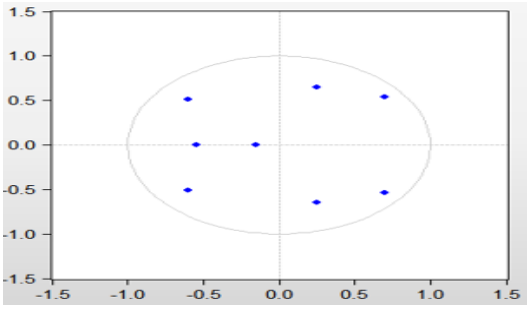


Table 7: LM Autocorrelation Test

Lag	LM Stat.	Prob.
1	3.749386	0.4410
2	3.191514	0.5263
3	2.439615	0.6555

Table 8: Heteroscedasticity Test

White Heteroskedasticity (No Cross Terms)		
Chi – Square	**df**	**Prob.**
52.01012	48	0.3206

Table 7 and Table 8 show that there are no autocorrelation and heteroscedasticity problems at the lag level determined in the model.

When we look at the graphs in Figure 2, the other two graphs, except the graphs at the top right and bottom left, explain the relationship with each other. In this context there is no need to interpret these figures. In the top right graph interpretation of impact-response analysis, the tax burden is 3rd period negatively affects growth. The bottom left graph of the impact-response analysis cannot be statistically interpreted.

Figure 2: Impact - Response Analysis

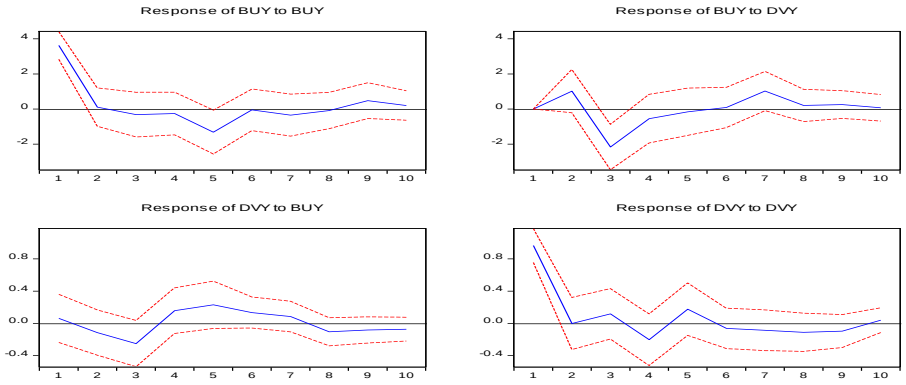


Table 9: Variance Decomposition

	GDP		TB		
Period	**GDP**	**TB**	**Period**	**GDP**	**TB**
1	100.0000	0.000000	**1**	0.404135	99.59587
2	92.67264	7.327363	**2**	1.801845	98.19816
3	69.84528	30.15472	**3**	7.834719	92.16528
4	68.86636	31.13364	**4**	9.630685	90.36932
5	71.34127	28.65873	**5**	13.42937	86.57063
6	71.31679	28.68321	**6**	14.68163	85.31837
7	68.10333	31.89667	**7**	15.08737	84.91263
8	67.98622	32.01378	**8**	15.69576	84.30424
9	68.11935	31.88065	**9**	16.03787	83.96213
10	68.15956	31.84044	**10**	16.36768	83.63232

When Table 9 is generally evaluated, the impact of economic growth on itself is decreasing and economic growth is increasing to be affected by the tax burden. By the 10th period, 31.84% of economic growth appears to be due to the tax burden. When the tax burden assessment is examined, it is seen that the impact of tax burden on itself is quite high. In the 10th period, 16.36% of the tax burden is due to economic growth.

Table 10: VAR Granger Causality Test

Explanation	**GDP**		**TB**	
GDP	----		**Chi - Square**	**Prob.**
			17.51533	0.0015
TB	**Chi - Square**	**Prob.**	----	
	9.184847	0.0566		

Table 10 shows the results of the Granger causality test between tax burden and economic growth. When the table is examined, the tax burden and economic growth emerges as a result of each other at the meaning level of 10%. As a result, it is concluded that tax burden negatively affects economic growth in impact-response analysis, economic growth is increasingly affected by tax burden in variance decomposition, and causality test is mutually related. These results support each other.

5. CONCLUSION

In this study, the period between 1970 and 2018 is examined in Turkey. In addition, the study is tested with VAR analysis and Granger causality test. As a result of VAR analysis, it is seen that tax burden negatively affects economic growth in the 3rd period. According to the results of Granger causality test, it is concluded that tax burden and economic growth are the mutual cause of each other. When the variance decomposition results are examined, it is observed that the tax burden effect gradually increases despite the fact (68.15) that growth is mostly affected by itself in the 10th period (31.84). Tax burden, again, is mostly affected by itself in the 10th period (83.63). The rate of self-impact of the tax burden is gradually decreasing and the share of economic growth is gradually increasing (16.36).

In this respect, the negative impact of the tax burden on economic growth is a good result for the review of tax policies. Accordingly, increasing tax rates will not have positive feedbacks in terms of economic growth, and vice versa. Policymakers would be more positive in practice to decrease tax rates rather than increase tax rates. In this context, various policy proposals can be presented.

One of these recommendations may be to alleviate the excessive tax burden on the minimum wage. There is an excessive tax burden with indirect taxes paid due to direct taxes and expenditures. According to the Constitution, the principle of fair distribution of taxes can be revised here. Another suggestion should be taken into account in regional factors when calculating the minimum wage. Moreover, increasing the rate of a significant tax, such as corporate tax, may negatively affect economic growth. Although the countries in the world intend to reduce corporate tax in order to attract investment, the desire to increase in our country may not have a positive effect on the economy.

It is known that income tax creates a higher tax burden for the middle-income citizens in Turkey. This situation leads to a tax system which is not functioning properly. This can be solved by spreading the tax to a wide base. High tax rates are the most important reason for the high tax burden. Therefore, high tax rates bring about tax evasion. Moreover, the fact that the indirect tax rates are high is an extra tax burden on low-income citizens. The more fair distribution of taxes is one of the most important duties of the state. Finally, tax policies should be implemented in a simpler and more voluntary tax compliance with low tax rates.

REFERENCES

Anastassiou, Thomas and Dritsaki, Chaido (2005). Tax Revenues and Economic Growth: An Emprical Investigation for Greece Using Causality Analysis, Journal of Social Sciences, 1, 2, 99 – 104. DOI : 10.3844/jssp.2005.99.104

Arnold, Jens (2008). Do Tax Structures Affect Aggregate Economic Growth? Emprical Evidence from A Panel of OECD Countries, Economics Department Working Papers, No: 643, 1 – 28. DOI: 10.1787/18151973

Avcı, Nihal (1988). Bütçe ve Para Politikalarının Makroekonomik Etkileri, Devlet Bütçe Uzmanlığı Araştırma Raporu, Ankara. (http://www.bumko.gov.tr/Eklenti/5474,navcipdf.pdf?0) (15.11.2019).

Bacarreza, G. Canavire., Vazquez, J. Martinez and Vulovic, Violeta (2013). Taxation and Economic Growth in Latin America, IDB Working Paper Series, No: IDB-WP-431, 1 – 44.

Ballard, Charles L., Fullerton, Don, Shoven, John. B. and Whalley, John (1985). The Relationship between Tax Rates and Government Revenue, University of Chicago Press, 188 – 202.

Çelikay, Ferdi (2017). Milli Gelirin Vergi Yükü Üzerindeki Etkileri: ARDL Sınır Testi Yaklaşımı ile Türkiye Üzerine Bir İnceleme (1924 – 2014, Sosyoekonomi Dergisi, Vol: 25 (32), 169 – 188. DOI: 10.17233/sosyoekonomi.286478

Çiftçi, Taha E., Kılıçer, Erkan and Peker, İmren (2012). Vergi Yükünün Düşürülmesine İmkan Yaratılması Bağlamında Alternatif Gelir Kaynakları, Hukuk ve İktisat Araştırmaları Dergisi, Cilt: 4, No: 2, 81 – 90.

Demir, Murat and Sever, Erşan (2016). Vergi Gelirleri Ekonomik Büyüme İlişkisi: OECD Ülkelerine İlişkin Panel Veri Analizi, Econ World, (http://london2016.econworld.org/papers/Demir_Sever_Relationship.pdf) (16.10.2019).

Doğan, Zehra (2014). Ekonomik Büyüme Süreçlerinin Analizinde Yeni Açılımlar ve Büyümenin Yersel Dinamikleri, Akademik Sosyal Araştırmalar Dergisi, Yıl: 2, Sayı: 6, 365 – 380. DOI : 10.16992/ASOS.339

Erdoğan, Ebru, Topçu, Mert and Bahar, Ozan (2013). Vergi Gelirleri ve Ekonomik Büyüme İlişkisi: Türkiye Ekonomisi Üzerine Eşbütünleşme ve Nedensellik Analizi, Finans Politik & Ekonomik Yorumlar, Cilt: 50, Sayı: 576, 99 – 109.

Erdoğan, Seyfettin and Canbay, Şerif (2016). İktisadi Büyüme ve Araştırma & Geliştirme (Ar-Ge) Harcamaları İlişkisi Üzerine Teorik Bir İnceleme, Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi, Cilt: 4, Sayı: 2, 29 – 44. DOI: 10.18506/anemon.16169

Fine, Ben (2000). Endogenous Growth Theory: A Critical Assessment, Cambridge Journal of Economics, 24, 245 – 265. DOI:10.1093/cje/24.2.245

GİB, www.gib.gov.tr (15.12.2017).

Günay, Kerem (2007). Türkiye'de Vergi Yükü ve Kapasitesi Hesaplaması Üzerinde Örnek Bir Çalışma, 1 – 15. (https://www.vergiportali.com/doc/Vergikapasitesi.pdf) (15.10.2019).

Higgs, Henry (2001). The Physiocrats, Canada: Batoche Boks Limited.

Işık, Nihat and Kılınç, Efe Can (2009). OECD Ülkelerinde Vergi Yükü ve Vergi Türleri: Karşılaştırmalı Bir Analiz, KMU İİBF Dergisi, Yıl: 11, Sayı: 17, 147 – 173.

İlhan, Gökalp (2007). Vergi Ödemeyi Etkileyen Ekonomik Faktörler, Akademik Bakış Uluslararası Hakemli Sosyal Bilimler E – Dergisi, Sayı: 12, 1 – 13.

İnaltong, Ceyhan (2012). Vergi Yükü: Tükiye ve OECD Ülkeleri Karşılaştırması, Vergi Dünyası Dergisi, Sayı: 369, 16 – 30.

Kneller, Richard A., Bleaney, Micheal F. and Gemmell, Norman b. (1999). Fiscal Policy and Growth: Evidence from OECD Countries, Journal of Public Economics, 74, 171 – 190. DOI:10.1016/S0047-2727(99)00022-5

Koch, Steven F., Schoeman, Niek J. and Tonder, J. J. Van (2005). Economic Growth and The Structure of Taxes in South Africa: 1960 – 2002, South Africa Journal of Economics, Vol: 73, 2, 190 – 2010. DOI:10.1111/j.1813-6982.2005.00013.x

Laffer, Arthur (2006). The Laffer Curve: Past, Present and Future, The Heritage Foundation, No: 1765, 1 – 16.

Lee, Young and Gordon, Roger H. (2005). Tax Structure and Economic Growth, Journal of Public Economics, 89, 1027 – 1043. DOI:10.1016/j.jpubeco.2004.07.002

Mucuk, Mehmet and Alptekin, Volkan (2008). Türkiye'de Vergi ve Ekonomik Büyüme İlişkisi: VAR Analizi (1975 – 2006), Maliye Dergisi, Sayı: 155, 159 – 174.

Neumark, Fritz (1937). Vergi Yükü ve İktisadi Hayat, İstanbul Üniversitesi Hukuk Fakültesi Mecmuası, (Çev: Sabri F. Ülgener), 247 – 261.

OECD, http://www.oecd.org/ (15.08.2019)

Özgen, Ferhat B. and Güloğlu, Bülent (2004). Türkiye'de İç Borçların İktisadi Etkilerinin VAR Tekniği ile Analizi, METU Studies in Development, 3, 93 – 114.

Özgün, Mehmet, Özkanca Andıç, Nagihan and İşler, İsmail (2016). Vergi Direnci ve Vergi Ahlakı Kavramları Işığında Pamukkale Üniversitesi Öğrencilerinin Vergi Kaçaklığına Bakış Açısı, Mali Kılavuz, Yıl: 18, Sayı: 73, 29 – 43.

Özpençe, Aylin İ. (2017). Türkiye'de 1980 Sonrası Kamu Harcamaları, Vergi Gelirleri ve Ekonomik Büyüme Arasındaki İlişkinin Analizi, Pamukkale Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, Sayı: 28, 31 – 41. DOI: 10.5505/pausbed.2017.13549

Özpençe, Aylin İ. and İşler, İsmail (2017). Türkiye'de KDV Sorunları ve Avrupa Birliği Ülkelerindeki KDV'nin Kamu Gelirleri ve GSYH İçerisindeki Payları, Vergi Raporu Dergisi, Yıl: 25, Sayı: 2019, 118 – 130.

Özpençe, Aylin İ. and Özpençe, Özay (2007). Küreselleşme ve Uluslararası Kuruluşların Ulus – Devletin Vergilendirme Yetkisine Etkileri, Uluslararası İnsan Bilimleri Dergisi, Cilt: 4, Sayı: 1, 1 – 21.

Öztürk, İlhami and Ozansoy, Ahmet (2011). Ücret Gelirleri Üzerindeki Vergi Yükünün Analizi, Maliye Dergisi, Sayı: 161, 197 – 214.

Pehlivan, Osman (2014). Kamu Maliyesi, Celepler Matbaacılık, Trabzon.

Rakıcı, Cemil and Vural, Tarık (2011). Asgari Ücret Üzerindeki Toplam Vergi Yükü ve Asgari Ücret Tutarının Anlamı, Ekonomi Bilimleri Dergisi, Cilt: 3, No: 2, 57 – 68.

Saraç, T. Bahadır (2015). Vergi Yükü ve Ekonomik Büyüme İlişkisi: Türkiye Örneği, Maliye Dergisi, Sayı: 169, 21 – 35.

Smith, Adam (1998). An Inquiry into The Nature and Causes of The Wealth of Nations, London: The Elecbook Book Company.

Solow, Robert M. (1956). A Contribution to The Theory of Economic Growth, The MIT Press, The Quarterly Journal of Economics, Vol: 70, No: 1, 65 – 94. DOI: 10.2307/1884513

Solow, Robert M. (1957). Technical Change and The Aggregate Production Function, The MIT Pres, The Review of Economics and Statistics, Vol: 39, No: 3, 312 – 320. DOI: 10.2307/1926047

Stoilova, Desislava (2017). Tax Structure and Economic Growth: Evidence from The European Union, Contaduria y Administracion, 62, 1041 – 1057. DOI:10.1016/j.cya.2017.04.006

Şiriner, İsmail and Doğru, Yılmaz (2005). Türkiye Ekonomisi'nin Büyüme Dinamikleri Üzerine Bir Değerlendirme, Yönetim Bilimleri Dergisi, (3: 2), 162 – 182.

Tekbaş, Abdullah and Dökmen, Gökhan (2007). Türkiye'de Vergi Yükünün Bölgesel Dağılımı, Maliye Dergisi, Sayı: 153, 195 – 2013.

Ünlükapan, İlter and Arısoy, İbrahim (2011). Vergi Yükü ve Yapısı ile İktisadi Büyüme Arasındaki Dinamik Etkileşimler Üzerine Uygulamalı Bir Analiz, ODTÜ Gelişme Dergisi, 38, 71 – 100.

Veronika, Baranova and Lenka, Janickova (2012). Taxation of Corporations and Their Impact on Economic Growth: The Case of EU Countries, Journal of Competitiveness, Vol: 4, Issue: 4, 96 – 108. DOI: 10.7441/joc.2012.04.07

Wanniski, Jude (1978). Taxes, Revenues, and The 'Laffer Curve', National Affairs, No: 33, (https://www.nationalaffairs.com/) (13.12.2019).

Widmalm, Frida (2001). Tax Structure and Growth: Are Some Taxes Better Than Others?, Public Choice, Vol: 107, No: 3/4, 199 – 219.

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

LONG RUN AND SHORT RUN IMPACTS OF COVID-19 ON FINANCIAL MARKETS

DOI: 10.17261/Pressacademia.2020.1221
JBEF- V.9-ISS.2-2020(8)-p.155-170

Gercek Ozparlak
Beykent University, Vocational School, Department of International Trade, Istanbul, Turkey.
gercekozparlak@beykent.edu.tr, ORCID ID: 0000-0002-8503-3199

Date Received: April 16, 2020 **Date Accepted:** June 6, 2020

To cite this document
Ozparlak, G., (2020). Long and short run impact of Covid-19 on financial markets. Journal of Business, Economics and Finance (JBEF), V.9(2), p.155-170.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2020.1221

ABSTRACT

Purpose- The purpose of this research is to contribute to the academic field by demonstrating long run and short run impact of Covid-19 virus on stock markets and CDS markets.
Methodology- In this paper, Johanse and Jeuselius (1990) Cointegration Test was used as the methodology to define the existence of thelong-run statistical relationship between Covid-19 data and economic variables of countries.
Findings- In the analysis, it was defined that there are at least two cointegration vectors in all countries. However, considering two countries-Italy and the USA, there is not significant long run relationship statistically. On the other hand, it can be noted that there is significant short run causality from CA to some variables. Moreover, there is no significant short run causality in France, Italy and the USA.
Conclusion- This article stated that there is the long term relationship between the total case of Covid-19 and China, France, Germany, the United Kingdom, Spain, Turkey. However, there is no long term relationship between the total cases of Covid-19 and France, Italy and the USA significantly. Furthermore, it can be said that there is significant short run causality from CA to some variables. However, there is no short run causality in France, Italy and the USA significantly. Finally, there is no long or short run causality in Italy and the USA.

Keywords: Covid-19, Corona, pandemic, stock markets, CDS, Johansen Cointegretion.
JEL Codes: E02, F00, G15

1. INTRODUCTION

Humanity has struggled with a pandemic that causes excessive number of deaths in every century for the long time. As can be seen in table 1, more than 200 million people died due to the Black Plague that emerged in the 14th century, while 40-50 million people died due to the Spanish flu that emerged in the 20th century. In addition, HIV / AIDS, killed 25-35 million people, still threatens humanity. Unfortunately, no vaccine has yet been developed for the disease.

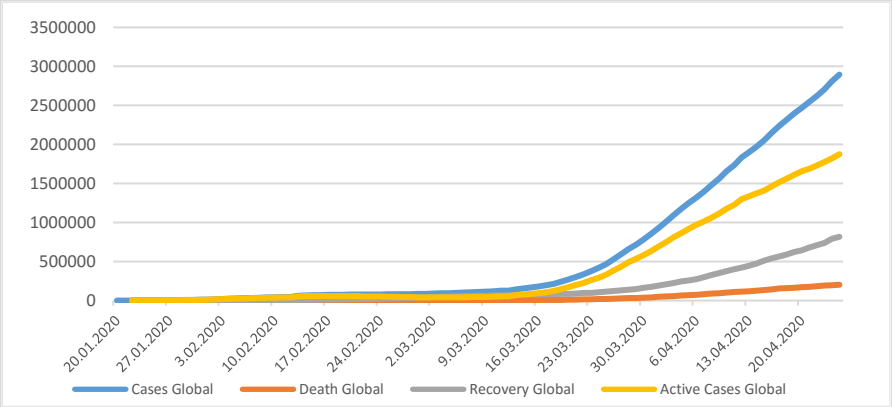
Table 1: History of Pandemics

Name	Time period	Century	Death toll
Black Death	1347-1351	14th	200M
New World Smallpox Outbreak	1520 – onwards	16th	56M
Cholera Pandemics	1817-1923	19-20th	1M+
Third Plague	1885	19th	12M
Spanish Flu	1918-1919	20th	40-50M
HIV/AIDS	1981-present	20th	25-35M
Covid-19	2019-Present	21th	287,670

Today, we live in the 21st century and it is assumed that there have been many developments in the fields of health, medicine and technology. It was assumed that it would be impossible to have such a major outbreak as it was in the past. (Fernandes, 2020) indicated, when the Covid -19 is historically compared to SARS, the effects of the Covid-19 outbreak were underrated.

However, the epidemic has first appeared in Wuhan, China then it spreads all over the world rapidly. Thus, it has become the biggest disaster in the world since The Second World War. At first, it was thought that the virus would be controlled in China, but the contagion speed of the virus was really fast. It has spread very quickly to almost every country in the world in two-three months. Therefore, World Health Organization (WHO) labelled Covid-19 Virus as pandemic on 11 February 2020. That means, a disease is prevalent more than one continent or over the world called as pandemic.

Figure 1: Total Confirmed Covid-19 Cases, Death, Recovery and Active Cases on the World



Estimates indicate that about 80% of people with COVID-19 have mild symptoms or asymptomatic. The most important reason of this estimation is that Covid-19 spread was unrecognised worldwide at the beginning. From December 2019 to May 12 2020, Covid-19 has caused at least 287,670 people's death and has led to physical sicknesses of more than 4,2 million people.

It paralyzed the health systems of the great number of developed and financially wealthy countries in the world. It caused to cease the works of global trade organizations and supply chains. It has led to instability on micro and macroeconomic conditions of countries. Since the physical areas were dangerous to work cooperatively during pandemic, Covid-19 has ceased the economy. It forced people to stay at home and also live under quarantine conditions. (Ozili and Arun, 2020) explain how coronavirus stifled economic activities with two methods. First, the spread of the virus required social distancing to be protected from disease so the financial markets, corporate offices, businesses and events were closed down. Second, the virus was spreading aggressively and there was the fierce ambiguity about how bad the pandemic could get, caused sudden increase in consumption and investment among consumers, investors and international trade partners.

Ercolani and Natoli (2020) indicated that private forecasters estimate the rebound in the 3th quarter of 2020 in the USA and also worldwide. On the other hand, Ercolani and Natoli predicted the recession in the United States will extend.

The purpose of this research is to contribute to the academic field by demonstrating long term and short term impact of Covid-19 virus on stock exchange markets and CDS markets. In this study, as methodology, Johansen Cointegration Test and VECM models are used.

As Covid-19 emerged in December 2019, studies in this area are still very restricted. However, a few authors completed and published their work in this field. For example, (Zeren and Hızarcı, 2020) checked into the effect of the centre countries of Covid-19 epidemic on their stock exchange markets thoroughly. They used Maki (2012) cointegration test as a method which uses both Covid-19 total case and Covid-19 total death number. In conclusion, they noted that all stock markets observed the death of Covid-19 act together in the long term. In addition, the authors indicated that there is a cointegration relationship between total cases of Covid-19 and indexes of stock markets in South Korea, China and Spain. Otherwise, there is no cointegration relationship with stock markets in Italy, France, Germany.

(Acar,2020) studied current and future potential impacts of the Covid-19 on tourism activities. Covid-19 will cause long-term damage to the economies of countries including tourism. Tourism will be one of the heavily affected sector by Covid-19. The author stated that the outbreak reduced the global tourist mobility from 1% to 3%. This downward rate is going to cause 30 to 50 billion USD loss approximately regarding international tourism revenues.

(Ayittey, Chiwero, Ayittey, Kamasah and Dzuvor, 2020) researched the effect of Covid-19 on Chinese and World Economies. As the authors indicated and estimated that China will lose up to $ 62 billion in January, February and Mach 2020. Besides, according to authors, it is a high probability the world may lose much more than 280 billion $.

(McKibbin, Fernando,2020) studied on the global macroeconomic effects of Covid-19 with seven Scenarios. The authors demonstrated in their scenarios that the Covid-19 might significantly affect the global economy in the short period.

(Ramelli and Wagner, 2020) point out that the market responses to the Covid-19 specify new understandings to explain how real shocks and financial polices convert firm value. Moreover, the authors explained how important financial channels are to state the scale of the expected effects of the health disaster.

(Shaen, Larkin and Brian, 2020) are authors who wrote about Chinese financial markets and COVID-19. They pointed out that the unstable relation between the main Chinese stock markets and Bitcoin developed visibly during the period of immense financial stress. They supplied a number of their observations and conclusions to explain the reason why this situation emerged.

(Ferdandes, 2020) issued a report about the economic influence of the COVID-19 crisis on economy of 30 countries, he uses different scenarios to analyse the economic activities. The author demonstrated in his one scenario that average GDP of 30 countries will decline -2.8%. In another scenario, GDP can decline more than 10% or 15%.

3. DATA AND METHODOLOGY

In this paper, Johanse and Jeuselius (1990) Cointegration Test was used as the methodology to define the existence of the long-run statistical relationship between Covid-19 data and economic variables of countries. This approach has been well popularized to measure the long-run relationships among variables. The method involves cointegration and the estimation of the Vector Error Correction Model[1] in order to define the time series behaviour.

The Johansen Cointgreation approach consists of two parts.

In this way, firstly, whether the series are stationary or not is examined using unit root test. Later, Johansen Cointegration test is used in the analysis. Secondly, the lag length criteria will be determined to perform the Johansen Cointegration Test. Finally, Johansen Cointegration test will imply to define the relationship among the variables.

China (CH), France (FR), Germany (GR), Italy (IT), The United States (USA), The United Kingdom (UK), Spain (SP) and Turkey (TR) are the countries where the Covid-19 virus is common in the world. Therefore, stock market indexes (S) and CDS rates (CD) of eight countries were chosen to determine the effect of the virus on the country's economy. Stock market indexes (S) and CDS (CD) market were chosen specifically, because these are extremely sensitive variables to identify the fluctuation of the market. Therefore, they are good variables to measure economic situations as well.

In the part of analysis, all variables are given with their abbreviations in the parentheses. All variables were collected between 22 January 2020 and 25 April 2020 daily. The number of active cases is one of the important data while struggling with pandemic. Because, this variable shows the existence of current number of patients. Therefore, this variable was added in the study. The calculation as below:

$$Active\ Cases\ (ACA) = Confirmed\ Cases(CA) - [Deaths\ (DE) + Recovery\ Cases(RCA)] \quad (1)$$

Covid-19 global data and economic data of the countries has been obtained from the website of Harvard Dataverse[2] and Investing.com[3], respectively. The log-transformation of the raw series were taken in order to standardize them for the relative same rates and the same numerical structure. Moreover, Cointegration Test allows us to use the log-transformation of the research data. Unit root tests must be done for each variable. Because, to carry out Johansen Cointegration test, it is supposed that the series are stationary. In the analysis ADF, DF and PP unit root tests were used to determine the series which were stationary in the level and in the first log difference or not.

[1] VECM
[2] https://dataverse.harvard.edu/
[3] https://www.investing.com/

After the all variables were determined as stationary in the first differences, their lag length criteria must be defined to perform the Johansen Cointegration Test. Thus, LR[4], FPE[5], AIC[6], SC[7] and HQ[8] criteria were employed to determine the most appropriate delay length.

After the most appropriate delay length was determined, the number of cointegration ranks (r) were tested via The Maximum Eigenvalue and Trace Test. From the theoretical, intuitive, and empirical discussion, the relationship between Covid-19 data and selected stock market variables and CDS prices were postulated as described as follows:

$$ln(CA)_t = \beta_0 + ln\beta_1(S) + \xi_t \quad (2)$$

$$ln(S)_t = \beta_0 + ln\beta_1(Covid19\_Death) + \xi_t \quad (3)$$

β_0 is a constant, β_1 is the sensitivity of each of the Covid-19 cases or death variables to stock prices and ξ_t is a stationary error correction term.

Johansen Cointegration test (Johanse and Juselius, 1990) was applied to determine the existence of long term relationship between Covid-19 data and economic variables so they are at the same level stationarity. The number of cointegration vectors in the variables were defined.

Johansen's approach proceeds its beginning point in the VAR of order *p* as follow

$$Y_t = \mu + \lambda_1 . Y_{t-1} + \lambda_2 . Y_{t-2} \dots\dots\dots\dots\dots\dots\dots\dots + \lambda_k Y_{t-k} + e_t \quad (4)$$

The VAR can be expressed again in dynamic shape as follow

$$\Delta Y_t = \mu + \sum_{i=1}^{k} \lambda_i \, \Delta Y_{t-i} + e_t \quad (5)$$

In Equation 6, Y_t is a *p* × 1 vector of integrated variables in an equation, λ_k is a *p* × 1 matrix of values, et is a *p*x1 vector of stochastic period and *p* is the number of rows in a matrix .

The matrix λ contains data about the long-term properties of the model. If λ has rank zero, r indicates the number of cointegrating vectors, at that point the system isn't cointegrated. If λ has rank *p*, all the variables in Y_t are stationary and are all cointegrated, demonstrating the long-term relationship between the exploration variables.

The test statistics for cointegration are formulated as

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{g} \ln(1 - \lambda_i) \quad (6)$$

$$\lambda_{max}(r, r+1) = -T \ln(1 - \lambda_{r+i}) \quad (7)$$

λ_{trace}tests the null the number of cointegration vectors is less than or equal to (r) against an unspecified alternative.

λ_{max}tests the null the number of cointegration vectors is (r) against is alternative of $(r+1)$

The Johansen test is a test for cointegration of several *I(1)* time series data.

Oseni and Onakoya (2012) described the error correction as follow:

$$e_t = Y_t - \beta X_{t,\dots\dots\dots\dots} \quad (8)$$

Where: β is a cointegrating coefficient and e_t is the error from a regression of Y_t on X_t . ECM is basically described as:

[4] Likelihood
[5] Final Prediction Error
[6] Akaike Information Criterion
[7] Schwarz Information Criterion
[8] Hannan-Quinn Information Criterion

$\Delta Y_t = \alpha e_{t-1} + \gamma \Delta X_t + u_t \ldots\ldots\ldots\ldots$ (9)

Where: u_t is iid , e_{t-1} the equilibrium error occurred in the earlier period, α and γ are short term constraints.

$VECM$: $\Delta y_t = \beta_0 + \sum_{i=1}^{n} \beta_i \Delta y_{t-i} + \sum_{i=0}^{n} \delta_i \Delta x_{t-i} + \varphi z_{t-1} + \mu_t$ (10)

Cointegration eq.: $z_{t-1} = ECT_{t-1} = y_{t-1} - \beta_0 - \beta_1 x_{t-1}$ long run model (11)

If time series are non-stationary but *I(1)* the time series are cointegrated, the VECM can be used to examine both the long and short term dynamics of the series.

4. FINDINGS AND DISCUSSIONS

4.1. Correlations

Preliminary results in the Table 3 and Table 4 additionally motivates the search of possible relation between Covid-19 and stock markets with Credit Default Swaps.

As expected, there is a negative high correlation between Cases, Death of Covid-19 and stock markets. The range of the correlations is from -0.45 (between Cases and SSEC) to -0.78 (between Death and IBEX 35) as seen in Table 3. In the same way, the range of the correlations is from 0,26 (between Cases and DJI) to 0.89 (between Deaths and BIST 100) as seen in Table 4.

Table 3: Correlation Matrix between Covid-19 Data and Stock Markets

Stock Markets	Global Cases	Global Deaths	Global Active Cases
SEC	-0.45	-0.46	-0.50
CAC 40	-0.74	-0.76	-0.71
DAX	-0.68	-0.70	-0.64
FTSE MIB	-0.74	-0.77	-0.71
DJI	-0.60	-0.61	-0.58
FTSE 100	-0.75	-0.77	-0.72
IBEX 35	-0.76	-0.78	-0.74
BIST 100	-0.75	-0.77	-0.73

Table 4: Correlation Matrix between Covid-19 Data and CDS Price

Credit Default Swap (CDS)	Global Cases	Global Deaths	Global Active Cases
China	0.45	0.47	0.38
France	0.79	0.82	0.79
Germany	0.75	0.79	0.75
Italy	0.65	0.68	0.60
USA	0.26	0.27	0.33
UK	0.82	0.84	0.82
Spain	0.78	0.81	0.77
Turkey	0.86	0.89	0.84

As seen in Figure 2, It is clear that volatility of the Stock Market increased relatively in February and March. As seen figure 3, the volatility of CDS price increased in March and April sharply.

Figure 2: Return of Stock Indexes

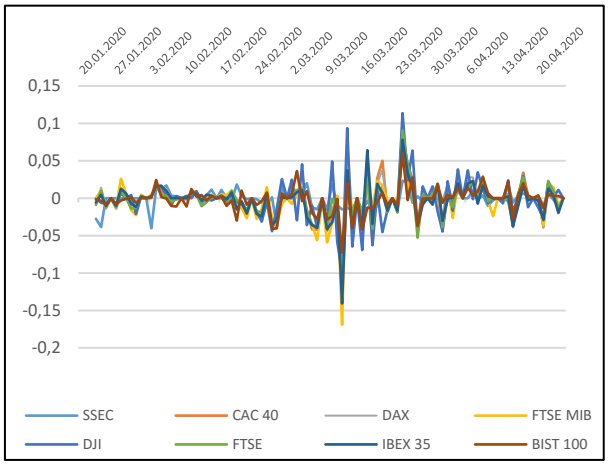
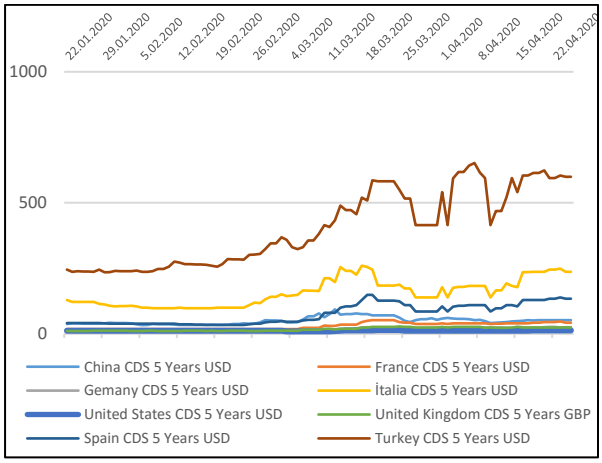


Figure 3: Five Years Credit Default Swaps (CDS) of Countries



4.2. Unit Root Test

ADF, DF and PP unit root tests were used. All of Covid-19 data, country stock market and CDS market data have unit roots in the level. However, they became stationary after taking the first difference as seen in table 5.

Table 5: ADF, DF-GLS and PP Unit Root Test Results- First Difference

LEVEL											
	Total Cases	Total Death	Active Cases	SSEC	CAC 40	DAX	FTSE MIB	DJI	FTSE 100	IBEX 35	BIST 100
N obs.	95	95	95	95	95	95	95	95	95	95	95
ADF	-2,06	-2,13	-0,91	-2,33	-1,41	-2,95	-2,46	-7,00***	-1,68	-1,51	-8,18***
DF-GLS	0,72	0,76	0,44	-0,88	-0,78	-1,73	-2,03**	-3,91***	-1,01	-0,97	-7,55***
PP	-3,99**	-3,51***	-2,98**	-2,44	-1,60	-4,64	-5,40***	-7,23***	-2,74*	-2,67*	7,50
1st LEVEL											
	Total Cases	Total Death	Active Cases	SSEC	CAC 40	DAX	FTSE MIB	DJI	FTSE 100	IBEX 35	BIST 100
ADF	-2,73*	-3,16**	-2,84*	-10,00***	-14,13***	-11,02***	11,28***	-11,00***	-10,68***	-10,77***	-9,27***
DF-GLS	-2,27**	-3,19***	-1,92*	-3,77***	-14,12***	-11,06***	-11,34***	-11,06***	-10,67***	-10,79***	-9,32***
PP	-4,38***	-4,94***	-4,17***	-10,04***	-15,41***	-30,29***	-41,71***	-42,53***	-24,40***	-25,58***	-81,91***

Note: ***, **, * demonstrate that the null hypothesis is rejected at %1, %5 and %10 significance level respectively.

4.3. Cointegration Tests and VECM Model of the Countries

4.3.1. China

Estimated Cointegration test (Juselius and Johangsen,1987) with lag length of 5 and Model 1 for China.

Table 6: Johansen Cointegration Test (1988) Results for China

	Trace Val.	**Critic. Val.**	**Pro.**
None* (r=0)	137.93	76.97	0.0000
At most one* (r≤1)	66.28	54.08	0.0028
At most two *(r≤2)	36.82	35.19	0.0331
At most three (r≤3)	17.30	20.26	0.1217
At most four (r≤4)	7.51	9.16	0.1021
Hypothesized No of CEs	**Max.Eg.Val.**	**Critic. Val.**	**Pro.**
None* (r=0)	71.66	34.81	0.0000
At most one* (r≤1)	29.46	28.59	0.0386
At most two (r≤2)	19.52	22.30	0.1170
At most three (r≤3)	9.79	15.89	0.3536
At most four (r≤4)	7.51	9.16	0.1021

Note:* This sign indicates that the hypothesis is rejected at %5 level.

Table 6 demonstrates the results of the Johansen Cointegration Test. In the table, trace statistics indicated three cointegrating vectors. The trace value is 137,93 and it is greater than 5% critical value. The Max_Eigen statistics also indicated two cointegrating vectors. In the same way, the maximum Eigen-value is greater than 5% critical value.

The results clearly state that the number of cases of Covid-19 is long-run determinants of financial markets in China.

If the variables are cointegarted or expressing in other words, the variables have long term relationship, then restricted a Vector autoregressive (VAR) can be run and this method is called as VECM Model. On the other hand, if the variables are not cointegareted, VECM model cannot be run, instead unrestricted VAR can be applied.

After cointegarted association is determined, the short-run model, VAR, is used. This model was estimated by

$$\Delta CA_t = -062ect_{t-1} - 1{,}11\Delta CA_{t-1} + 0{,}35\Delta CA_{t-2} - {,}49\Delta CA_{t-3} - {,}84\Delta CA_{t-4} + 1{,}36\Delta CA_{t-5} + 0{,}91\Delta ACA_{t-1} - 0{,}01\Delta ACA_{t-2} + 0{,}08\Delta ACA_{t-3} - 0{,}63\Delta ACA_{t-4} - 0{,}82\Delta ACA_{t-5} + 0{,}09\Delta DE_{t-1} - 0{,}22\Delta DE_{t-2} + 0{,}56\Delta DE_{t-3} - 0{,}29\Delta DE_{t-4} - 0{,}64\Delta DE_{t-5} - 0{,}12\Delta SCH_{t-1} + 0{,}08\Delta SCH_{t-2} - 0{,}33\Delta SCH_{t-3} - 1{,}36\Delta SCH_{t-4} - 0{,}37\Delta SCH_{t-5} - 0{,}13\Delta CDCH_{t-1} - 0{,}04\Delta CDCH_{t-2} - 0{,}15\Delta CDCH_{t-3} - 0{,}08\Delta CDCH_{t-4} - 0{,}15\Delta CDCH_{t-5} \quad (12)$$

Equation 13 is thelong-run model. The model resulted with a cointegrating vector.

$$ect_{t-1} = CA_{t-1} + 104{,}94SCH_{t-1} + 6{,}55CDCH_{t-1} - 875 \quad (13)$$

Table 7: Vector Error Correction Model

The Var.	**Coeff.**	**Std. Er.**	**t-Sta.**	**Prob.**
C(1)	-0.616633	0.151633	-4.066615	0.0001

C(1) displays the Error Correction Term in table 7. The coefficient value of C(1) is negative and it is statistically significant. It confirms that there is the long run causality from ACA, DE, ST and CD to CA. In addition, R^2 rate is %82,4. This confirms that the model is fit and has a good analytical power.

Table 8: Walt Test

Test Statistics	**The Variable**	**Value**	**Probability**
Chi-square	DE	31,22	0,0000
Chi-square	ACA	15,53	0,0083
Chi-square	CDCH	6,59	0,2525
Chi-square	SCH	8,80	0,1169

The probability of the Chi-square test is less than %5. That means that there is the short run causality running from DE and ACA to CA. Otherwise, there is no short run causality running from CDCH and SCH to CA in China.

4.3.2. France

Cointegration test was carried out with lag length of 6 and Model 1 for France.

Table 9: Johansen Cointegration Test (1988) Results for France

Hypothesized Number of CEs	Trace Val.	Critic. Val.	Pro.
None* (r=0)	123.29	76.97	0.0000
At most one* (r≤1)	73.70	54.08	0.0004
At most two *(r≤2)	41.10	35.19	0.0103
At most three *(r≤3)	22.83	20.26	0.0217
At most four (r≤4)	9.14	9.16	0.0505
Hypothesized Number of CEs	**Max.Eg.Val.**	**Critic. Val.**	**Pro.**
None* (r=0)	49.60	34.81	0.0005
At most one* (r≤1)	32.60	28.59	0.0145
At most two (r≤2)	18.27	22.30	0.1664
At most three (r≤3)	13.69	15.89	0.1076
At most four (r≤4)	9.14	9.16	0.0505

Note: * *This sign displays, the hypothesis is rejected at %5 level.*

In table 9, trace value shows four cointegrating equations. They are more than 5% critical values. In the same way, the Max_Eigen value is more than %5 and it indicates two cointegrating equations. The results demonstrate the existences of the long run association between Covid-19 (CA) and financial markets (S and CD).

Equation 14 demonstrates Estimated VECM with CA as target variable.

$$\begin{aligned}\Delta CA_t = {} & -0{,}06ect_{t-1} - 0{,}21\Delta CA_{t-1} - {,}40\Delta CA_{t-2} - 0{,}14\Delta CA_{t-3} + 0{,}764\Delta CA_{t-4} + 0{,}68\Delta CA_{t-5} + 0{,}06\Delta CA_{t-6} \\ & + 0{,}14\Delta ACA_{t-1} + 0{,}31\Delta ACA_{t-2} - 0{,}002\Delta ACA_{t-3} - 0{,}50\Delta ACA_{t-4} - 0{,}40\Delta ACA_{t-5} - 0{,}02\Delta ACA_{t-6} \\ & + 0{,}58\Delta DE_{t-1} + 0{,}16\Delta DE_{t-2} + 0{,}18\Delta DE_{t-3} - 0{,}35\Delta DE_{t-4} - 0{,}17\Delta DE_{t-5} + 0{,}12\Delta DE_{t-6} - 0{,}20\Delta SFR_{t-1} \\ & - 0{,}02\Delta SFR_{t-2} - 0{,}05\Delta SFR_{t-3} - 0{,}15\Delta SFR_{t-4} - 0{,}22\Delta SFR_{t-5} - 0{,}12\Delta SFR_{t-6} - 0{,}12\Delta CDFR_{t-1} \\ & - 0{,}019\Delta CDFR_{t-2} - 0{,}11\Delta CDFR_{t-3} - 0{,}07\Delta CDFR_{t-4} - 0{,}13\Delta CDFR_{t-5} - 0{,}10\Delta CDFR_{t-6}\end{aligned} \quad (14)$$

Equation 15 shows Cointegration Equation for long run model.

$$ect_{t-1} = CA_{t-1} + ACA_{t-1} + DE_{t-1} + SFR_{t-1} + CDFR_{t-1} \quad (15)$$

Table 10: Vector Error Correction Model

The Var.	Coeff.	Std. Er.	t-Sta.	Prob.
C(1)	-0,06	0,1111	-0,5813	0,5634

In table 10, the coefficient of C(1) has negative value but its probability is more than %5. It means that it isn't significant. Therefore, it can't be said the existence of the long run causality from ACA, DE, ST and CD to CA. In addition, R^2 is %78,04. This is a pretty good rate to confirm the explanatory power of this model.

Table 11: Walt Test

Test Statistics	The Variable	Value	Probability
Chi-square	DE	10,60	0,1015
Chi-square	ACA	3,57	0,7344
Chi-square	CDFR	6,64	0,3552
Chi-square	SFR	2,63	0,8539

As seen in table 11, the probability of the test is less than 0,05. It indicates that there is short run causality running from DE and ACA to CA. Conversely, it can't be said the existence the short term causality which run from CD and S to CA.

4.3.3. Germany

Cointegration test was used with lag length of 2 and Model 2 for Germany.

Table 12: Johansen Cointegration Test (1988) Results for France.

Hypothesized Number of CEs	**Trace Val.**	**Critic. Val.**	**Pro.**
None* (r=0)	100.55	76.97	0.0003
At most one* (r≤1)	54.29	54.08	0.0479
At most two (r≤2)	30.00	35.19	0.1632
At most three (r≤3)	9.17	20.26	0.7206
At most four (r≤4)	3.97	9.16	0.4162
Hypothesized Number of CEs	**Max.Eg.Val.**	**Critic. Val.**	**Pro.**
None* (r=0)	46.26	34.81	0.0014
At most one (r≤1)	24.29	28.59	0.1608
At most two (r≤2)	20.83	22.30	0.0791
At most three (r≤3)	5.19	15.89	0.8710
At most four (r≤4)	3.97	9.16	0.4162

Note:* This sign displays, the hypothesis is rejected at %5 level.

As seen table 12, both Trace value and The Max_Eigen value demonstrate two cointegrating equations which are other important results, because these information might be beneficial to predict long run forecast about Covid-19 and financial markets.

Equation 16 demonstrates Estimated VECM with CA as target variable.

$$\Delta CA_t = -0{,}3ect_{t-1} - 0{,}62\Delta CA_{t-1} + 0{,}49\Delta CA_{t-2} + 0{,}44\Delta ACA_{t-1} + 0{,}006\Delta ACA_{t-2} + 0{,}08\Delta DE_{t-1} - 0{,}44\Delta DE_{t-2} - 0{,}29\Delta SGR_{t-1} + 0{,}19\Delta SGR_{t-2} - 0{,}16\Delta CDGR_{t-1} + 0{,}002\Delta CDGR_{t-2} \quad (16)$$

Equation 17 shows Cointegration Equation for long term model.

$$ect_{t-1} = ACA_{t-1} + CA_{t-1} - 0{,}92DE_{t-1} - 0{,}48SGR_{t-1} - 0{,}72CDGR_{t-1} - 0{,}088 \quad (17)$$

Table 13: Vector Error Correction (VECM) Model

The Var.	**Coeff.**	**Std. Er.**	**t-Sta.**	**Prob.**
C(1)	-0,3154	0,0699	-4,5095	0,0000

In table 13, the coefficient value is -0,3154 which is negative and significant as well. Therefore, it can be accepted the probability or existence as the long term causality from ACA, DE, SGR and CDGR to CA. In addition, R^2 is %77,8. This ratio specifies that the model has an adequate explanatory power.

Table 14: Walt Test

Test Statistics	**The Variable**	**Value**	**Probability**
Chi-square	DE	6,77	0,0337
Chi-square	ACA	1,65	0,4362
Chi-square	CDGR	3,34	0,1883
Chi-square	SGR	2,26	0,3229

As seen in Table 14, the probability of the test is less than %5 for only variable DE which means, there is short run causality running from DE to CA. Conversely, it can't be said for the existence of the short run causality from ACA, CDGR and SGR to CA.

4.3.4. Italy

Cointegration Test is used with lag length of 6 and Model 2 for Italy. The result of the Johansen Test was demonstrated as follows.

Table 15: Johansen Cointegration Test (1988) Results for France

Hypothesized Number of CEs	Trace Val.	Critic. Val.	Pro.
None* (r=0)	127.46	76.97	0.0000
At most one* (r≤1)	84.86	54.08	0.0000
At most two* (r≤2)	47.47	35.19	0.0015
At most three* (r≤3)	24.08	20.26	0.0142
At most four (r≤4)	5.03	9.16	0.2804
Hypothesized Number of CEs	**Max.Eg.Val.**	**Critic. Val.**	**Pro.**
None* (r=0)	42.60	34.81	0.0048
At most one* (r≤1)	37.39	28.59	0.0029
At most two* (r≤2)	23.39	22.30	0.0351
At most three* (r≤3)	19.05	15.89	0.0154
At most four (r≤4)	5.03	9.16	0.2804

Note:* This sign displays the hypothesis is rejected at %5 level.

Trace and the Max_Eigen statistics figure out the indication of four cointegrating vectors. The trace value is 24,08 and it is more than the critical value (20,26). Likewise, The Max_Eigen value is 19,05 which is more than the critical value (15,89). Consequently, it can be said that there is long run relationship between Covid-19 cases and financial markets.

Equation 18 determines Estimated VECM with CA as target variable.

$$\Delta CA_t = 0{,}20ect_{t-1} + 0{,}01\Delta CA_{t-1} - {,}28\Delta CA_{t-2} - 0{,}15\Delta CA_{t-3} + 0{,}21\Delta CA_{t-4} + 0{,}50\Delta CA_{t-5} + 0{,}06\Delta CA_{t-6} + 0{,}35\Delta ACA_{t-1} + 0{,}39\Delta ACA_{t-2} - 0{,}0003\Delta ACA_{t-3} - 0{,}004\Delta ACA_{t-4} - 0{,}12\Delta ACA_{t-5} + 0{,}06\Delta ACA_{t-6} - 0{,}75\Delta DE_{t-1} - 0{,}16\Delta DE_{t-2} - 0{,}28\Delta DE_{t-3} - 0{,}42\Delta DE_{t-4} - 0{,}31\Delta DE_{t-5} + 0{,}06\Delta DE_{t-6} - 0{,}20\Delta SIT_{t-1} - 0{,}02\Delta SIT_{t-2} - 0{,}33\Delta SIT_{t-3} + 0{,}17\Delta SIT_{t-4} + 0{,}17\Delta SIT_{t-5} + 0{,}09\Delta SIT_{t-6} + 0{,}10\Delta CDIT_{t-1} - 0{,}08\Delta CDIT_{t-2} + 0{,}08\Delta CDIT_{t-3} + 0{,}07\Delta CDIT_{t-4} + 0{,}006\Delta CDIT_{t-5} + -0{,}003\Delta CDIT_{t-6} \quad (18)$$

Equation 19 displays Cointegration Equation for long run model.

$$ect_{t-1} = ACA_{t-1} + CA_{t-1} + +DE_{t-1} + 8{,}36SIT_{t-1} + CDIT_{t-1} - 95{,}04 \quad (19)$$

Table 16: Vector Error Correction Model

The Var.	Coeff.	Std. Er.	t-Sta.	Prob.
C(1)	0,1447	0,1000	1,4465	0,1538

Table 16 displays that coefficient value of C(1) is positive in sign but it isn't significant, then it can't be assumed that there is long run causality running from ACA, DE, ST and CD to CA. In addition, R^2 of the model is %79,6. That indicates that the model is fit.

Table 17: Walt Test

Test Statistics	The Variable	Value	Probability
Chi-square	DE	8,41	0,2089
Chi-square	ACA	1,26	0,9700
Chi-square	CDIT	3,82	0,7004
Chi-square	SIT	2,37	0,8827

The probability of all tests is more than %5. That means that null hypothesis can be accepted there is no short run causality running from DE, ACA, CDIT and SIT to CA.

4.3.5. United States

Cointegration test was calculated with lag length of 6 and Model 2 for United States.

Table 18: Johansen Cointegration Test (1988) Results for France

Hypothesized Number of CEs	Trace Val.	Critic. Val.	Pro.
None* (r=0)	151.65	76.97	0.0000
At most one* (r≤1)	84.55	54.08	0.0000
At most two* (r≤2)	49.68	35.19	0.0007
At most three* (r≤3)	24.04	20.26	0.0144
At most four (r≤4)	4.57	9.16	0.3345
Hypothesized Number of CEs	**Max.Eg.Val.**	**Critic. Val.**	**Pro.**
None* (r=0)	67.10	34.81	0.0000
At most one* (r≤1)	34.87	28.59	0.0069
At most two* (r≤2)	25.64	22.30	0.0164
At most three* (r≤3)	19.47	15.89	0.0131
At most four (r≤4)	4.57	9.16	0.3345

Note:* This sign displays, the hypothesis is rejected at %5 level.

From the Table 20, Trace and the Max_Eigen statistics displays four cointegrating vectors.

$$\Delta CA_t = 0{,}34ect_{t-1} - 0{,}16\Delta CA_{t-1} - 0{,}59\Delta CA_{t-2} - 0{,}53\Delta CA_{t-3} + 0{,}08\Delta CA_{t-4} + 0{,}38\Delta CA_{t-5} - 0{,}33\Delta CA_{t-6} + 0{,}35\Delta ACA_{t-1} + 0{,}39\Delta ACA_{t-2} - 0{,}0003\Delta ACA_{t-3} - 0{,}004\Delta ACA_{t-4} - 0{,}16\Delta ACA_{t-5} + 0{,}29\Delta ACA_{t-6} - 0{,}35\Delta DE_{t-1} + 0{,}60\Delta DE_{t-2} + 0{,}43\Delta DE_{t-3} - 0{,}03\Delta DE_{t-4} + 0{,}017\Delta DE_{t-5} - 0{,}04\Delta DE_{t-6} - 0{,}15\Delta SUS_{t-1} - 0{,}08\Delta SUS_{t-2} - 0{,}06\Delta SUS_{t-3} + 0{,}17\Delta SUS_{t-4} + 0{,}17\Delta SUS_{t-5} + 0{,}09\Delta SUS_{t-6} - 0{,}13\Delta CDUS_{t-1} - 0{,}09\Delta CDUS_{t-2} - 0{,}18\Delta CDUS_{t-3} + 0{,}07\Delta CDUS_{t-4} + 0{,}006\Delta CDUS_{t-5} + -0{,}003\Delta CDUS_{t-6} \quad (20)$$

Equation 21 displays Cointegration Equation for long run model.

$$ect_{t-1} = ACA_{t-1} + CA_{t-1} + +DE_{t-1} + 38{,}8SUS_{t-1} + CDUS_{t-1} - 406{,}66 \quad (21)$$

Table 19: Vector Error Correction Model

The Var.	Coeff.	Std. Er.	t-Sta.	Prob.
C(1)	0,1447	0,1000	1,4465	0,1538

In table 19, the coefficient value of C(1) is positive in sign but it isn't significant. Therefore, it can't be said the existence of long run causality from ACA, DE, STUS and CDUS to CA. In addition, R^2 is %79,6. That means, the model is fit.

Table 20: Walt Test

Test Statistics	The Variable	Value	Probability
Chi-square	DE	8,41	0,2089
Chi-square	ACA	1,26	0,9700
Chi-square	CDIT	3,82	0,7004
Chi-square	SIT	2,37	0,8827

In table 20, all probability is greater than %5. Therefore, it is clearly said that there is no short run causality running from DE, ACA, CDIT and SIT to CA.

4.3.6. The United Kingdom

Cointegration test was analysed with lag length of 2 and no trend & no intercept model.

Table 21: Johansen Cointegration Test (1988) Results for France

Hypothesized Number of CEs	Trace Val.	Critic. Val.	Pro.
None* (r=0)	110.87	76.97	0.0000
At most one* (r≤1)	69.64	54.08	0.0011
At most two (r≤2)	34.48	35.19	0.0596
At most three (r≤3)	12.90	20.26	0.3722
At most four (r≤4)	2.63	9.16	0.6518
Hypothesized Number of CEs	**Max.Eg.Val.**	**Critic. Val.**	**Pro.**
None* (r=0)	41.23	34.81	0.0075
At most one* (r≤1)	35.16	28.59	0.0062
At most two (r≤2)	21.58	22.30	0.0627
At most three (r≤3)	10.27	15.89	0.3108
At most four (r≤4)	2.63	9.16	0.6518

Note:** This sign displays, the hypothesis is rejected at %5 level.*

From Table 21, the trace value (69,64) is more than the critical values (54,08). Also, The Max_Eigen value (35,16) is more than critical value (28,59). As a result, both tests indicate 2 cointregration vectors.

$$\Delta CA_t = -0{,}29ect_{t-1} - 0{,}67\Delta CA_{t-1} + 0{,}68\Delta CA_{t-2} + 0{,}52\Delta ACA_{t-1} - 0{,}07\Delta ACA_{t-2} + 0{,}14\Delta DE_{t-1} - 0{,}63\Delta DE_{t-2} - 0{,}10\Delta SUK_{t-1} + 0{,}10\Delta SUK_{t-2} - 0{,}09\Delta CDUK_{t-1} - 0{,}05\Delta CDUK_{t-2} \quad (22)$$

Equation 23 displays Cointegration Equation for long run model.

$$ect_{t-1} = ACA_{t-1} + CA_{t-1} + 0{,}74DE_{t-1} - 13{,}88SUK_{t-1} - 12{,}44CDUK_{t-1} + 135{,}41 \quad (23)$$

Table 22: Vector Error Correction Model

The Variable	Coefficient	Standard Error	t-Statistic	Probability
C(1)	-0,2991	0,0856	-3,4913	0,0008

The coefficient value of C(1) variable is negative sign and significant. It means that there is long run causality running from ACA, DE, SUK and CDUK to CA. In addition, R^2 is of the model is %75,1 which shows the model is fit.

Table 23: Walt Test

Test Statistics	The Variable	Value	Probability
Chi-square	DE	13,47	0,0012
Chi-square	ACA	3,21	0,2006
Chi-square	CDUK	0,75	0,6867
Chi-square	SUK	0,36	0,8335

All test probability is greater than %5 except DE. Therefore, it can be said that there is no short run causality running from ACA, CDUK and SUK to CA. Otherwise, the existence the short term connection running from DE to CA is clear.

4.3.7. Spain

Cointegration test is used with lag length of 2 and Model 2 for Spain.

Table 24: Johansen Cointegration Test (1988) Results for Spain

Hypothesized Number of CEs	Trace Val.	Critic. Val.	Pro.
None* (r=0)	127.05	76.97	0.0000
At most one* (r≤1)	68.66	54.08	0.0015
At most two (r≤2)	30.67	35.19	0.1420
At most three (r≤3)	10.20	20.26	0.6198
At most four (r≤4)	4.95	9.16	0.2894
Hypothesized Number of CEs	**Max.Eg.Val.**	**Critic. Val.**	**Pro.**
None* (r=0)	58.38	34.81	0.0000
At most one* (r≤1)	38.00	28.59	0.0024
At most two (r≤2)	20.46	22.30	0.0884
At most three (r≤3)	5.26	15.89	0.8650
At most four (r≤4)	4.95	9.16	0.2894

Note:* This sign displays, the hypothesis is rejected at %5 level.

As seen Table 24, Trace and The Max_Eigen statistics are greater than the critical values. They point out two cointegrating equations.

$$\Delta CA_t = -0{,}30ect_{t-1} - 0{,}45\Delta CA_{t-1} + 1{,}11\Delta CA_{t-2} + 0{,}25\Delta ACA_{t-1} - 0{,}46\Delta ACA_{t-2} + 0{,}21\Delta DE_{t-1} - 0{,}62\Delta DE_{t-2} - 0{,}28\Delta SSP_{t-1} + 0{,}10\Delta SSP_{t-2} - 0{,}05\Delta CDSP_{t-1} - 0{,}03\Delta CDSP_{t-2} \quad (24)$$

Equation 25 shows Cointegration Equation for long run model.

$$ect_{t-1} = ACA_{t-1} + CA_{t-1} - 1{,}01DE_{t-1} + 0{,}41SSP_{t-1} + 1{,}23CDSP_{t-1} - 12{,}20 \quad (25)$$

Table 25: Vector Error Correction Model

The Var.	Coeff.	Std. Er.	t-Sta.	Prob.
C(1)	-0,3068	0,0675	-4,5454	0,0000

In table 25, C(1) variable displays Error Correction Term. The coefficient of C(1) has negative value as well as it is statistically significant. It points out that there is long term causality running from ACA, DE, SSP and CDSP to CA. Furthermore, R^2 is %76,6 which means the model is fitted.

Table 26: Walt Test

Test Statistics	The Variable	Value	Probability
Chi-square	DE	14,21	0,0008
Chi-square	ACA	1,80	0,4051
Chi-square	CDSP	0,70	0,7025
Chi-square	SSP	1,95	0,3754

All tests are greater than 0,05 except DE variable. Therefore, it can be stated the existence of the short run causality running from ACA, CDUK and SUK to CA. Moreover, it is possible about existence the short run causality running from DE to CA.

4.3.8. Turkey

Cointegration test was applied with lag length of 2 and Model 1.

Table 27: Johansen Cointegration Test (1988) Results for Turkey

Hypothesized Number of CEs	Trace Val.	Critic. Val.	Pro.
None* (r=0)	85.56	60.06	0.0001
At most one* (r≤1)	49.43	40.17	0.0046
At most two* (r≤2)	25.07	24.28	0.0397
At most three (r≤3)	4.98	12.32	0.5700
At most four (r≤4)	1.67	4.13	0.2303
Hypothesized Number of CEs	**Max.Eg.Val.**	**Critic. Val.**	**Pro.**
None* (r=0)	36.12	30.44	0.0088
At most one* (r≤1)	24.37	24.16	0.0469
At most two* (r≤2)	20.08	17.80	0.0223
At most three (r≤3)	3.31	11.22	0.7389
At most four (r≤4)	1.67	4.13	0.2303

Note:* This sign displays the hypothesis is rejected at %5 level.

The result of all tests in table 27 indicated three cointegrating equation. In addition, the trace value is 25,07 and The Max Eigen statistics is 20,08. Both of them is more than the %5 critical value.

The analysis demonstrates that the number of cases of Covid-19 is long-run determinants of financial markets in Turkey.

$$\Delta CA_t = -0{,}35ect_{t-1} - 1{,}12\Delta CA_{t-1} + 0{,}45\Delta CA_{t-2} + 0{,}70\Delta ACA_{t-1} + 0{,}04\Delta ACA_{t-2} + 0{,}44\Delta DE_{t-1} - 0{,}31\Delta DE_{t-2} + 0{,}15\Delta STR_{t-1} + 0{,}52\Delta STR_{t-2} - 0{,}06\Delta CDTR_{t-1} - 0{,}053\Delta CDTR_{t-2} \quad (26)$$

Equation 27 shows Cointegration calculation for long term model.

$$ect_{t-1} = ACA_{t-1} + CA_{t-1} + DE_{t-1} + 2{,}27STR_{t-1} - 6{,}13CDTR_{t-1} \quad (27)$$

Table 28: Vector Error Correction Model

The Var.	Coeff.	Std. Er.	t-Sta.	Prob.
C(1)	-0,3510	0,0583	-6,0142	0,0000

As seen table 28, the coefficient of C(1) is negative in as well as it is statically significant. Therefore, the possibility of existence the long run causality running from ACA, DE, SSP and CDSP to CA can be claimed. In addition, R^2 of the model is %77,5. The rate of R^2 of model is quite adequate.

Table 29: Walt Test

Test Statistics	The Variable	Value	Probability
Chi-square	DE	7,15	0,0280
Chi-square	ACA	5,28	0,0713
Chi-square	CDTR	0,83	0,6602
Chi-square	STR	2,20	0,3321

The probability of the Chi-square test is more than 0,05 for ACA, CDTR and STR. Therefore, the existence the short run causality running from ACA, CDUK and SUK to CA cannot ne claimed. Nevertheless, the short run causality is possible when running from DE to CA.

Table 29: The Summarize of Contemporaneous Regression

	China		France		Germany		Italy		USA		UK		Spain		Turkey	
Number of CEs	3		4		2		4		4		2		2		3	
	Lng. Cas.	Shr. Cas.	Lng. Cas.	Shr. Cas.	Lng. Cas.	Shr. Cas.	Lng. Cas.	Shr. Cas.	Lng. Cas.	Shr. Cas.	Lng. Cas.	Shr. Cas.	Lng. Cas.	Shr. Cas.	Lng. Cas.	Shr. Cas.
DE	+	+	+	-	+	+	-	-	-	-	+	+	+	+	+	+
ACA	+	+	+	-	+	-	-	-	-	-	+	-	+	-	+	-
CD	+	-	+	-	+	-	-	-	-	-	+	-	+	-	+	-
S	+	-	+	-	+	-	-	-	-	-	+	-	+	-	+	-

Table 29 displays summary result of all Cointregration analysis for eight countries.

5. CONCLUSION

The Pandemic first broke out in Wuhan City, China and has become the biggest disaster in the world since The Second World War. It spread very quickly to almost every country in the world in two-three months. From December 2019 to May 12 2020, Covid-19 has caused at least 287,670 people's death and has caused the sickness of more than 4,2 million people.

It paralyzed the health systems of the great number of developed and financially wealthy countries in the world. It caused to cease the works of global trade organizations and supply chains. It has led to instability on micro and macroeconomic conditions of countries. Since the physical areas were dangerous to work cooperatively during pandemic, Covid-19 has ceased the economy. It forced people to stay at home and also live under quarantine conditions.

In this paper, the effects of Covid-19 cases on national economies were analysed. For this purpose, eight selected countries are affected badly from the virus. As an economic variable, daily stock index values and CDS prices of these eight countries were taken. Johansen Cointegration method, long-term relationships among the variables are tested. In addition, the existence of short-term relationships among variables were tested by the VECM model.

According to results, all countries have at least two cointegrations vectors. However, the long-term relationship of Italy and the USA is not statistically significant.

Zeren and Hizirci (2020) has found out the cointregation relationship between Covid-19 cases and Stock indexes of China with Spain. This finding was confirmed in this study, as well. Besides, Zeren and Hizirci (2020) didn't detect any cointregration relationship between Covid-19 cases and Stock indexes of France and Germany. However, in this paper, it can be obviously claimed the existence of the long run causality relationship in France (CAC40) and Germany (DAX). Nevertheless, both studies didn't detect the significant cointegration relationship for Italy.

In addition, there is no short run causality running from ACA, CD, S to CA for France, Germany, Italy, USA, UK and Turkey to CA. In addition, there is the short run causality running from DE to CA for France, Germany, UK, Spain and Turkey to CA. In conclusion, it can be said that there is the short run causality from CA to some variables as significantly. Moreover, there is no short run causality in France, Italy and the USA significantly.

In conclusion, there is the long term relationship between the cases of total Covid-19 and China, France, Germany, the United Kingdom, Spain, Turkey. But, there is no long term relationship between the case of total Covid-19 and France, Italy and the USA significantly. Furthermore, it can be said that there is short run causality from CA to some variables as significantly. However, there is no short run causality in France, Italy and the USA significantly. Finally, there is no long or short run causality in Italy and the USA.

REFERENCES

Acar, Y. (2020). Yeni Koronavirüs (Covid-19) Salgını ve Turizm Faaliyetlerine Etkisi. *Güncel Turizm Araştırmaları Dergisi, 4*(1), 7-21. doi:10.32572/guntad.703410

Ayittey, F. K., Ayittey, M. K., Chiwero, N. B., Kamasah, J. S., & Dzuvor, C. (2020). Economic impacts of Wuhan 2019-nCoV on China and World. *J Med Virol, 92*(473-475). doi:10.1002/jmv.25706

Beutels, P., Jia, N., Zhou, Q.-Y., Smith, R., Cao, W.-C., & Vlas, S. (2009). The economic impact of SARS in Beijing, China. *Tropical Medicine and International Health, 14*(1), 85-91. doi:10.1111/j.1365-3156.2008.02210.x

Corbet, Shaen and Larkin, Charles James and Lucey, Brian M.,(2020) The Contagion Effects of the COVID-19 Pandemic: Evidence from Gold and Cryptocurrencies, Available at SSRN: https://ssrn.com/abstract=3564443 or http://dx.doi.org/10.2139/ssrn.3564443

Dey, S., Saha, S., & Akter, R. (2019). Short Run and Long Run Association between Real Exchange Rate and Trade Balance: Empirical Evidence from Bangladesh (Johansen Approach and Vector Error Correction Model). *Global Journal of Human-Social Science : E Economics, 19*(3).

Fernandes, Nuno, (2020). Economic Effects of Coronavirus Outbreak (COVID-19) on the World Economy. Available at SSRN: https://ssrn.com/abstract=3557504 or doi:10.2139/ssrn.3557504

Gbaiye, O. G., Ogundipe, A., Osabuohien, E., Olugbire, O. O., Adeniran, O. A., Bolaji-Olutunji1, K. A., . . . Oluwatomi , A. (2013). Agricultural Exports and Economic Growth in Nigeria (1980-2010). *Journal of Economics and Sustainable Developmen, 4*, 1-4.

Johansen , S., & Juselius, K. (1990). Maximum Likelihood Estimation And İnference On Cointegration — With Applications To The Demand For Money. *Oxford Bulletin of Economics and Statistics, 52*(2), 169-210.

Johansen, S. (1988). Statistical Analysis of Cointegration Vectors. *Journal of Economic Dynamics and Control, 12*(2-3), 231-254.

McKibbin, W., & Fernando, R. (2020). The Global Macroeconomic Impacts of COVID-19:Seven Scenarios. *The Centre for Applied Macroeconomic Analysis (CAMA)*, 1-43. doi:10.2139/ssrn.3547729

Ozili, Peterson K and Arun, Thankom,(2020). Spillover of COVID-19: Impact on the Global Economy, Available at SSRN: https://ssrn.com/abstract=3562570 or http://dx.doi.org/10.2139/ssrn.3562570

Pahwa, N. (2018). Impact of Debt on Short Run and Long Run Growth: Empirical Evidence from India. *Current Issues in Economics and Finance*, 3-18. doi:10.1007/978-981-10-5810-3_1

Ramelli, Stefano and Wagner, Alexander F., (2020). Feverish Stock Price Reactions to COVID-19. Swiss Finance Institute Research Paper No. 20-12. Available at SSRN: https://ssrn.com/abstract=3550274 or http://dx.doi.org/10.2139/ssrn.3550274

Zeren, F., & Atike , H. E. (2020). The Impact of Covid-19 Coronavirus on Stock Markets: Evidence from Selected Countries. *Muhase ve Finans İncelemeleri Dergisi, 3*(1), 78-84. doi:10.32951/mufider.706159

Zhang, D., Hu, M., & Ji, Q. (2020). Financial markets under the global pandemic of COVID-19. *Finance Research Letters, 101528*. doi:10.1016/j.frl.2020.101528

China Data Lab, (2020), "World COVID-19 Daily Cases with Basemap", https://doi.org/10.7910/DVN/L20LOT, Harvard Dataverse, V18, UNF:6:N6nMzAAg+cImLPTNzI+/zQ== [fileUNF]

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

EFFECTS OF AGE, SIZE, SPONSOR AND GOVERNMENT SHAREHOLDINGS ON PROFITABILITY: EVIDENCE FROM ENGINEERING INDUSTRY OF BANGLADESH

DOI: 10.17261/Pressacademia.2020.1222
JBEF- V.9-ISS.2-2020(9)-p.171-181

Md. Atiqullah Khan
University of Dhaka, Dept. of Finance, Dhaka, Bangladesh.
writetoatiq@gmail.com, ORCID: 0000-0002-4704-5594

Date Received: April 9, 2020 **Date Accepted:** June 16, 2020

To cite this document
Khan, M. A., (2020). Effects of age, size, sponsor and government shareholdings on profitability: evidence from engineering industry of Bangladesh. Journal of Business, Economics and Finance (JBEF), V.9(2), p.171-181.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2020.1222

ABSTRACT

Purpose- This paper aims at investigating the effects of age, size, fixed assets utilization, sponsor and government shareholdings on the profitability of engineering industry of Bangladesh for the period of 2000-2019.

Methodology- This paper analyzed 37 out of 39 companies under engineering industry listed on Dhaka Stock Exchange. Fixed effects model has been applied after deciding this from Hausman test to estimate the effects of age, size, fixed asset utilization, sponsor and government shareholdings on the profitability.

Findings- Size, fixed asset utilization, and sponsor shareholding have significant impact on profitability. While fixed asset utilization has positive impact and age, size, sponsor shareholding and government shareholding have negative impact on it. Mixed influences of learning effect and size effect are experienced among the firms.

Conclusion- The findings from the analysis are diversified in nature. The investors and policy makers should have in depth insight to make better decision.

Keywords: Age effect, size effect, shareholding, profitability, engineering.
JEL Codes: D21, G32, L25

1. INTRODUCTION

Engineering industry is the emergent promising sector which can farther broaden the export diversity of Bangladesh by light engineering sector. Engineering industry contributes to all other sectors for example, construction sector, railway sector, automobile sector, paper and pulp sector, pharmaceutical sector, marine sector of Bangladesh. Thus light engineering industry has drawn the attention of the policymaker as a potential cost cutting sector in the near future through providing almost 50% of the substitutes of all the relevant imported items of Bangladesh. A study conducted by Japan International Cooperation Agency (JICA) showed that there are around 40,000 small-scale light engineering enterprises are producing about to 10 thousand different items for construction, agriculture, and other industries in Bangladesh ("Light Engineering Sector Bangladesh", 2020).

For a long period of time, two questions have been arisen. First one is whether the older firms make higher profits than the younger firms. It's expected that the more a firm grows older, the more the firm learns and increases the profitability (Ilaboya and Ohiokha, 2016). But study shows that age effect doesn't help to increase the profitability of firm (Pervan, Pervan and Ćurak, 2017). The effect of age on the profitability of the firms under engineering industry of Bangladesh is still unknown. Thus the effect of learning by doing on the performance of these firms is a topic of investigation.

The second question is whether the profitability of larger firms is higher than the profitability of smaller firms in terms of total assets as a proxy of size. Study shows that, the size of firms helps to increase productivity (Pagano and Schivardi, 2003). In opposite of the findings, study also shows that size effect doesn't have considerable impact on the firm in making higher profit (Abeyrathna

and Priyadarshana, 2019). How much the older firms suffer because of 'liability of obsolescence' and 'liability of senescence' helps to understand the size effect on the profitability but it's still unclear in engineering industry of Bangladesh. So there is another lack of knowledge to investigate the size effect on the profitability of the engineering industry of Bangladesh.

The utilization of fixed assets and the shareholding patterns are supposed to have impacts on profitability. But the fixed assets utilization doesn't impact profitability (Ani, 2014). It's examined that shareholding pattern of managerial ownership of the firm influences the firm value (Rizqia, Aisjah and Sumiati, 2013) but Mollah, Al Farooque and Karim (2012) found that major ownership patterns including sponsor shareholding, government shareholding are destructive to the financial performances of the firms and also added that the firm performances are improved by dispersed ownership.

Mixed empirical results were found regarding the impacts of age, size, fixed asset utilization, sponsor shareholding and government shareholding on the profitability of the firm. From the context of developing countries, insufficient empirical work is found regarding these factors.

The inconsistencies among the findings from previous researches are an indication of inconclusive nature of the impacts of these variables. Additionally, it's experienced that the relationship between the size and the profitability of firm was actually industry specific (Becker-Blease, Kaen, Etebari and Bauman, 2010). Thus main purpose of this paper is to investigate the relationship of age, size, fixed asset utilization, sponsor shareholding, government shareholding, institutional shareholding on the profitability of the firms which are running operations under engineering industry of Bangladesh. The findings after conducting the study show that age, size, sponsor shareholding and government shareholding have negative impact and fixed asset utilization has positive impact on the return on assets as a measurement of profitability of the engineering industry of Bangladesh.

An overview of the previous studies and the findings of these are discussed in second part of this paper. Third part discusses about the data and methodology and fourth part of the paper briefly discusses about the analysis and findings of this research. Fifth part provides a complete investigation of learning effect and size effect on profitability. The ending of the paper includes conclusion and recommendations for policy makers and investors.

2. LITERATURE REVIEW

The theory of learning by doing hypothesis is a big area of interest in finance and accounting literature. Navaretti, Castellani and Pieri (2012) investigated that the firms having higher ages are less likely to grow fast although they face shrinking probability more than the younger firms. They also concluded that a combination of learning and willingness to grow makes the path of firm growth. Later Coad, Daunfeldt and Halvarsson (2015) conducted an analysis to understand the relationship between the age of frim and the sales growth. It was found that for new ventures, age has positive autocorrelation while it has negative relation for the older firms. The main reasons behind the difference in scenario by age are the environmental turbulence, challenges in adapting the strategies to the changing market conditions. Thus the older firms face more troubles than the newer firms in managing these issues.

On the contrary, by analyzing 302 non-financial firms listed on Borsa Istanbul for a period of 2005-2014, Akben-Selcuk (2016) showed that there exists a negative and convex relationship between the firm age and ROA as profitability. The younger firms face a decrease in profitability but they may become profitable in an old age. In accordance with that the performance of the business firm is negatively correlated with the age of the firm after analyzing 956 firms under Croatian food industry during 2005-2014 (Pervan et al., 2017). They also showed that size, solvency, liquidity are also influential factors on the profitability of the firms.

Cowling and Tanewski (2018) experimented that not all firm growths will lead to productivity gains. There is significant difference in the way of adding value creation between the small and large firms. The efficiency of the firm follows an inverted U shaped in accordance with firm age and it was found that the youngest (having the age of (0-2 years) and the oldest firms (having the age more than 9 years) are less likely to be more productive than the middle aged firms. But Coad (2016) found that the age effects are occurred with the first 5-7 years. Finally, Oyelade (2019) examined that total sales and age of the firms have significant impact on the return on assets since the incorporation while the age of firm has a negative impact and total sales revenue has a positive impact.

The effect of size on firm's profitability is also another big area of interest. Positive and robust relationship is found between the average firm size and the growth after conducting the study by Pagano and Schivardi (2003). They also found that larger size of firm fostered productivity growth because of taking advantage of the increasing returns related with Research and Development.

Later, Becker-Blease, Kaen, Etebari and Bauman (2010) examined the relationship between the size of firm and the profitability of the firm in U.S. manufacturing industries and found that profitability increases at a decreasing rate and eventually it declined for 47 of the industries. No relationship was found between the size of firm and profitability up to 52 industries among 109 industries. Only for 11 industries, it was seen that profitability increased with the size of the firm. From this analysis, it's derived that the relationship between the size and the profitability of firm is actually industry specific.

But John and Adebay (2013) discovered that the firm size both in terms of log of total assets and the log of sales had a positive impact on the profitability of the manufacturing companies of Nigeria by considering return on assets as the benchmark to understand profitability. Again Hui, Radzi, Jenatabadi, Kashim and Radu (2013) investigated the relationship of organizational innovation, organizational learning on the organizational performance by picking 168 manufacturing companies under food industry from China, Malaysia and Taiwan. It was explored that firm age and size are the moderating variables by controlling the relationship among organizational learning, innovation and performance.

Kartikasari and Merianti (2016) examined 100 manufacturing companies listed on Indonesia Stock Exchange in a period of 2009-2014. They discovered that leverage measured by debt ratio has a significant positive impact while total assets as size has a significant negative impact on the profitability represented by return on assets (ROA). Turnovers of the firm doesn't have significant effect on it. But Ilaboya and Ohiokha (2016) analyzed the effect of firm age, size on the profitability by the panel data after choosing 30 firms from a period of 2006-2012 listed on Nigerian Stock Exchange. Log of profit before interest and tax was chosen as dependent variable for understanding profitability. They stated that firm age and firm size have positive impact on the profitability. The significant positive impact of firm age is an evident of learning by doing hypothesis. Again the significant positive relationship between firm size and profitability denied the structural inertia hypothesis. Fareed, Ali, Shahzad, Nazir and Ullah (2016) too examined the impacts of some key determinants of the profitability of 16 listed firms under power and energy sector of Pakistan for a period off 200-2012. They found that firm growth, size, and electricity crisis positively influence the profitability while age, financial leverage negatively influence the profitability. Productivity and size are found to be the strongest determinants of the profitability in this sector.

Isık, Aydın Unal and Unal (2017) examined the impact of firm size on the profitability by selecting 112 publicly listed companies under manufacturing sector in Turkey from the period of 2005 to 2013. The results from the estimation suggested that the firm size measured through the assets, turnover, no. of employees tends to have a positive influence on profitability by the control variables which are firm age, growth opportunities, liquidity level, financial risks, unsystematic risk. But Abeyrathna and Priyadarshana (2019) examined that the size of the firms doesn't have considerable impact on the profitability of the listed manufacturing business firms in Sri Lanka.

Proper utilization of fixed assets is a key factor to increase profitability of the firm. Varied findings are seen regarding the fixed assets utilization on firm's profitability. Ani (2014) showed that fixed assets turnover impact on returns on equity and not on returns on assets by considering some manufacturing companies listed on Muscat Securities Market. But Warrad and Omari (2015) found that there fixed asset turnover ratio doesn't have significant impact on the returns on assets of service sectors. Same outcome was found by Okwo, Okelue and Nweze (2012) that investment in fixed assets doesn't have strong impact on the profitability of the brewery firms in Nigeria.

Little empirical work is found regarding how sponsor shareholding and government shareholding impact on the profitability of the firm. Cho and Kim (2007) explored that managerial ownership didn't have significant moderating effects on corporate performance of the firms of Korea. Mollah et al. (2012) explored whether different ownership structure, board characteristics variables influenced the firm performance by considering all the firms listed on Botswana Stock Market for a period of 2000-2007. Surprisingly it was found that all the major ownership patterns like sponsor shareholding, institutional shareholding, government shareholding, foreign shareholding are destructive to the financial performances of the firms. Dispersed ownership improved the firm performances and mitigated the agency conflicts. It was also seen that the performance of firm in Botswana was industry specific instead of firm specific risks and size to explain firm performance.

In accordance with that Stančić, Čupić and Obradović (2014) examined the impacts of board and the ownership structure on the profitability of 74 commercial banks of South east Europe for a period of 2005-2010. It was found that board size has significant negative impact on bank's profitability while the proportion of independent directors' negative impact is not significant. The privately hold domestic banks outperform the state owned banks and foreign banks. Size and capitalization also influence the profitability. Liu (2018) discovered that the government shareholding is likely to be largest block holders and when the government is the largest block holder, the size of its ownership is also quite big. But Makhlouf, Laili, Basah and Ramli (2017) examined the

effectiveness of the board of directors and the firm performance. It was experienced that the ownership of the board of directors has a positive impact on the profitability of firm where ROA was chosen for a benchmark of profitability.

3. DATA AND METHODOLOGY

3.1. Data

For constructing the panel dataset, 37 companies out of 39 companies listed on Dhaka Stock Exchange under engineering industry have been chosen. The period of the data is 2000-2019 for the previously listed companies and for the companies listed later, it's from the year of listing to the year 2019. Because of unavailability and postponing the business operations, a few years of observations were omitted from this unbalanced panel dataset.

3.2. Dependent Variable

Return on Assets (ROA): The Return on Assets (ROA) is a great measurement to understand the profitability of any business firm. ROA indicates how profitable the business is by comparing the net income and the total assets of the firm. In this study, ROA has been used for measuring the profitability.

Returns on Assets (ROA)= Net Income/ Total Assets

3.3. Independent Variables

Age: The age of a firm indicates how long the firm has been running its business operations. Over the period of time, business firm gets experienced about how to conduct business operations prudently. Thus the age of firm has an active influence on the profitability of the business firm. Instead of the listing year, the year of commencement of the business firm has been used as the age of the firm.

Age of Firm= Since the Year of Commencement of Business Operations

Size: The size of the firm is an important fundamental characteristic of any business firm. The total assets of the firm are a measurement of understanding the size of this firm. The natural log of the total assets has been used as the size of the firm in the study.

Size of Firm= Log of Total Assets

Fixed Asset Utilization: How much the business is generating the revenues by investing into fixed assets can be understood by fixed asset utilization ratio. Thus fixed asset utilization has been used is this study to understand the efficiency of the firm by its impact on the profitability of the firm.

Fixed Asset Utilization = Sales/ Fixed Assets

Sponsor Shareholding: Sponsor shareholding indicates the percentage of share in shareholding pattern held by the sponsors of the firm. Sponsor shareholders work for building up the business firm for generating more profits. The change in sponsor shareholding is a strong sign of change in profitability of the business firm.

Sponsor Shareholding = Total No. of Shares Held by Sponsors/ Total No. of Shares of the Company

Government Shareholding: Government shareholding indicates the percentage of share in shareholding pattern held by the government. Both in developed and developing countries, government ownership is widely existing. It's highly likely that the business performance is influenced when there exists higher government shareholding.

Government Shareholding = Total No. of Shares Held by Government/ Total No. of Shares of the Company

3.4. Model and Estimation

Multiple regression analysis has been used in the study to examine the impacts of age, size, fixed asset utilization and shareholding pattern which includes sponsor shareholding and government shareholding on the profitability of the firm. The following equation expressed in econometric form has been developed based on the variables used in this study for conducting the test:

$$\mathbf{ROA}_{i,t} = \boldsymbol{\alpha} + \boldsymbol{\beta}_1 * \text{Age} + \boldsymbol{\beta}_2 * \text{Size} + \boldsymbol{\beta}_3 * \text{Fixed Asset Utilization} + \boldsymbol{\beta}_4 * \text{Sponsor Shareholding} + \boldsymbol{\beta}_5 * \text{Government Shareholding} + \boldsymbol{\varepsilon}_{i,t}$$

Where the dependent variable, ROA (Returns on Assets) = Net Profit/ Total assets,

α = Constant value (value of net profit when all independent variables are zero)

β_1 to β_5 all are the slopes of the independent variables of the regression

Ɛ = Error (normally distributed error term with an assumed mean value of 0),

i = company, t = covered time period

The impacts of the independent variables are tested by using the statistical tools in Stata version 13.0 and EViews 9. To understand the central tendency and the dispersions of data, descriptive statistics are used with the help of correlation analysis. To understand the appropriate model specification in between fixed effects model and random effects model, Hausman test is used. The test suggests that fixed effect model is appropriate for this study.

4. FINDINGS AND DISCUSSIONS

4.1. Descriptive Statistics

The descriptive statistics of the study provides the central tendency of the variables in Table 1. The mean of ROA (Returns On Assets) is 4.21% with a minimum value of -12.12% and a maximum value of 23.54%. The average age of firm is 27.95 years with a minimum of 4 years and a maximum of 67 years based on the commencement of the business operations. For measuring the size of the firm, logarithm value of total assets was used. The average size of the firm indicates the value of total assets is BDT 4,321 million with a minimum value of BDT 12.19 million and a maximum value of BDT 91,067.18 million. The fixed asset utilization ratio indicates an average of 7. 21 times with a minimum value of 0.04 time and a maximum value of 265.56 times. The average shareholding pattern of the sponsors is 36.49% with a minimum and maximum range of 0.00% to 80.00%. The average shareholding pattern of the government indicates 8.68% with a minimum of 0.00% to a maximum of 65%.

Table 1: Descriptive Statistics

Variable	Obs.	Mean	St. Dev	Minimum	Maximum
Return on Assets	422	4.21	4.93	-12.12	23.54
Age of Firm	422	27.95	13.96	4	67
Log of Total Assets	422	9.08	0.73	7.09	10.96
Total Assets (in Million)	422	4,321	9,307	12.19	91,067.18
Fixed Asset Utilization	422	7.21	22.46	0.04	265.56
Sponsor Shareholding	422	36.49	22.04	0	80
Govt. Shareholding	422	8.68	19.46	0	65

4.2. Correlation

The correlation matrix among the variables are shown in Table 2. The correlation matrix of the study indicates the value of 1.00 which indicates perfect correlation within variables which is expected. The other correlation coefficients in the study is low which means of having no multicollinearity problem.

Table 2: Correlation Coefficients

Variable	1	2	3	4	5	6
(1) Return on Assets	1.00					
(2) Age of Firm	-0.03	1.00				
(3) Log of Total Assets	0.03	0.16	1.00			
(4) Fixed Asset Utilization	0.33	0.18	-0.08	1.00		
(5) Sponsor Shareholding	0.10	0.00	0.15	-0.20	1.00	
(6) Govt. Shareholding	-0.01	0.15	-0.03	0.29	-0.70	1.00

4.3. VIF and Multicollinearity

The Variance Inflation Factor (VIF) is a great measurement to understand the multicollinearity in the tests. Table 3 shows that none of the values is above 2.16 where if the value raises above 10.0 is considered to have multi-collinearity problem. That means no problem of multicollinearity exists in the regression variables.

Table 3: VIF Test

Variable	VIF	1/VIF
Age of Firm	1.10	0.91
Log of Total Assets	1.07	0.93
Fixed Asset Utilization	1.13	0.88
Sponsor Shareholding	2.07	0.48
Govt. Shareholding	2.16	0.46
Mean VIF	1.51	

4.4. Heteroskedasticity Test

Table 4 indicates the probability values of p=0.1327 and 0.1325 both are greater than 0.05 indicate the presence of homoscedastic residuals. So there exists no problem of heteroskedasticty.

Table 4: Heteroskedasticity Output

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.7027	Prob. F(5,416)	0.1327
Obs*R-squared	8.4632	Prob. Chi-Square(5)	0.1325
Scaled explained SS	20.8327	Prob. Chi-Square(5)	0.0009

4.5. Hausman Test

To choose the appropriate model between fixed effects model and random effects model, Hausman test helps to make the decision. Table 5 shows the outcome of Hausman test.

Table 5: Hausman Test

Test Summary	Chi-Sq. df	Chi-Sq. Statistic	Prob.
Cross Section Random	5	36.01	0.000
ROA	Fixed	Random	Difference
Age of Firm	-0.0653	-0.0797	-0.0145
Log of Total Assets	-2.7005	-0.7151	1.9853
Fixed Asset Utilization	0.0549	0.0640	0.0091
Sponsor Shareholding	-0.0870	-0.0424	0.0446
Govt. Shareholding	-0.0544	-0.0482	0.0062

The output through conducting Hausman test indicates the probability value of 0.000 which is less than 0.05 what means fixed effects model is appropriate for the test.

4.6. Fixed Effects Model

R squared value and adjusted R squared value are 20.01% and 11.37% respectively. The F statistic value of the test is 19.01 indicating the probability value of 0.000 which is robust and suggests that the relationship between the dependent and independent variables is significantly linear. The results show that only fixed asset utilization has positive impact while age of firm,

log of total assets as size, sponsor shareholding, and government shareholding have negative impact on profitability. The overall findings indicate that log of total assets, fixed asset utilization, sponsor shareholding have significant impact at 1% level of significance on the profitability of the firm.

Table 6: Fixed Effect Model

Return on Assets	Coeff.	t-Statistic	Prob.
Constant	33.8011	4.27	0.000
Age of Firm	-0.0653	-1.38	0.169
Log of Total Assets	-2.7005	-2.84	0.005*
Fixed Asset Utilization	0.0549	5.46	0.000*
Sponsor Shareholding	-0.0870	-4.74	0.000*
Govt. Shareholding	-0.0544	-1.42	0.156

*significant at 1% level of significance

R-squared	0.2001	F(5, 380)	19.01
Adj. R-squared	0.1137	Prob > F	0.0000

Age has negative impact on the profitability of firms supporting the findings of Oyelade (2019), Pervan et al., (2017), Akben-Selcuk (2016) but differing the findings of Ilaboya and Ohiokha (2016), Pagano and Schivardi (2003),

Log of total assets which indicate size of firm has significant and significant impact on the profitability supporting Kartikasari and Merianti (2016) but varying from the findings of Isık et al. (2017), John and Adebayo (2013), Pagano and Schivardi (2003)

Fixed asset utilization has significant positive impact on the profitability of firm varying from the findings of Warrad and Omari (2015), Okwo et al. (2012)

Sponsor shareholding has significant negative impact on the profitability of firm varying from the findings of Makhlouf et al. (2017) and government shareholding has also negative but insignificant impact on the profitability of firm partially supporting the findings of Mollah et al. (2012).

5. LEARNING EFFECT AND SIZE EFFECT

5.1. Does Business Firm Learn Overtime?

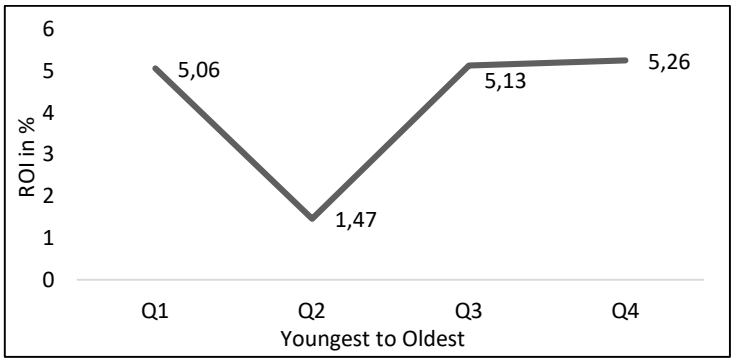
All the chosen companies listed on DSE under engineering industry were divided into four quartiles according to age and sorted from younger firms to older firms. Each quartile indicates the average age of the firms under assigned category for the period of 2000-2019. The first quartile (Q1) represents the average age of youngest firms and fourth quartile (Q4) represents the average age of oldest firms by following the pattern of Q1< Q2< Q3< Q4 where Q stands for Quartile according to the average ages in years shown on Table 7.

Table 7: Age Quartile

Quartile	Average Age in Years
Q1	12
Q2	22
Q3	29
Q4	44

Figure 1 helps to understand the learning effect on the firms. At Q1, the youngest stage, a firm makes on an average ROA of 5.06%. At Q2, the firm grows older but faces most troubles and loses profitability. The average ROA reduces to 1.47% what is an indication of not learning by getting older.

Figure 1: Profitability of Firm as Learning Effect



Later at Q3, the firm tries to learn, understands the mistakes and generates higher profits with an average ROA of 5.13%. At Q4, the oldest stage, the firm outperforms the market by adding more profitability resulting to an average ROA of 5.26%. But the growth of profitability at the oldest stage isn't the same as immediate previous stage.

Figure 2: Learning Effect of Firm Overtime

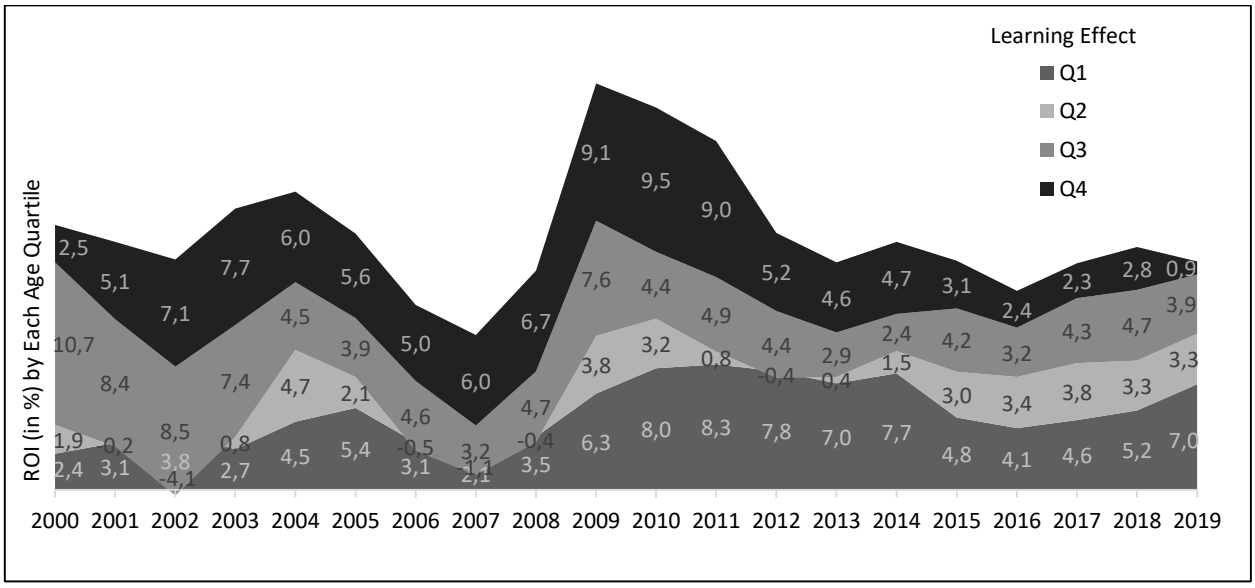


Figure 2 clarifies whether the business firm learns to maximize the profitability as a result of learning effect. The individual average returns on assets in Q3 and Q4 are higher than the individual returns on assets in Q1 and Q2 but no clear movement pattern is strongly seen. Thus a mixed view is received regarding the learning effect on the performance of firms under engineering industry of Bangladesh. This observation varies from the findings of Coad, Daunfeldt and Halvarsson (2014) but supports the findings of Akben-Selcuk (2016).

5.2. Does the Size of Firm Increase Profitability?

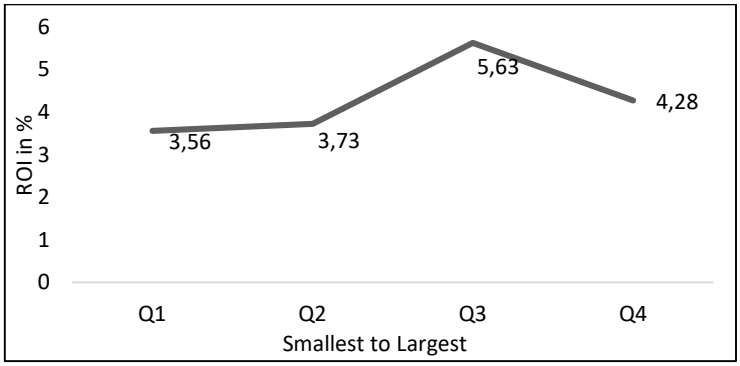
All the chosen companies listed on DSE under engineering industry were divided into four quartiles according to the total assets as a measurement of size and sorted from smaller firms to larger firms in size. Each quartile indicates the average size of the firms under assigned category for the period of 2000-2019. The first quartile (Q1) represents the firms in smallest size and fourth quartile (Q4) represents the firms in largest size by following the pattern of Q1< Q2< Q3< Q4 where Q stands for Quartile according to the average sizes shown on Table 8.

Table 8: Size Quartile

Size	Mean Size in BDT Billion
Q1	0.23
Q2	0.95
Q3	2.32
Q4	9.17

Figure 3 helps to understand the size effect on the firms. At Q1, the smallest stage, a firm makes on an average ROA of 3.56%. At Q2, the firm grows larger in size and increases profitability to an average ROI of 3.73%.

Figure 3: Profitability of Firm as Size Effect



Later at Q3, the firm keeps growing in size, understands business strategies better and generates higher average ROA of 5.63%. Firm outperforms the market at Q3 and the consecutive higher returns on assets indicate the impacts of size effect. At Q4, the largest stage, the firm loses the profitability resulting to an average ROA of 4.28%. At Q4, the firms face most troubles. The bigger in size the firms grow, the firms successfully maintains the consistency on making higher profitability except Q4. Owing to organizational inertia, firms can't utilize the size advantage on making higher profitability in Q4.

Figure 4: Size Effect of Firm Over time

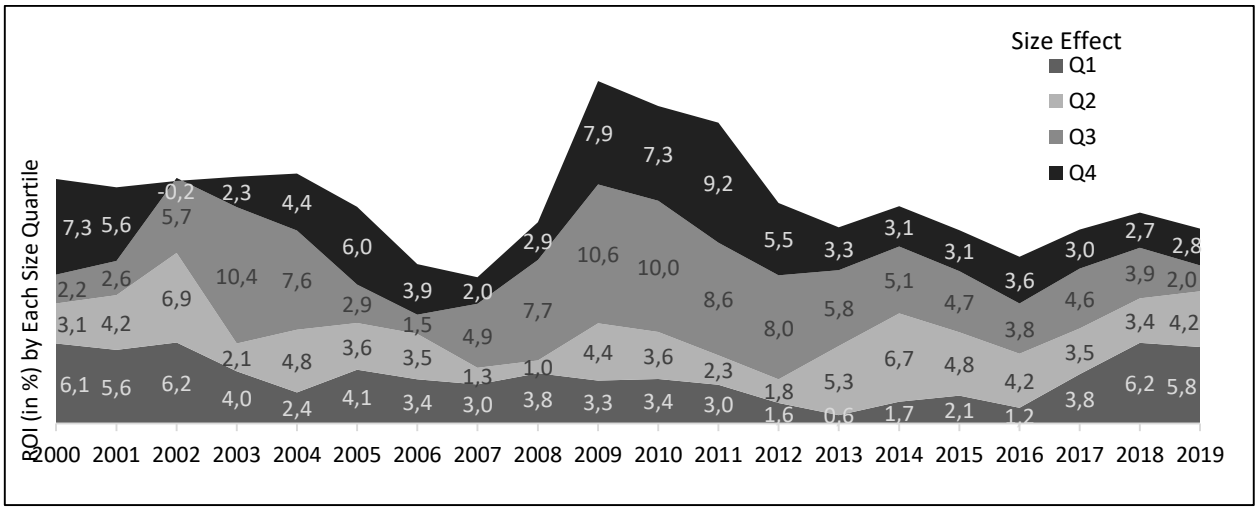


Figure 4 clarifies whether the business firm can utilize its size to maximize the profitability as a result of size effect. The individual average returns on assets in Q3 and Q4 are higher than the individual returns on assets in Q1 and Q2. Thus in size effect here also a mixed view is experienced on the performance of firms under engineering industry of Bangladesh in Figure 4. This observation differs from the findings of Ilaboya and Ohiokha (2016), Pagano and Schivardi (2003) but supports the findings of Abeyrathna and Priyadarshana (2019), Kartikasari and Merianti (2016).

6. CONCLUSION

In this paper, the effects of age, size, fixed asset utilization, sponsor and government shareholdings on the profitability of the firm are investigated by analyzing the data of 37 companies listed on Dhaka Stock Exchange for a period of 2000 to 2019. The result is robust and contextual as per the probable outcomes assumed from previous study. The paper found that size, fixed asset utilization, and sponsor shareholding have strong impacts on the return on assets of the firm. There exists positive relationship of fixed asset utilization on the profitability and negative relationship of age, size, sponsor and government shareholdings on the profitability of the chosen firms. For the economy of Bangladesh, engineering industry plays a vital role by providing products from capital intensive projects to the consumer goods. Proper asset utilization and operational excellence from management of the company help to continue learning progress. The analysis indicates that age effect and size effect influence the profitability of firms in a mixed movement due learning process and organizational inertia.

7. POLICY IMPLICATIONS

The paper clarifies some key points. For making an investment into the firm under engineering industry, an investor should focus more on the size, fixed asset utilization, sponsor shareholding pattern of the firm. As the firms performs better in youngest and oldest periods than in middle periods, an investor should try to make investment into the newest and the oldest firms for minimizing investment risks and maximizing profitability. Again the investors should prefer the larger firms than the smaller firms in terms of size for making investment decision. But they should avoid making investment in the largest firms as the profitability of reduces at this stage because organizational inertia. Economic activities are highly influenced by the engineering industry as this industry correlates the economy. For proliferation, the government should introduce a new policy regarding fair distribution among different shareholding patterns as it impacts the profitability of the firm through maintaining efficiency. The management of the firm should focus on it too. The engineering industry strongly needs skilled manpower and more expertise. Firms should minimize the operating expenses, increase the size, distribute ownership structure in nearby equal proportionate for getting best position in changing the competitive structure of the engineering industry of Bangladesh.

REFERENCES

Abeyrathna, S., and Priyadarshana, A. (2019). Impact of Firm size on Profitability. *International Journal Of Scientific And Research Publications (IJSRP)*, *9*(6), p9081. doi: 10.29322/ijsrp.9.06.2019.p9081

Akben-Selcuk, E. (2016). Does Firm Age Affect Profitability? Evidence from Turkey. *International Journal Of Economic Sciences*, *V*(3). doi: 10.20472/es.2016.5.3.001

Ani, M. (2014). Effects of Assets Structure on the Financial Performance: Evidence From Sultanate of Oman. *Journal Of US-China Public Administration*, *11*(2), 170-179.

Becker-Blease, J., Kaen, F., Etebari, A., and Bauman, H. (2010). Employees, firm size and profitability in U.S. manufacturing industries. *Investment Management And Financial Innovations*, *7*(2), 7-23.

Cho, D., and Kim, J. (2007). Outside Directors, Ownership Structure and Firm Profitability in Korea. *Corporate Governance: An International Review*, *15*(2), 239-250. doi: 10.1111/j.1467-8683.2007.00557.x

Coad, A. (2016). Firm age: a survey. *Journal Of Evolutionary Economics*, *28*(1), 13-43. doi: 10.1007/s00191-016-0486-0

Coad, A., Daunfeldt, S., and Halvarsson, D. (2015). Bursting into Life: Firm Growth and Growth Persistence by Age. *SSRN Electronic Journal*. doi: 10.2139/ssrn.2616759

Cowling, M., and Tanewski, G. (2018). On the productive efficiency of Australian businesses: firm size and age class effects. *Small Business Economics*, *53*(3), 739-752. doi: 10.1007/s11187-018-0070-0

Fareed, Z., Ali, Z., Shahzad, F., Nazir, M., and Ullah, A. (2016). Determinants of Profitability: Evidence from Power and Energy Sector. *Studia Universitatis Babe-Bolyai Oeconomica*, *61*(3), 59-78. doi: 10.1515/subboec-2016-0005

Hui, H., Radzi, C., Jenatabadi, H., Kashim, F., and Radu, S. (2013). The Impact of Firm Age and Size on the Relationship among Organizational Innovation, Learning, and Performance: A Moderation Analysis in Asian Food Manufacturing Companies. *Interdisciplinary Journal Of Contemporary Research Business*, *5*(4), 166-174.

Ilaboya, O., and Ohiokha, I. (2016). Firm Age, Size and Profitability Dynamics: A Test of Learning by Doing and Structural Inertia Hypotheses. *Business And Management Research*, *5*(1), 29-39. doi: 10.5430/bmr.v5n1p29

Isık, O., Aydın Unal, E., and Unal, Y. (2017). THE EFFECT OF FIRM SIZE ON PROFITABILITY: EVIDENCE FROM TURKISH MANUFACTURING SECTOR. *Pressacademia*, *6*(4), 301-308. doi: 10.17261/pressacademia.2017.762

John, A., and Adebayo, O. (2013). Effect of Firm Size on Profitability: Evidence from Nigerian Manufacturing Sector. *Prime Journal Of Business Administration And Management (BAM)*, *3*(9), 1171-1175.

Kartikasari, D., and Merianti, M. (2016). The Effect of Leverage and Firm Size to Profitability of Public Manufacturing Companies in Indonesia. *International Journal Of Economics And Financial Issues*, *6*(2), 409-413.

Liu, K. (2018). Government Ownership in Listed Firms Around the World. *Studies In Business And Economics*, *13*(2), 131-146. doi: 10.2478/sbe-2018-0025

Light Engineering Sector Bangladesh. (2020). Retrieved 8 May 2020, from http://www.projectsprofile.com/info/potential_one.html

Makhlouf, M., Laili, N., Basah, M., and Ramli, N. (2017). Board of Directors' Effectiveness and Firm Performance: Evidence from Jordan. *Research Journal Of Finance And Accounting*, *8*(18), 23-34.

Mollah, S., Al Farooque, O., and Karim, W. (2012). Ownership structure, corporate governance and firm performance. *Studies In Economics And Finance*, *29*(4), 301-319. doi: 10.1108/10867371211266937

Navaretti, G., Castellani, D., and Pieri, F. (2012) (pp. 1-30). Dhaka: European Commission's Seventh Framework Programme. Retrieved from https://www.bruegel.org/wp-content/uploads/2015/09/efige_wp60_3108121.pdf

Okwo, I., Okelue, U., and Nweze, A. (2012). Investment in Fixed Assets and Firm Profitability: Evidence from the Nigerian Brewery Industry. *European Journal Of Business And Management*, *4*(20), 10-18.

Oyelade, A. (2019). The Impact of Firm Size on Firms Performance in Nigeria: A Comparative Study of Selected Firms in the Building Industry in Nigeria. *Asian Development Policy Review*, *7*(1), 1-11. doi: 10.18488/journal.107.2019.71.1.11

Pagano, P., and Schivardi, F. (2003). Firm Size Distribution and Growth*. *Scandinavian Journal Of Economics*, *105*(2), 255-274. doi: 10.1111/1467-9442.t01-1-00008

Pervan, M., Pervan, I., and Ćurak, M. (2017). The Influence of Age on Firm Performance: Evidence from the Croatian Food Industry. *Journal Of Eastern Europe Research In Business And Economics*, 1-9. doi: 10.5171/2017.618681

Rizqia, D., Aisjah, S., and Sumaiti. (2013). Effect of Managerial Ownership, Financial Leverage, Profitability, Firm Size, and Investment Opportunity on Dividend Policy and Firm Value. *Research Journal Of Finance And Accounting*, *4*(11), 120-130.

Stančić, P., Čupić, M., and Obradović, V. (2014). Influence of board and ownership structure on bank profitability: evidence from South East Europe. *Economic Research-Ekonomska Istraživanja*, *27*(1), 573-589. doi: 10.1080/1331677x.2014.970450

Warrad, L., and Omari, R. (2015). The Impact of Turnover Ratios on Jordanian Services Sectors' Performance. *Journal Of Modern Accounting And Auditing*, *11*(2), 78-85. doi: 10.17265/1548-6583/2015.02.001

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

INVENTORY INVESTMENT AND CASH FLOW SENSITIVITY: EVIDENCE FROM TURKISH FIRMS[1]

DOI: 10.17261/Pressacademia.2020.1223
JBEF- V.9-ISS.2-2020(10)-p.182-188

Omer Faruk Tan[1], Emin Avci[2]
[1] Marmara University, Faculty of Business Administration, Department of Accounting and Finance, Istanbul, Turkey.
omer.tan@marmara.edu.tr , ORCID: 0000-0002-8875-4696
[2] Marmara University, Faculty of Business Administration, Department of Accounting and Finance, Istanbul, Turkey.
eavci@marmara.edu.tr , ORCID: 0000-0003-3172-897X

Date Received: April 25, 2020 **Date Accepted:** June 18, 2020

To cite this document
Tan, O.F., Avci, E., (2020). Inventory investment and cash flow sensitivity: evidence from Turkish firms. Journal of Business, Economics and Finance (JBEF), V.9(2), p.182-188.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2020.1223

ABSTRACT

Purpose - This study analyzes the inventory investment – cash flow sensitivity for 166 manufacturing firms in Turkey listed in Borsa Istanbul. The time spans 2006-2018.
Methodology - Based on the previous literature, Lovell's (1961) target adjustment model is used. The baseline equation model is estimated by the system Generalized Method of Moments (GMM).
Findings- The relationship between inventory investment and cash flow is statistically positive for constrained firms, while insignificant for unconstrained firms according to all models. The effect of Gross Domestic Product (GDP) on inventory investment is positive and significant for both constrained and unconstrained firms, this implies that GDP contributes to an increase in inventory investment.
Conclusion- This study is the first one that analyzes the inventory investment and cash flow relationships for Turkish manufacturing firms and want to fulfill this gap in the literature. It is found that cash flow is positively significant for constrained firms according to size and age classification criteria.

Keywords: Inventory management, cash flows, Turkey, GMM Model, financial constraints.
JEL Codes: D80, G30, G31

1. INTRODUCTION

Firms generally prefer to use internally generated funds for investment activities like employment level, fixed investments, R&D and inventories. Among these investments, inventories have some unique futures. Inventories are accepted as a vital reflection of economic conditions and business activities; such that, inventory investment is a significant factor to be examined when assessing a business cycle within an economy. For example, Blinder & Maccini (1991) observed that inventory investment declined by 87% in the U.S. during a postwar downturn. As a result, macroeconomic fluctuations are reflected in the level of total inventories, because inventories have lower adjustment costs when compared other investment activities. For manufacturing firms, total inventories are embodied important part of total assets. A decline in inventory is useful in balancing the decrease in cash flows, especially during economic recession (Carpenter et al., 1994). On the other hand, inventory management strategy of a firm bay be affected by the financial constraints that the firm is facing. The paper by Fazzari et al. (1998) find that if external

[1] This study is a part of an ongoing doctoral thesis *"Financial Decisions and Financial Constraints: Evidence from Emerging Markets" by* PhD candidate Ömer Faruk Tan under the supervision of Professor Emin Avcı (PhD) of the Social Sciences Institute of Marmara University in the department of Finance and Accounting.

financing is more costly than internal financing because of agency costs, moral hazard and asymmetric information problems; thus, investment will be more sensitive to cash flows for constrained firms. The relationship between inventory investment and cash flow in developed countries such as U.S. and U.K has been studied, but there has been little research on the same relationship in the context of emerging economics. Carpenter et al., (1994) is the first study to examine the relationship between inventory investment and cash flow sensitivity in U.S. firms. According to their analysis, although investment-cash flow sensitivity is significant for both large and small firms, the effect is heightened in small firms. They get also similar results when they classify firms whether firms have bond ratings or not. Kashyap et al., (1994) examine the inventory behavior of U.S.A. firms by using cash stock as a financial constraint proxy. They find that firms without access to bond markets are significantly constrained by limitations on liquidity. Gertler & Gilchrist (1994) analyze manufacturing firms in the U.S. and observe that small firms are more sensitive than large firms to monetary tightening. They assert that coverage ratio can be used to identify financially constrained firms. Carpenter et al., (1998)' analysis employed three variables: cash stock, coverage ratio and cash flow as a financial constraints proxy. Cash flow is better to identify inventory investment for financially constrained firms.

Guariglia (1999) examine the inventory cash flow relationship for U.K. and place a special emphasis on total inventories, work-in process and raw materials. She finds that financial constraints affects work-in process and raw materials more than total inventories; this indicates adjustment costs related to total inventories are lower. (Guariglia, 2000) also use a structural linear quadratic model to analyze U.K. firms. In that study, she examines that financially constrained firms who have a low coverage ratio and higher short-term debt to inventories are more sensitive. (Guariglia & Mateut, 2006) test the inventory investment-cash flow sensitivity with trade of channel of monetary transmission in U.K. over the period 1980-2000. Coverage ratio and trade credit to assets ratio are used for classification. They find that use of trade credit can balance the liquidity constraint of U.K. firms. Guariglia & Mateut (2010) conduct an analysis of U.K. firms by classifying them as either exporter, a foreign-owned firm, or domestic firm. They conclude that domestic firms are more constrained than the others.

Small (2000) examines 527 U.K firms between 1977-2004. It is used current ratio, coverage ratio and size to categorize the firms. Unlike previous studies, the coverage and size criterion does not reduce the impact of cash flow on inventory investment for financially constrained firms. Cunningham (2004) research about 166 publicly traded Canadian firms for the 1992-1994 period with the quarterly data. The classification schemes of firms are size, age and bond rating. According to the results, he does not find any difference between both constrained and unconstrained firms in Canada. Tsoukalas (2006) utilize panel of 385 U.S.A manufacturing firms in the period 1975 and 1994 with the mean group estimator. It is found that, small firms exhibit higher inventory – cash flow sensitivity than larger firms.

Bo et al., (2002) investigate 82 Dutch firms from 1984 to 1995 using an augmented model of Lovell's target adjustment model (1961). Firms are categorized according to their dividend payout ratio, size and debt. They reveal that financially constrained firms in the Netherlands show significant inventory-cash flow sensitivity. Since large firms are multinationals, they do not exhibit inventory-cash flow sensitivity. Bagliano & Sembenelli (2004) compare the U.K, French and Italian firms by age and size category. They find that although small and young firms are more sensitive in all countries, young and small firms in Italy are more sensitive than the others. Benito (2005) compare 3905 Spanish and 926 U.K. manufacturing and retail firms for the period 1985-2000. They conclude that cash flow and liquidity effects exist in both countries, but they are much stronger for U.K. firms. Since the U.K. financial system is market-based, while that of the Spain is bank-based, this is interpreted as contrary to the bank dependency hypothesis. Cunha (2010) analyze the Portuguese firms between 1990 and 2000. Firms are categorized according to their interest coverage ratio. Firms with lower coverage ratio demonstrate higher inventory-cash flow sensitivity. Sangalli (2013) investigate the Italian firms between 1991-2009 according to the coverage ratio, acid test ratio and multivariate proxy for risk (CEBI- Centrale dei Bilanci ratings). It is found that financially constrained firms indicate higher inventory – cash flow sensitivity than financially unconstrained firms.

Yue (2011) categorize Chinese firms according to its size, region and ownership structure. Firms, which are private or located in coastal region display significant inventory investment-cash flow relationships. Yang et al., (2016) demonstrate that with an increase in financial development, a firm's inventory investment increase as well.

In this study, the link between inventory investment and cash flow is investigated for both constrained and unconstrained firms. To round the literature, to the best of our knowledge, this study is the first one to examine the link between inventory investment and cash flow in both constrained and unconstrained firms in Turkey. The remainder of this study is organized as follows. Section 2 gives information about the data and methodology. Section 3 covers the empirical findings and discussions. Finally, section 4 is the conclusion part.

2. DATA AND METHODOLOGY

In this study, Turkish manufacturing firms listed in Borsa Istanbul (BIST) are analyzed. The study spans 2006-2018. We acquire the data from Thomson Reuters Datastream and Thomson Reuters Eikon. Age information of the firms are taken manually. Missing values are taken from the annual financial reports of each firm. Manufacturing firms with at least four years of consecutive data are selected. Applying the selection criteria resulted in unbalanced panel data containing 166 manufacturing firms. All variables are winsorized at 1st and 99th percentiles to minimize the effect of outliers. Table 1 shows the definition of each variables.

Table 1: Definition of Variables

Explanatory Variables	Definitions
INVENTORY	Natural logarithm of total inventories.
SALES	Natural logarithm of annual total sales.
CASH FLOW	Net income before extraordinary items and depreciation/amortization to total assets.
GDP	Annual growth rate (%)

Age and size are selected as financial constraint criteria in the study. Determining the existence of financial constraints, size and age are accepted as the most useful methods (Beck, Demirgüç-Kunt, Laeven, & Maksimovic, 2006). Following previous studies (Carpenter et al., 1994; Gertler & Gilchrist, 1994; Gilchrist & Himmelberg, 1995; Guariglia & Mateut, 2010; Schiantarelli & Sembenelli, 2000; Yue, 2011), firms are ranked in each country on the basis of their total assets and classify them as financially constrained (unconstrained) if their size is below (above) the median size value. Because of moral hazard, agency costs and asymmetric information problems, smaller firms require more internal funds.

According to the age criteria, younger firms are not well known, and public information is less about these firms (Guariglia & Mateut, 2010). Firms are assigned in each country and categorize them as financially constrained (unconstrained) if their age is below (above) the median age value (Arslan, Florackis, & Ozkan, 2006; Guariglia & Mateut, 2010; Schiantarelli & Sembenelli, 2000)

Based on the previous literature, Lovell's (1961) target adjustment model is used (Guariglia & Mateut, 2010; Sangalli, 2013; Shiau, Chang, & Yang, 2018; Yue, 2011). *Inv* and *Sales* denote the natural logarithm of total inventories and total sales respectively.

$$\Delta Inv_{i,t} = \beta_o + \beta_1 \Delta Inv_{i,t-1} + \beta_2 \Delta Sales_{i,t} + \beta_3 \Delta Sales_{i,t-1} + \beta_4 (Inv_{i,t-1} - Sales_{i,t-1}) + \beta_5 CF_{i,t-1} + \lambda_i + \eta_t + \mu_j + \varepsilon_{it} \quad (1)$$

$$\Delta Inv_{i,t} = \beta_o + \beta_1 \Delta Inv_{i,t-1} + \beta_2 \Delta Sales_{i,t} + \beta_3 \Delta Sales_{i,t-1} + \beta_4 (Inv_{i,t-1} - Sales_{i,t-1}) + \beta_5 CF_{i,t-1} + \beta_6 GDP_{i,t} + \lambda_i + \eta_t + \mu_j + \varepsilon_{it} \quad (2)$$

Where, ΔInv is the difference of the natural logarithm of total inventories at time *t* and *t-1*, $\Delta Sales$ is the difference of the natural logarithm of sales at time *t* and *t-1* respectively. Differences of natural logarithms and sales capture the short-term dynamics. $(Inv_{i,t-1} - Sales_{i,t-1})$ influences the long-term target level, which gives information about the error-correction format. When inventory is lower than the target level (*Sales*), the future inventory investment would be higher or vice a versa. The error correction term should be negative. *CF* is cash flow scaled by total assets at time *t-1*. *GDP* is an annual growth rate at time *t*, λ_i is a firm-fixed effects, η_t is time effects, μ_j is industry effects and ε_{it} is an error term. Model 1 is our baseline model, which includes cash flow. Model 2 also contains GDP growth rate.

The baseline equation model is estimated by the system GMM model created by (Arellano & Bover, 1995; Blundell & Bond, 1998) with orthogonal transformation is applied to overcome potential endogeneity and heterogeneity issues and eliminate the problem of autocorrelation. A two-step system GMM model is applied and included Windmeijer's (2005) correction for standard errors. As suggested by (Roodman, 2009), instruments are collapsed to prevent too many variables. The system GMM use both a level equation model and a first-order difference equation model. The second and more lagged instruments are used, and all explanatory variables are treated as endogenous or predetermined variables. GDP variable is treated as exogenous variable.

3. FINDINGS AND DISCUSSIONS

Table 2 provides information on descriptive statistics. The mean of the natural logarithm of total inventories and total sales are 9.88 and 11.67, respectively. Cash flow to total ratio is approximately %7. The mean of GDP is %5.1 during the study period. The variance inflation factor (VIF) gives information about whether there is multicollinearity between variables. IF the VIF is greater than 5 or 10, the multicollinearity is high in the regression model (Guizani, 2017). The mean VIF is 1.10, so there is no multicollinearity problem among our variables.

Table 2: Descriptive Statistics

Variables	Mean	Median	Std. Dev.	Q25	Q75	VIF
Inventories	9.8853	9.9555	1.6846	8.798	10.8751	
Sales	11.6694	11.587	1.7496	6.4514	12.7246	1.02
CF/TA	0.0694	0.0659	0.1923	0.0178	0.1195	1.02
GDP (%)	5.12	5.3	3.71	3.3	7.3	1

Note: Inventories is the natural logarithm of total inventories. Sales is the natural logarithm of annual total sales. CF/TA is the ratio cash flow to total assets. GPD is the annual growth rate. VIF is the variance inflation factor.

Table 3 displays the results of investment – cash flow sensitivity according to the size criteria. According to the analysis, the coefficient of lagged inventory investment is negative and significant for both constrained and unconstrained firms. This implies that firms adjust their target levels from the actual to the desired inventory stock (Carpenter et al., 1994; Guariglia & Mateut, 2010; Sangalli, 2013). Current sales have positive and significant effects that are stronger for unconstrained firms. Lagged sales are insignificant for both types of firms. The error correction term is negative and statistically significant because of inventory is lower than the target level (*Sales*), the future inventory investment would be higher or vice a versa. The coefficient of cash flow is our main interest, and it is statistically positive and significant for constrained firms, while insignificant for unconstrained firms according to all models. The result of the study are consistent with the previous literature (Carpenter et al., 1994, 1998; Gilchrist & Himmelberg, 1995; Boo et al., (2002). The coefficient of small firms (0.1008) are two times higher than large firms (0.0449). This result confirms the hypothesis and show that small firms need more internal funds because of asymmetric information, agency cost problems GDP is positive and significant for both constrained and unconstrained firms, this implies that GDP contributes to an increase in inventory investment.

Table 3: Estimation Results According to Size Criteria

Dependent Variable: $\Delta Inv_{i,t}$	**SIZE**			
	FC		**NFC**	
	1	*2*	*1*	*2*
$\Delta Inv_{i,t-1}$	-0.08967*	-0.09599*	-0.15007***	-0.15489***
	(0.054)	(0.053)	(0.052)	(0.051)
$\Delta Sales_{i,t}$	0.20044**	0.19621**	0.52688***	0.54303***
	(0.096)	(0.091)	(0.087)	(0.086)
$\Delta Sales_{i,t-1}$	0.11308	0.10747	0.06905	0.06535
	(0.078)	(0.078)	(0.065)	(0.063)
$Inv_{i,t-1} - Sales_{i,t-1}$	-0.18560**	-0.18367**	-0.31123***	-0.30716***
	(0.086)	(0.085)	(0.079)	(0.077)
$CF_{i,t-1}$	0.10086***	0.10308***	0.04496	0.04514
	(0.034)	(0.033)	(0.258)	(0.259)

$GDP_{i,t}$		0.02446***		0.02048***
		(0.004)		(0.003)
YEAR	YES	YES	YES	YES
INDUSTRY	YES	YES	YES	YRS
Observations	809	809	876	876
ar1	-4.60***	-4.55***	-4.31***	-4.29***
ar2	-0.94	0.328	-2.11**	-2.11**
ar3	-	-	1.58	1.55
Hansen	25.56 (22)	26.18 (22)	25,28 (14)	25,96 (14)

Note: FC=Financial Constraint, NFC = Financially Unconstraint. Under the *Size* criteria, firms are ranked in each country on the basis of their assets and categorize them as financially constrained (unconstrained) if their size is below (above) the median size value. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4 exhibits the results of investment – cash flow sensitivity according to the age criteria. As in Table 3, the coefficient of lagged inventory investment is negative and significant for both constrained and unconstrained firms. The coefficient of financially constrained firms two times higher than financially constrained firms. This implies that unconstrained firm adjust their target faster than constrained firms. Current sales are significant for both type of firms, but stronger for unconstrained firms. As in Table 3, the error correction term is negative for both of them, but significant only for constrained firms. The coefficient of cash flow is statistically positive and significant for constrained firms, while insignificant for unconstrained firms according to all models. The coefficient of small firms (0.0948) are approximately two times higher than large firms (0.0587). According to the hypothesis, younger firms are not well known, and public information is not enough for them, while old firms have a reputation in the market. The result is consistent with the hypothesis and previous studies as size criteria.

Table 4: Estimation Results According to Age Criteria

Dependent Variable: $\Delta Inv_{i,t}$	**AGE**			
	FC		**NFC**	
	1	***2***	***1***	***2***
$\Delta Inv_{i,t-1}$	-0.09513*	-0.09309*	-0.20617**	-0.22317**
	(0.053)	(0.054)	(0.103)	(0.098)
$\Delta Sales_{i,t}$	0.22565*	0.24504*	0.49768***	0.49297***
	(0.128)	(0.128)	(0.118)	(0.118)
$\Delta Sales_{i,t-}$	0.09797	0.09736	0.07033	0.07059
	(0.096)	(0.094)	(0.065)	(0.061)
$Inv_{i,t-1} - Sales_{i,t-1}$	-0.18605**	-0.20504**	-0.16701	-0.13011
	(0.090)	(0.095)	(0.167)	(0.168)
$CF_{i,t-1}$	0.09486***	0.09261***	0.05876	0.05576
	(0.030)	(0.030)	(0.417)	(0.405)
$GDP_{i,t}$		0.02425***		0.02029***
		(0.006)		(0.005)
YEAR	YES	YES	YES	YES

INDUSTRY	YES	YES	YES	YES
Observations	804	804	884	884
ar1	-4.7***	-4.59***	-4.00***	-3.97***
ar2	-1.22	-1.22	-1.17	-1.25
Hansen	31.50 (22)	32.97 (22)	43.96 (26)	44.41 (26)

FC=Financial Constraint, NFC = Non-Financially Constraint. Under the *Age* criteria firms are ranked in each country on the basis of its age and categorize them as financially constrained (unconstrained) if their age is below (above) the median age value. Age is defined as the foundation year of the firm. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

4. CONCLUSION

In this study, we analyze the inventory investment – cash flow sensitivity for 167 listed firms in Borsa Istanbul. 2006-2018 is chosen as the study period. Lovell's (1967) target adjustment model is applied and the system GMM model is used for the analysis. While classifying firms as financially constrained and unconstrained, it is considered the size and age criterion most frequently used in the literature. To the best of our knowledge, this study is the first one that analyzes the inventory investment and cash flow relationships for Turkish manufacturing firms. First of all, firms prefer to use their internal funds for their investment behaviors. The main investment activities for firms are fixed investments, research and development, training of employment and inventories. Among these, inventory has an important place in total assets. Since the adjustment costs of inventories are cheaper than others, firms can reduce or increase their inventory more quickly in any fluctuations in the economy. According to analysis in the study, we find that cash flow is positively significant for constrained firms, but not significant for others, according to size and age classification criteria. The results confirm the hypothesis that external financing is costly for small and young firms so, sensitivity of internal funds is higher for those firms. The coefficient of small and young firms are approximately two times higher than old and big firms. The effect of GDP on inventory investment is positive and significant for both constrained and unconstrained firms, this denotes that GDP contributes to an increase in inventory investment. For further study, academicians/researchers analyze investment cash flow sensitivity for the specific terms such as global financial crisis in 2008-2009, the Turkish economic crisis in 2001, the quantitative easing era of 2010-2014, and so on. Also, there are many other emerging markets available for analysis.

REFERENCES

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*(1), 29–51. https://doi.org/10.1016/0304-4076(94)01642-D

Arslan, Ö., Florackis, C., & Ozkan, A. (2006). The role of cash holdings in reducing investment-cash flow sensitivity: Evidence from a financial crisis period in an emerging market. *Emerging Markets Review*, *7*(4), 320–338. https://doi.org/10.1016/j.ememar.2006.09.003

Bagliano, F. C., & Sembenelli, A. (2004). The cyclical behaviour of inventories: European cross-country evidence from the early 1990s recession. *Applied Economics*, *36*(18), 2031–2044. https://doi.org/10.1080/0003684042000295601

Beck, T., Demirgüç-Kunt, A., Laeven, L., & Maksimovic, V. (2006). The determinants of financing obstacles. *Journal of International Money and Finance*, *25*(6), 932–952. https://doi.org/10.1016/j.jimonfin.2006.07.005

Benito, A. (2005). Financial pressure, monetary policy effects and Inventories : Firm-level evidence from a market-based and a bank-based financial system. *Economica*, *72*, 201–224.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115–143. https://doi.org/10.1016/S0304-4076(98)00009-8

Bo, H., Kuper, G., Lensink, R., & Sterken, E. (2002). Dutch inventory investment: Are capital market imperfections relevant? *Applied Economics*, *34*, 15–22.

Carpenter, R. E., Fazzari, S. M., & Petersen, B. C. (1998). Financing constraints and inventory investment: A comparative study with high-frequency panel data. *Review of Economics and Statistics*, *80*(4), 513–519.

Carpenter, R. E., Fazzari, S. M., Petersen, B. C., Kashyap, A. K., & Friedman, B. M. (1994). Inventory investment, internal finance fluctuations, and the business cycle. *Brokings Papers on Economic Activity*, *1994*(2), 75–138.

Cunha, J. (2010). The financing constraint hypothesis and inventory investment decisions of firms, 1–20.

Cunningham, R. (2004). *Finance constraints and inventory investment : Empirical tests with panel data* (38 No. 2004). Ottawa.

Gertler, M., & Gilchrist, S. (1994). Monetary policy, business cycles, and the behavior of small manufacturing firms. *Quarterly Journal of Economics*, *109*(2), 309–340.

Gilchrist, S., & Himmelberg, C. P. (1995). Evidence on the role of cash flow for investment. *Journal of Monetary Economics*, *36*, 541–572. https://doi.org/10.1016/0304-3932(95)01223-0

Guariglia, A. (1999). The effects of financial constraints on inventory investment: Evidence from a panel of UK firms. *Economica*, *66*(261), 43–62.

Guariglia, A. (2000). Inventory investment and capital market imperfections: A generalization of the linear quadratic inventory model. *Oxford Bulletin of Economics and Statistics*, *62*(2), 223–243.

Guariglia, A., & Mateut, S. (2006). Credit channel , trade credit channel , and inventory investment : Evidence from a panel of UK firms. *Journal of Banking & Finance*, *30*, 2835–2856. https://doi.org/10.1016/j.jbankfin.2005.11.002

Guariglia, A., & Mateut, S. (2010). Inventory investment, global engagement, and financial constraints in the UK: Evidence from micro data. *Journal of Macroeconomics*, *32*, 239–250. https://doi.org/10.1016/j.jmacro.2009.03.001

Guizani, M. (2017). The financial determinants of corporate cash holdings in an oil rich country: Evidence from Kingdom of Saudi Arabia. *Borsa Istanbul Review*, *17*(3), 133–143. https://doi.org/10.1016/j.bir.2017.05.003

Kashyap, A., Lamont, O. a, & Stein, J. C. (1994). Credit conditions and the cyclical behavior of inventories. *The Quarterly Journal of Economics*, *109*(3), 565–592. https://doi.org/10.2307/2118414

Lovell, M. (1961). Manufacturers' inventories, sales expectations, and the acceleration principle. *Econometrica*, *29*(3), 293–314.

Roodman, D. (2009). Practitioners' corner: A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics*, *71*(1), 135–158. https://doi.org/10.1111/j.1468-0084.2008.00542.x

Sangalli, I. (2013). Inventory investment and financial constraints in the Italian manufacturing industry: A panel data GMM approach. *Research in Economics*, *67*(2), 157–178. https://doi.org/10.1016/j.rie.2013.02.003

Schiantarelli, F., & Sembenelli, A. (2000). Form of ownership and financial constraints: Panel data evidence from flow of funds and investment equations. *Empirica*, *27*, 175–192. https://doi.org/10.1023/A:1026588619191

Shiau, H. L., Chang, Y. H., & Yang, Y. J. (2018). The cash holdings and corporate investment surrounding financial crisis: The cases of China and Taiwan. *Chinese Economy*, *51*(2), 175–207. https://doi.org/10.1080/10971475.2018.1447833

Small, I. (2000). *Inventory investment and cash flow* (No. 112). London - Bank of England.

Tsoukalas, J. D. (2006). Financing constraints and firm inventory investment: A reexamination. *Economics Letters*, *90*(2), 266–271. https://doi.org/10.1016/j.econlet.2005.08.012

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, *126*(1), 25–51. https://doi.org/10.1016/j.jeconom.2004.02.005

Yang, J., Guariglia, A., Shi, Y., & Peng, Y. (2016). *Inventory investment and the choice of financing in China: Does city-level financial development play a role?*

Yue, F. (2011). *Financial constraints and firms' activities in China*. Durham University.

PressAcademia
www.pressacademia.org/journals/jbef

JBEF
ISSN 2146-7943

Journal of Business, Economics and Finance YEAR 2020 VOLUME 9 ISSUE 2

STOCK MARKET INTEGRATION BETWEEN TURKEY AND BRICS COUNTRIES: EMPIRICAL EVIDENCE FROM COINTEGRATION TEST WITH STRUCTURAL BREAKS

DOI: 10.17261/Pressacademia.2020.1228
JBEF- V.9-ISS.2-2020(11)-p.189-195

Yuksel Iltas
Kirsehir Ahi Evran University, Faculty of Economics and Administrative Sciences, Department of Business Administration, Kirsehir, Turkey
yiltas@ahievran.edu.tr , ORCID:0000-0001-8853-838X

Date Received: April 15, 2020 **Date Accepted:** June 21, 2020

To cite this document
Iltas. Y., (2020). Stock market integration between Turkey and BRICS countries: empirical evidence from a cointegration test with structural breaks. Journal of Business, Economics and Finance (JBEF), V.9(2), p.189-195.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2020.1228

ABSTRACT

Purpose - The goal of this paper is to examine the cointegration relationship between BIST-100 index and BRICS countries' (Brazil, Russia, India, China, and South Africa) stock market indices using monthly data over the period 2003:01-2019:08. To that end, this paper performs a cointegration test that considers both sharp and gradual breaks.
Methodology - Long term relationship between BIST-100 index and BRICS countries stock indexes for January 2003-August 2019 period is examined by Dickey and Fuller (1981) and Phillips and Perron (1988) unit root test and Tsong et al. (2016) cointegration test with structural breaks.
Findings- The empirical findings indicate that BIST-100 index is cointegrated with the stock market indices in Brazil, Russia, and China, while it is not cointegrated with the stock market indices in India and South Africa.
Conclusion- The findings reveal that BIST 100 is not cointegrated with the stock market indices in India and South Africa. These findings imply that investors in BIST can also invest in India's and South Africa's stock markets. In this way, investors will be able to reduce their risks by investing in stock exchange indices which has not long-term relationship (cointegration).

Keywords: Stock markets, BIST 100 index, BRICS countries, cointegration test, structural breaks.
JEL Codes: C22, F36, G15

1. INTRODUCTION

As denoted by Kearney and Lucey (2004), due to the rapid expansion of international trade, services and financial assets, the degree of interaction between financial markets is increasing day by day. While the interaction between these markets concerns policy makers in terms of the sustainability of financial stability in the country, it also concerns international investors making portfolio diversification for reducing risks in their investment portfolios. The long-term/cointegration relationship between the capital markets of the countries indicates that there is a co-movement among these markets and that the expected return from portfolio diversification among these stock markets will decrease due to their long-term relationship. In this context, investors who include international investments in their portfolios should concentrate on stock market indices with low correlations in order to diversify the risk taken and to increase the return. Otherwise, portfolio diversification consisting of markets with long-term relationship will not provide an opportunity for investors to reduce risk and will not generate required returns for investors.

Identifying the existing relationships between commercially and financially integrated markets is important for both policy makers and fund managers with international portfolio investments. Low correlation and no co-movement between different national stock market indices are often preferred to ensure the international diversification of portfolios (Lim, 2007; Diamandis, 2009). Every potential return to investors investing in stocks in different markets is negatively related to the cointegration levels of stock

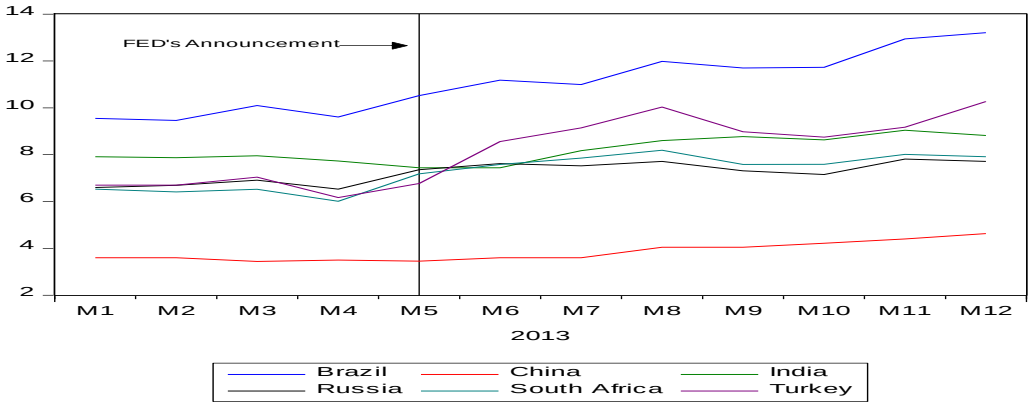
market indices. Investors will be able to reduce risks through international diversification by benefiting from low correlation or no long-term co-movement between national stock market indices (Shamsuddin and Kim, 2003).

In the last decades following the stock market crisis in October 1987, capital flows have been faster among economies and stocks have been traded much more easily all around the world as a result of (i) increasing policy coordination, (ii) the removal of obstacles to capital movements in financial markets, (iii) the ending of the intervention of governments on financial markets, (iv) the rapid developments in the trade and communication technologies, and (v) the development of new financial products (Diamandis, 2009). Besides, the increase in the number of financial instruments helped financial liberalization be faster by providing foreign investors with the opportunity to diversify risks.

Especially in the period following 1970s, countries had the opportunity to develop their commercial activities with each other as a result of globalization and financial liberalization. Increasing trade between countries resulted in rising interactions and interdependence among national economies. The current or potential relations of countries with each other concern investors in terms of risk distribution and portfolio diversification and policy makers in terms of trade and development. Therefore, determining the interactions of the markets among each other is both theoretically and practically important.

On May 22, 2013, the Federal Reserve (FED) announced that the magnitude of its third monetary expansion program which had been implemented since September 2012 and would be reduced and the program would be ended in 2014 as well. Following this date, significant fluctuations were observed in both money and capital markets of many developing countries. In this process, some emerging economies performed quite similarly due to some structural vulnerabilities, such as high current account deficits, high inflation rates, and low growth rates (Akel, 2015). Besides, after May 22, 2013, while the interest rates in BRICST countries (Brazil, Russia, India, China, South Africa, and Turkey) increased, there was a serious decrease in the stock market indices of these countries. Figure 1 exhibits 10-year government bond interest rates in BRICST countries during the year 2013 with a dashed line for May 2013. As is seen in the figure, 10-year government bond yields of Turkey and Brazil grew faster compared to those of other countries. The increase in bond interest rates of India, China, South Africa, and Russia was relatively low.

Figure 1: 10-year Bond Interest of BRICST Countries



Source: Investing.com (2019)

These developments may indicate a rise in the level of integration of domestic capital markets. Besides, some studies analyzing whether or not there exists a long-term relationship between national stock market indices has increased in the last years. Within this scope, this paper investigates whether there exists a co-movement between BIST-100 index and the stock market indices in BRICS countries over the period 2003-2019 by employing a recently developed cointegration test that presents efficient results in the existence of both sharp and gradual breaks. Hence, the main contribution of this paper to the extant literature is that it is the first paper that considers both gradual and sharp breaks while examining the cointegration relationship between stock markets.

The rest of the paper is as follows: Section 2 presents the empirical literature. Section 3 introduces data. Estimation methodology and findings are given in Section 4. Section 5 concludes the paper.

2. LITERATURE REVIEW

Financial market theories suggest that portfolios invested in fully integrated markets carry both global and local risks. While local risks are eliminated in the portfolio by investing in international stock markets (portfolio diversification), only global risks are priced (Lehkonen, 2015). The vast majority of markets, especially the emerging ones, are partially integrated. In these markets, stock prices reflect both local and global factors and expected returns are determined by these two sources of risks (Bekaert and Harvey, 1995). Although local risks are important determinants of returns in emerging markets, the importance of them has weakened for most markets due to the further integration of financial markets (Bekaert and Harvey, 1995; Carrieri et al. 2007; Pukthuanthong and Roll, 2009; Bekaert et al. 2011; Arouri, Nguyen , and Pukthuanthong, 2012).

There exists a vast literature the literature examining the cointegration relationship between stock markets. This paper classifies the empirical literature into two groups. The first group of the papers investigated the relation among the stock market indices of different countries rather than Turkey. For instance, Kanas (1998) examined the cointegration relationship between the stock market indices of the USA and six European countries (UK, Germany, France, Switzerland, Italy and Netherlands). According to the findings of the study, no long-term relationship between the USA's stock market index and six European countries' stock market indices was found. Similarly, Tabak and Lima (2002) investigated the relationship between the US stock market index and the stock market indices of seven Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela). According to the results, a long-term relationship between the USA's and other countries' stock market indices was not established. Chang and Lu (2006) investigated the long-term relationship between the stock market indices of Shanghai and Shenzhen using different cointegration tests. The results of all cointegration tests indicated there existed no relationship between these indices. Aktan et al. (2009) examined the relationships among the stock market indices of BRICA countries (Brazil, Russia, India, China, and Argentina) and stock market index of the USA. In the short term, they found that the US stock market had a significant impact on the stock markets of all BRICA countries. While the cointegration relationship between the stock market indices of Russia and Brazil was strong, the cointegration relationship between the stock markets of China and Argentina was weak. According to the Granger causality results, the Russian stock market affected the stock markets of all other countries. In addition, while the stock market of Brazil affected the stock markets of Argentina, Russia, and India, the stock market of China affected only the stock markets of Argentina and Russia. Chang and Tzeng (2009) examined the nexus between the stock market of the USA and those of the four major trading partners of the US (Canada, Germany, Japan, and the Mexico). According to the empirical findings, the US stock market was only cointegrated with the Mexican stock market. Chittedi (2010) investigated the long-term relationship and the causal nexus between the stock market indices of BRIC countries and those of developed countries, such as the USA, the UK, and Japan. According to the findings of the study, there was a long-term relationship between the stock market indices of BRIC countries and those of developed countries. Besides, it was determined that the stock markets of the USA and Japan influenced the Indian stock market, while the stock markets of Brazil and Russia were affected by the Indian stock market.

The second group of the studies investigated the nexus between BIST 100 and some countries' stock market indices. For instance, Bayrı and Güloğlu (2005) examined the relation between BIST 100 and the stock market indices of European Union (EU) and the US. They discovered BIST 100 was related to the stock market indices of EU and the USA. Mandacı and Taşkın (2005) examined the relation between BIST 100 and 17 European stock market indices (Germany, Austria, Denmark, Belgium, France, the Netherlands, Portugal, Finland, the UK, Ireland, Spain, Sweden, Italy, Hungary, Norway, Poland, and Greece). In the study, it was observed that the relationship between the European stock market indices and BIST 100 was quite weak, and it was concluded that the stock market of Turkey could be an alternative investment tool to European stock markets. Marashdeh (2005) inspected the cointegration relation between the stock market indices of Turkey, Egypt, Jordan, and Morocco and those of some developed countries (the US, Germany, and the UK). The results indicated that there existed a co-movement between the stock market indices of Turkey, Egypt, Jordan, and Morocco, but there was no long-term relation between the stock market indices of these countries and those of developed countries. Çıtak and Gözbaşı (2007) investigated the long-term relation between BIST 100 and the stock market indices of the USA, Germany, India, the UK, Japan, and Malaysia. In the study, a long-term relation was found between BIST 100 and the stock market indices of the USA, Germany, India, and the UK. Korkmaz, Zaman, and Çevik (2007) examined whether there occured a cointegration relationship between BIST 100 and the stock market indices of many developed and developing countries by using a cointegration test with structural breaks. According to the findings, BIST 100 was cointegrated with the stock market indices of 16 developed and 21 developing countries. Sevüktekin and Nargeleçekenler (2008) examined the interaction between the US stock market indices (Dow Jones, Nasdaq, and S&P 500) and BIST 100. A long-term relationship was determined between the relevant stock markets. Additionally, while there was bidirectional causality in the long run, there existed unidirectional causality running from the US stock market indices to BIST 100 in the short run. Bozoklu and Saydam (2010) investigated the cointegration relationship between BIST 100 and the stock market indices of the BRIC countries (Brazil, Russia,

India and China). According to the cointegration test's results, they found out that BIST-100 index was cointegrated with BRIC countries' stock market indices. Gözbaşı (2010) investigated the relationship between BIST 100 and the stock market indices of Argentina, Brazil, Mexico, India, Malaysia, Hungary, and Egypt. The findings indicated that while BIST 100 was associated with the stock market indices of Brazil, India, and Egypt in the long term, it was related to the stock market indices of Brazil, India, Egypt, Mexico, and Hungary in the short term. Vuran (2010) tested the long-term relationship between BIST 100 and the stock market indices of the USA, the UK, France, Germany, Japan, Brazil, Argentina, and Mexico through a cointegration test. The study found that BIST 100 was related to stock market indices of Germany, Argentina, Brazil, the UK and Mexico in the long term. Boztosun and Çelik (2011) investigated the long-term relation between BIST 100 and some European stock market indices (Germany, Austria, Belgium, France, the Netherlands, the UK, Spain, Sweden, Switzerland, and Norway). According to the results, BIST 100 was cointegrated with the stock market indices of Germany, Belgium, the Netherlands, the UK, and Norway. Akel (2015) tested the cointegration and causal relationship between the stock market indices of the fragile five countries, namely Brazil, Indonesia, South Africa, India, and Turkey. He explored that there was no cointegration and causal relationship between the stock market indices of these countries. Finally, Özşahin (2017) tested the relation between BIST 100 and the stock market indices of the BRICS (Brazil, Russia, India, China and South Africa) countries. According to the empirical findings, BIST-100 index was cointegrated with all the stock market indices except for the stock market index in Brazil.

It can be observed from the empirical literature that the previous papers did not exhibit clear-cut evidence about the relationships between the stock market indices of countries. It may be argued that different empirical findings stem from different countries, time periods, and estimation methodologies.

3. DATA AND METHODOLOGY

This paper investigates whether BIST 100 is related to the stock market indices of the BRICS countries (Brazil, Russia, India, China, and South Africa) using monthly data over the period 2003:01-2019:08. Data are extracted from Morgan Stanley Capital International (2019). All series are priced in USD. Table 1 depicts the series used in the empirical analysis.

Table 1: Definitions of the Series

Country	Stock Market	Stock Market Index	Symbol
Turkey	Borsa İstanbul (BIST)	BIST 100	BIST 100
Brazil	Bolsa de Valores de Sao Paulo	IBOVESPA	BVSP
Russia	Moscow Times Index	RTSI Index	RTSI
India	Bombay Stock Exchange	BSE Sensex	BSE
China	Shanghai Stock Exchange	SSEC	SSE
South Africa	Johannesburg Stock Exchange	JSE	JSE

In time series analyses, the first step is to examine the stationarity properties of the series through some unit root tests. This paper performs the Augmented Dickey and Fuller (1981, hereafter ADF) and the Phillips and Perron (1988, hereafter PP) unit root tests to determine the order of integration of the variables. Both methods test for the null hypothesis of non-stationarity.

If variables under consideration are found to be stationary at first difference, the long-run relationship between them can be examined through a cointegration test. This paper performs the recently suggested cointegration test of Tsong et al. (2016) that considers both sharp and gradual breaks to test for cointegration.

To consider both sharp and gradual breaks, Tsong et al. (2016) suggest a cointegration test with the Fourier approximation. Besides paying attention to both sharp and gradual breaks, this test is able to report efficient findings irrespective of the number of the breaks. They start using the following model:

$$y_t = d_t + x_t'\beta + \eta_t, \qquad \eta_t = \gamma_t + \upsilon_{1t}, \qquad \gamma_t = \gamma_{t-1} + u_t, \qquad x_t = x_{t-1} + \upsilon_{2t} \tag{1}$$

In Equation (1), u_t denotes the error term and γ_t demonstrates a random walk. In this equation, d_t is described as $d_t = \delta_0 + f_t$. In this model, f_t implies the Fourier function defined as follows:

$$f_t = \alpha_k \sin\left(\frac{2k\pi t}{T}\right) + \alpha_k \cos\left(\frac{2k\pi t}{T}\right) \tag{2}$$

where T is the number of observations, t stands for time trend, and k denotes the Fourier frequency. If $\sigma_u^2 = 0$, $\eta_t = \upsilon_{1t}$ is stationary. This condition indicates there occurs cointegration in the empirical model. Thus, the null hypothesis of cointegration against the alternative hypothesis of no cointegration is depicted as below:

$$H_0: \sigma_u^2 = 0 \text{ versus } H_1: \sigma_u^2 > 0 \quad (3)$$

In order to test the null hypothesis, the model in Equation (1) can be redescribed as below:

$$y_t = \sum_{i=0}^{m} \delta_i t^i + \alpha_k \sin\left(\frac{2k\pi t}{T}\right) + \beta_k \cos\left(\frac{2k\pi t}{T}\right) + x_t'\beta + \upsilon_{1t} \quad (4)$$

The test statistic for cointegration can be defined as $CI_f^m = T^{-2}\hat{\omega}_1^{-2}\sum_{t=1}^{T} S_t^2$, where St is the partial sum of the ordinary least squares (OLS) residuals in Equation (4) and $\hat{\omega}_1^2$ implies the consistent estimator of the long-run variance of υ_{1t}.

Tsong et al. (2016) also test if the model should contain the Fourier component. Put differently, they examine whether or not the cointegration testing procedure should be based on the Fourier approach through F test. Tsong et al. (2016) estimates Equation (4) via the dynamic OLS estimator of Saikkonen (1991).

4. EMPIRICAL RESULTS

Table 2 reports the results for the ADF and PP unit root tests. Accordingly, the null hypothesis of non-stationarity can be rejected at first differences for all of the series. In other words, all variables seem to be integrated of order one. Hence, the findings of the unit root tests imply that the cointegration relation between BIST 100 and the stock market indices of BRICS countries can be examined.

Table 2: Results of ADF and PP Unit Root Tests

Variable		ADF		PP	
		Intercept	**Intercept and trend**	**Intercept**	**Intercept and trend**
BIST 100	**Level**	-2.594	-2.461	-2.697	-2.520
	1st dif.	-13.926*	-14.015*	-13.925*	-14.022*
BVSP	**Level**	-2.180	-2.028	-2.367	-2.234
	1st dif.	-12.358*	-12.395*	-12.428*	-12.415*
RTSI	**Level**	-2.502	-2.701	-2.562	-2.729
	1st dif.	-11.525*	-11.531*	-11.607*	-11.612*
BSE	**Level**	-2.164	-2.646	-2.228	-2.917
	1st dif.	-13.667*	-13.663*	-13.687*	-13.681*
SSE	**Level**	-2.120	-2.648	-2.151	-2.924
	1st dif.	-13.258*	-13.250*	-13.255*	-13.247*
JSE	**Level**	-2.701	-2.586	-2.666	-2.475
	1st dif.	-15.273*	-15.354*	-15.275*	-15.354*

Notes: 5% critical values are respectively -2.875 and -3.432 for the models with intercept and with intercept and trend. * indicates statistical significance.

Table 3 presents the empirical results for the cointegration test. Accordingly, the null hypothesis that the Fourier component should not be included in the empirical model is rejected for all models in the paper. Put differently, the empirical findings indicate the Tsong et al. (2016) test to cointegration should be performed to investigate the cointegration relation between BIST 100 and BRICS's countries stock market indices. Besides, the null hypothesis of cointegration is rejected for the relationship between BIST 100 and BSE and between BIST 100 and JSE, while it is not rejected for other models. Hence, the empirical findings imply that BIST 100 is cointegrated with BVSP, RTSI, and SSE, whereas it is not cointegrated with BSE and JSE. In other words, the paper explores that the stock market index in Turkey is cointegrated with the stock market indices in Brazil, Russia, and China and is not cointegrated with the stock market indices in India and South Africa.

Table 3: Results for Cointegration Test

Cointegration Relationship	Frequency (k)	Test statistic	F statistic
BIST 100-BVSP	2	0.218	9.529*
BIST 100-RTSI	1	0.052	11.493*
BIST 100-BSE	1	0.146*	6.023*
BIST 100-SSE	1	0.106	7.362*
BIST 100-JSE	1	0.192*	5.684*

Notes: For test statistic, 5% critical values for k=1 and k=2 are respectively 0.124 and 0.276. For F statistic, 5% critical value is 4.066. * illustrates statistical significance.

Hence, the empirical findings of this paper majorly are similar with those of Bozoklu and Saydam (2010) and Akel (2015) and substantially contradict with those of Özşahin (2017). On one hand, the output of the paper for the cointegration relationship between BIST 100 and BVSP is compatible with those of Gözbaşı (2010) and Vuran (2010). On the other hand, the results of the empirical analysis of the present paper about the cointegration relationship between BIST 100 and BSE conflicts with those of Gözbaşı (2010).

5. CONCLUSION

This paper has empirically investigated the cointegration relation between BIST 100 and the stock market indices in BRICS countries using monthly data from 2003:01 to 2019:8. After determining all the series were integrated of order one, the paper employed the Tsong et al. (2016) cointegration test with structural breaks. The cointegration test's results indicate that BIST 100 is cointegrated with the stock market indices in Brazil, Russia, and China and is not cointegrated with the stock market indices in India and South Africa. These empirical findings provide researchers and international investors some considerable inferences.

The findings of the paper indicate that the BIST 100 index has a long-term relationship that moves together with Brazil's, Russia's, and Chine's stock market indices. These findings imply that it is not possible to gain returns by making international portfolio diversification and arbitrage between BIST and these stock markets. The findings also posit that investors in BIST can also invest in India's and South Africa's stock markets as these stock markets do not have a long-term relationship with BIST. In other words, the stocks in India and South Africa can be an alternative investment tool for the stocks in Turkey. Hence, it can be argued that investors who have the stocks in BIST in their portfolios can also invest in the stocks in India's and South Africa's stock markets and can have the opportunity to increase their returns from stocks.

REFERENCES

Akel, V. (2015). Kırılgan Beşli Ülkelerinin Hisse Senedi Piyasaları Arasındaki Eşbütünleşme Analizi. *Uluslararası Yönetim İktisat ve İşletme Dergisi*, *11*(24), 75–96.

Aktan, B., Mandacı, P. E., Kopurlu, B. S., and Ersener, B. (2009). Behaviour of Emerging Stock Markets In The Global Financial Meltdown: Evidence From BRIC-A. *African Journal of Business Management*, *3*(9), 396–404.

Arouri, M. E. H., Nguyen, D. K., and Pukthuanthong, K. (2012). An International CAPM For Partially Integrated Markets: Theory and Empirical Evidence. *Journal of Banking and Finance*, *36*(9), 2473–2493.

Bayri, O., and Güloğlu, B. (2005). Hisse Senedi ve Yabancı Para Piyasalarının Entegrasyonu: Türkiye, AB, ABD Örneği. *İktisat, İşletme ve Finans*, *20*(234), 13–34.

Bekaert, G., and Harvey, C. R. (1995). Time-Varying World Market Integration. *The Journal of Finance*, *50*(2), 403–444.

Bekaert, G., Harvey, C. R., Lundblad, C. T., and Siegel, S. (2011). What Segments Equity Markets? *Review of Financial Studies*, *24*(12), 3841–3890.

Bozoklu, Ş., and Saydam, İ. M. (2010). BRIC Ülkeleri ve Türkiye Arasındaki Sermaye Piyasaları Entegrasyonunun Parametrik ve Parametrik Olmayan Eşbütünleşme Testleri ile Analizi. *Maliye Dergisi*, *159*, 416–431.

Boztosun, D., and Çelik, T. (2011). Türkiye Borsasının Avrupa Borsaları ile Eşbütünleşme Analizi. *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, *16*(1), 147–162.

Carrieri, F., Errunza, V., Hogan, K., Carrieri, F., Errunza, V., and Hogan, K. (2007). Characterizing World Market Integration through Time. *The Journal of Financial and Quantitative Analysis*, *42*(4), 915–940.

Chang, T., and Lu, Y. C. (2006). Equity Diversification in Two Chinese Share Markets: Old Wine and New Bottle. *Economics Bulletin*, *7*(4), 1–7.

Chang, T., and Tzeng, H. W. (2009). International Equity Diversification Between The United States and Its Major Trading Partners: Nonparametric Cointegration Test. *International Research Journal of Finance and Economics*, *32*, 139–147.

Chittedi, K. R. (2010). Global Stock Markets Development and Integration: With Special Reference to BRIC Countries. *International Review of Applied Financial Issues and Economics*, (1), 018–036.

Çıtak, L., and Gözbaşı, O. (2007). İMKB ile Önde Gelen Gelişmiş ve Gelişmekte Olan Ülke Borsaları Arasındaki Bütünleşmenin Temel Endeks ve Ana Sektör Endeksleri Temelinde Analizi. *Dokuz Eylül Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, *22*(2), 249–271.

Diamandis, P. F. (2009). International Stock Market Linkages: Evidence From Latin America. *Global Finance Journal*, *20*(1), 13–30. https://doi.org/10.1016/j.gfj.2009.03.005

Dickey, D. A., and Fuller, W. A. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica*, *49*(4), 1057.

Gözbaşı, O. (2010). İMKB ile Gelişmekte Olan Ülkelerin Hisse Senedi Piyasalarının Etkileşimi: Eşbütünleşme ve Nedensellik Yaklaşımı. *Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, *35*, 99–118.

Kanas, A. (1998). Linkages Between The US and European Equity Markets: Further Evidence From Cointegration Tests. *Applied Financial Economics*, *8*(6), 607–614.

Kearney, C., and Lucey, B. M. (2004). International equity market integration: Theory, evidence and implications. *International Review of Financial Analysis*, *13*(5 SPEC.ISS.).

Korkmaz, T., Zaman, S., and Çevik, E. İ. (2007). İMKB ile Uluslararası Hisse Senedi Piyasaları Arasındaki Entegrasyon İlişkisinin Yapısal Kırılma Testleri İle Analizi. *Akdeniz İ.İ.B.F. Dergisi*, *17*, 40–71.

Lehkonen, H. (2015). Stock Market Integration and the Global Financial Crisis. *Review of Finance*, *19*(5), 2039–2094.

Lim, L. K. (2007). Linkages between ASEAN stock markets: A cointegration approach. *MMODSIM 2007 International Congress on Modelling and Simulation*, 1818–1824.

Mandacı, P. E., and Taşkın, D. (2005). AB'ye Uyum Sürecinde İMKB'nin AB Piyasaları ile Karşılaştırılması. *Muhasebe ve Finansman Dergisi*, *26*, 127–137.

Marashdeh, H. (2005). Stock Market Integration in the MENA Region: An Application of the ARDL Bounds Testing Approach. *Faculty of Commerce-Economics Working Papers*, *05–27*(November), 1–14.

Özşahin, Ş. (2017). Yükselen Piyasa Ekonomilerinde Menkul Kıymetler Borsalarının Entegrasyonu: Türkiye ve BRICS Ülkeleri Üzerine Çoklu Yapısal Kırılmalı Eş-bütünleşme Analizi. *Yönetim ve Ekonomi: Celal Bayar Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, *24*(2), 601–619.

Phillips, P. C. B., and Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, *75*(2), 335–346.

Pukthuanthong, K., and Roll, R. (2009). Global market integration: An alternative measure and its application. *Journal of Financial Economics*, *94*(2), 214–232.

Sevüktekin, M., and Nargeleçekenler, M. (2008). Türkiye ve Amerika'daki Hisse Senedi Piyasaları Arasındaki Dinamik İlişkinin Belirlenmesi. *Finans Politik & Ekonomik Yorumlar*, *45*(520), 15–22.

Shamsuddin, A. F. M., and Kim, J. H. (2003). Integration and interdependence of stock and foreign exchange markets: An Australian perspective. *Journal of International Financial Markets, Institutions and Money*, *13*(3), 237–254.

Tabak, B. M., & Lima, E. J. A. (2002). Causality and Cointegration in Stock Markets: the Case of Latin America. *Banco Central Do Brasil Working Paper Series*, *56*, 3–24.

Tsong, C. C., Lee, C. F., Tsai, L. J., and Hu, T. C. (2016). The Fourier Approximation and Testing For The Null of Cointegration. *Empirical Economics*, *51*(3), 1085–1113.

Vuran, B. (2010). IMKB 100 Endeksinin Uluslararası Hisse Senedi Endeksleri ile İlişkisinin Eşbütünleşim Analizi ile Belirlenmesi. *İstanbul Üniversitesi İşletme Fakültesi Dergisi*, *39*(1), 154–168.