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 2021 VOLUME 10 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, Directory of Research Journals Indexing (DRJI), International Society for Research Activity(ISRA), InfoBaseIndex, Scientific Indexing Services (SIS), Google Scolar, Root Indexing, Journal Factor Indexing, International Institute of Organized Research (I2OR), ASOS, Cabell's Directory, SOBIAD.

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 September 2021.
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 2021 VOLUME 10 ISSUE 2

EDITORIAL BOARD

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2021 VOLUME 10 ISSUE 2

CONTENT

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2021 VOLUME 10 ISSUE 2

EXCHANGE RATE PASS-THROUGH UNDER THE EFFECT OF BREXIT: AN EMPIRICAL ANALYSIS ON THE UNITED KINGDOM

DOI: 10.17261/Pressacademia.2021.1404
JBEF- V.10-ISS.2-2021(1)-p.47-57

Onur Seker
Beykent University, Graduate School, Department of Economics, Istanbul, Turkey.
seker.s.onur@gmail.com, ORCID : 0000-0003-1940-7452

Date Received: December 8, 2020 **Date Accepted:** May 29, 2021

To cite this document
Seker, O.,(2021). Exchange rate pass-through under the effect of Brexit: an empirical analysis on the United Kingdom. Journal of Business, Economics and Finance (JBEF), 10(2), 47-57.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2021.1404

ABSTRACT

Purpose - This study aimed to examine the effects of the environment of uncertainty caused by the United Kingdom (UK) people's decision to leave the European Union (EU) as a result of the referendum held on June 23, 2016, on the UK's economy. In this context, the effects of fluctuations in exchange rates on prices (consumer and producers) and profitability rates were analyzed.

Methodology - The data set was divided into the Brexit period (2016:06 - 2020:02) and the pre-Brexit period (2010:01 - 2016:05) for a comparative analysis of the effect of Brexit on ERPT. Structural Vector Autoregressions (SVAR) models were used to get rid of the non-theoretical structure of standard VAR models, and the McCarthy (1999) model was taken as the reference for the theoretical framework of the model. The analysis of variance decomposition was performed to examine the relationship between the variables using the dynamic structure of VAR models.

Findings- The unexpected result of the referendum and the environment of uncertainty caused by this result in the UK's economy had negative effects, especially on producer prices. It was observed that the increase in costs, which was due to fluctuations in the exchange rate caused by the environment of uncertainty after the referendum, could not be fully reflected on consumer prices by firms. According to the results of the analysis of variance decomposition, while 5.55 percent of changes in producer prices and 4.44 percent of changes in consumer prices in the Pre-Brexit period were explained by changes in the exchange rate, these rates were found to be 16.45 percent and 6.41 percent, respectively, during the Brexit period.

Conclusion- During the Brexit period, it was observed that firms could not reflect the increases in costs to prices and this situation caused a decrease in the profitability rates of the firms. Some of these decreases in the profitability ratios of firms are expected to be permanent. However, it will be possible to make a distinction between structural effects and periodic effects after the terms of the agreement are determined. Considering the overlap of two important global events, such as the COVID-19 pandemic and the Brexit process, it is observed that the UK's economy is going through an extremely sensitive period. Accordingly, the monetary authorities in the UK should take into account many more variables while taking decisions during this period, unlike previous periods.

Keywords: Exchange rate pass-through, inflation, Brexit, variance decomposition, SVAR analysis.
JEL Codes: C32, E31, F31

1. INTRODUCTION

The Brexit referendum, in which the UK people decided to leave the EU, was the beginning of a new period both politically and economically for both sides. Although Brexit had political consequences such as the resignation of the Prime Minister David Cameron and the internal disputes within the main opposition Labor Party, its economic effects were among the most important issues on the UK's agenda.

Although it was observed that the two options were close to each other in the surveys conducted before the referendum, betting markets considered that undecided voters were likely to choose to remain in the EU by 85 percent. The effect of the unexpected result of the referendum on the financial markets was instantaneous, and on June 24, 2016, the FTSE 100 stock market index fell by 8.1 percent against the USD and 5.8 percent against the Euro (Breinlich, Leromain, Novy and Sampson, 2019). After the

referendum, many economists discussed Brexit from many different aspects such as its effects on the financial markets (Schiereck, Kiesel and Kolaric 2016; Belke, Dubova and Osowoski 2016; Hohlmeier and Fahrholz 2018), regional effects (Dhingra, Machin and Overman 2017) and the investments (Dhingra, Ottaviano, Sampson and Van Reenen 2016a; Welfens and Baier 2018).

In this study, the environment of uncertainty caused by the process of the UK's withdrawal from the EU and accordingly the effect of the fluctuations in the value of the British Pound (GBP) on producer and consumer prices were analyzed. The data set was divided into two different parts as the pre-Brexit period and the Brexit period for a comparative analysis of this effect, and the McCarthy (1999) model was taken as a reference for the methodological framework of the study. The interaction between the variables was calculated by the analysis of variance decomposition using the dynamic structure of VAR models. The results are like other studies in the literature with regard to the pass-through calculated for the pre-Brexit period and the decreasing profitability ratios of companies (Jimenez-Rodriguez and Morales-Zumaquero 2016; Winters and Fernandes 2018). However, unlike other studies, the analysis of both periods using the same econometric methods and the comparison of the results made a significant contribution to the literature.

2. LITERATURE REVIEW AND TAYLOR'S HYPOTHESİS

In this section, the literature on ERPT will be examined in three different sections. While the definitions of ERPT will be included in the first section, the theoretical framework of Taylor's hypothesis and studies based on this hypothesis will be included in the second section, and the methods used in the calculation of ERPT will be included in the third section.

Although ERPT is basically defined as the reflection of changes in exchange rates on prices, there are also different definitions in the economic literature. Goldberg and Knetter (1997) defined ERPT as the percentage change in local currency import prices resulting from a one percent change in the exchange rate between the exporting and importing countries. Hooper and Mann (1989) discussed it within a narrower context by focusing on the variables used in the study, and they defined it as the change in import prices caused by changes in the nominal exchange rate. Menon (1996) defined it as the extent to which changes in the exchange rate are reflected in the target currency prices of the traded goods.

Although the inclusion of ERPT in the economic literature goes back to earlier dates, Taylor (2000) has been an important reference point in studies on ERPT by arguing that there is a relationship between ERPT and inflation rates. According to Taylor, firms have a certain power in determining the price of the product they will put on the market. Increases in costs and changes in the prices of firms with which they compete are the main variables that affect the pricing power of firms. In an environment where price stability is provided, the pricing power of firms is lower compared to periods of high inflation without price stability. Taylor's hypothesis is based on the differential pricing model. The linear demand equation for the goods of a firm is presented in equation 1 (Otani, Shiratsuka and Shirota 2003);

$$\theta_t = \varepsilon_t - \pi(\beta_t - P_t) \quad (1)$$

θt represents the production of the firm's goods, Pt represents the average price of the goods produced by competing firms, εt represents the random shift by demand, π represents the opposite of the firm's power. π being equal to infinity represents perfect competition. Let us assume that the firm has predetermined the price for the next four periods and reviewed the determined price for every four periods. Furthermore, if it is assumed that Ct represents the marginal cost and βt represents the price determined by the firm, the firm's expected profit for four periods can be expressed as follows:

$$\sum_{i=0}^{3} E_t\,(\beta_t\theta_{t+i} - C_{t+i}\theta_{t+i}) \quad (2)$$

θt represents the production of the firm's goods, Pt represents the average price of the goods produced by competing firms, εt represents the random shift by demand, π represents the opposite of the firm's power. π being equal to infinity represents perfect competition. Let us assume that the firm has predetermined the price for the next four periods and reviewed the determined price for every four periods. Furthermore, if it is assumed that Ct represents the marginal cost and βt represents the price determined by the firm, the firm's expected profit for four periods can be expressed as follows:

$$\beta_t = 0.125 \sum_{i=0}^{3} (E_t C_{t+i} + E_t P_{t+i} + E_t \varepsilon_{t+i}/\beta) \quad (3)$$

When the optimal price equation number 3 is applied to a firm that imports products from foreign countries and sells them in its domestic market, three different results will be obtained as follows;

- Changes in the exchange rate affect the marginal cost, and accordingly, the firm's selling prices change,

- Even though the import cost increases as a result of changes in the exchange rate, the firm attempts to avoid price increases as much as possible,
- Weak market power decreases the firm's pricing power in response to demand shocks. Accordingly, the possibility of the firm to reflect the increases in cost to the product price decreases.

In his study, which was another one of the turning points of the studies on ERPT, Taylor (2000) found that high inflation periods increased the ability of firms to reflect their costs on prices and that this situation reversed in the low inflation period. After Taylor (2000), a significant part of the studies on pass-through was based on the testing of this hypothesis. When studies in the literature are reviewed, it is observed that Taylor's hypothesis has been examined in many different countries with different data sets and different methods. Although most of the results obtained in these studies support Taylor's hypothesis, there are also studies in which the hypothesis could not be confirmed. Ca 'Zorzi, Hahn, and Sanchez (2007) concluded that there was a positive correlation between inflation rates and pass-through in 10 of the 12 selected developing countries (excluding Argentina and Turkey). In parallel with this result, while Choudhri and Hakura (2006) confirmed the validity of Taylor's hypothesis in 71 countries including both developing and industrialized countries between 1979-2000, Baqueiro, Díaz de Leon, and Torres (2003) confirmed it in 16 countries with a flexible exchange rate regime, and Loloh (2014) confirmed it in Ghana between 1994-2012.

Studies in the literature generally usually the high inflation periods experienced in the 1990s. During this period, many countries adopted the inflation targeting regime and provided price stability. Bouakez and Rebei (2005) in Canada, Baharumshah, Sirag and Soon (2017) in Mexico, and Taguchi and Bolortuya (2019) in Mongolia observed that the decreasing inflation rates in the period after the inflation targeting regime was implemented also reduced the pass-through.

Contrary to Taylor's hypothesis, Parsons and Kiyotaka (2008) concluded that transitivity did not change over time in Japan. Campa and Goldberg (2002) concluded that there was a weak correlation between high inflation and exchange rate pass-through to import prices.

Many different methods were used for the calculation of ERPT in the literature. The SVAR model used by McCarthy (1999) while calculating ERPT in 9 different developed countries and its constraints have been among the most referenced methods in this field. In other studies, in which the same method was used, while Gueorguiev (2003) and Ocran (2010) concluded that exchange rate pass-through to producer prices was higher compared to its pass-through to consumer prices, Stulz (2007) concluded that changes in the exchange rate in Switzerland rapidly passed to import prices. However, this passing was incomplete in the long term. Ito and Sato (2006) concluded that the pass-through effect of the exchange rate on import prices was high in the East Asian economies that were affected by the crisis. However, the pass-through effect on consumer prices was low in countries other than Indonesia, and Leigh and Rossi (2002) concluded that the exchange rate pass-through to wholesale prices was higher compared to pass-through to consumer prices in Turkey.

Another one of the most used methods in calculating the pass-through in recent years has been the nonlinear time series. In their study on the USA conducted using the STAR method, Shintani, Terada-Hagiwara, and Yabu (2013) concluded that the decrease in pass-through in the 1980s and 1990s was associated with inflation rates. In his study on Tunisia between 2011Q4 - 2019Q4, Wissem (2020) used the LSTAR method and concluded that there was a high exchange rate pass-through to inflation through external debt in both regimes. In addition to the regime change models used in previous studies, the NARDL method is also highly preferred in this field. In their study on the Czech Republic between 1999M05 - 2018M12, Nasir, Huynh, and Vo (2020) determined that ERPT had significant effects on inflation expectations. In their study conducted on Sudan between 1992Q1—2015Q2, Baharumshah, Sirag, and Nor (2017) concluded that inflation was largely due to sharp fluctuations in the exchange rate and that the effect of oil prices on prices was insignificant.

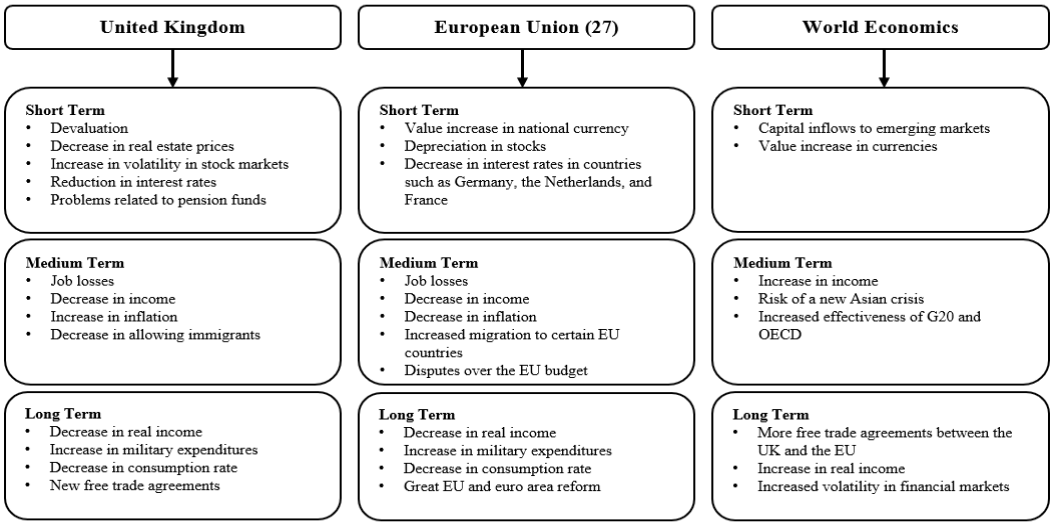
2. ECONOMIC EFFECT OF BREXIT

It is necessary to analyze the dynamics of the UK economy to observe the effect that Brexit can have on the UK. Before joining the European Economic Community (EEC) in 1973, approximately a third of the UK's trade was with the EEC. However, in 2014, the other 27 EU members accounted for 45 percent of the UK's exports and 53 percent of its imports. The UK's exports to the EU constituted 13 percent of the UK's national income. This high volume of trade between the two sides also provided lower prices and household's access to higher quality goods and services (Dhingra, Ottaviano, Sampson and Van Reenen 2016b).

International organizations and investors predict that commercial relations that are damaged will cause a long-term slowdown in the growth rates of the UK economy. On the other hand, it is expected that Brexit will also affect not only the UK and the EU, but also the world economies. In particular, the commercial position to be taken by the countries that are not members of the EU but

have trade agreements after Brexit will significantly affect the UK's economy. The expected effects of Brexit in the short, medium and long term can be summarized as shown in (figure no 1).

Figure 1: Short, Medium, and Long-Term Effects of Brexit



Source: Welfens, 2018, p. 113.

The decision to leave the EU led to a high increase in uncertainty in the UK's economy. In the Brexit uncertainty index (BUI) prepared by the Bank of England, a significant increase was observed towards the end of 2018 due to the fact that the terms of the agreement could not be determined exactly. This uncertainty has adverse effects, especially on the value of the national currency. The long-term fate of the GBP depends on the terms of the EU-UK separation. The stricter the terms of the agreement are, the greater the adverse effects on the UK economy will be. It is expected that the GBP will be priced between 1.40 USD – 1.45 USD after a relatively soft Brexit and around 1 USD after a harsher Brexit. In addition to this situation, this uncertainty also has effects on firms. It is estimated that the level of productivity has decreased between 2 percent and 5 percent during the period since the referendum. A large part of this decrease is due to the time that senior managers in firms spend on Brexit planning (Pilbeam 2019). Apart from all these adverse effects, the new commercial partnerships to be established by the UK after Brexit will be the beginning of a new commercial period both in the UK and in different parts of the world.

When the position of the UK within the EU is considered, it is inevitable that Brexit will also have extremely important effects on the EU. In particular, the withdrawal of the UK, one of the most important financing resources within the union, is expected to cause worldwide economic insecurity against the union. Moreover, along with the conclusion of Brexit, a deficit of 13-15 billion Euros is expected to occur in the EU budget. Other member states will have to close this deficit. Apart from economic effects, Brexit will be a significant loss of power and prestige for the union since the UK is one of the most important military powers in the EU in many aspects.

When the terms of the agreement are finalized in the following periods, the environment of uncertainty in the UK economy is expected to improve. However, considering the customs controls, additional costs, and bureaucratic procedures, it will not come as a surprise for both parties of the agreement that some of the damage that occurred during the period of uncertainty will be permanent. Accordingly, it will take a long time to decompose the structural and periodic effects of Brexit on the UK economy.

3. DATA AND METHODOLOGY

In the analysis performed to examine the effect of Brexit on the exchange rate pass-through in the UK, the data set was divided into two periods as the Brexit period (2016:06-2020:02) and the pre-Brexit (2010:01-2016:05) period. The constraints of the SVAR model used in the study of McCarthy (1999) were referenced to calculate ERPT. The variables used in the analysis and the sources of the variables are presented in Table 1.

Table 1: Variables and Sources

Designation of İndicator	Description	Source
OIL	Brent Oil	St. Louis FED
IPI	İndustrial Production İndex	OECD
OG	Output Gap	Obtained using the IPI variable
ER	Exchange rate (GBP/USD)	St. Louis FED
IMP	İmport Prices	OECD
PPI	Producer Price İndex	OECD
CPI	Consumer Price İndex	OECD

The Hodrick-Prescott filtering method was used to calculate the output gap variable in the model. All variables were included in the model by taking their logarithms to interpret the effects of changes in independent variables on the dependent variable at a fixed rate. Descriptive statistics regarding the data used in the study are as in the Table 2.

Table 2: Descriptive Statistics

			Brexit Period		
	Mean	**Median**	**Maximum**	**Minimum**	**Std. Dev.**
OIL	60.64	62.33	80.47	45.07	9.67
IPI	102.05	101.95	105.26	99.15	1.62
ER	1.30	1.29	1.42	1.22	0.05
IMP	120.12	120.50	123.80	117.10	1.95
PPI	107.71	108.48	112.01	100.17	3.79
CPI	2.03	2.00	2.80	0.80	0.53
			Pre-Brexit Period		
OIL	90.21	103.11	124.93	30.80	26.41
IPI	98.87	99.25	101.85	93.93	1.54
ER	1.57	1.57	1.71	1.42	0.06
IMP	128.38	129.00	136.60	118.30	5.09
PPI	101.93	103.22	106.56	93.29	3.73
CPI	2.08	2.40	4.50	0.20	1.14

The SVAR model was used to limit the effect of the non-theoretical structure of the standard VAR model on the results. The constraints of the model, which is established when e structural shocks represent the residuals of the μ reduced VAR model, are as shown in matrix number 4.

$$\begin{bmatrix} \mu_t^{OIL} \\ \mu_t^{OG} \\ \mu_t^{ER} \\ \mu_t^{IMP} \\ \mu_t^{PPI} \\ \mu_t^{CPI} \end{bmatrix} = \begin{bmatrix} A_{11} & 0 & 0 & 0 & 0 & 0 \\ A_{21} & A_{22} & 0 & 0 & 0 & 0 \\ A_{31} & A_{32} & A_{33} & 0 & 0 & 0 \\ A_{41} & A_{42} & A_{43} & A_{44} & 0 & 0 \\ A_{51} & A_{52} & A_{53} & A_{54} & A_{55} & 0 \\ A_{61} & A_{62} & A_{63} & A_{64} & A_{65} & A_{66} \end{bmatrix} \begin{bmatrix} e_t^{OIL} \\ e_t^{OG} \\ e_t^{ER} \\ e_t^{IMP} \\ e_t^{PPI} \\ e_t^{CPI} \end{bmatrix} \quad (4)$$

McCarthy (1999) uses a distribution chain to examine the transition of fluctuations in exchange rate and import prices to producer and consumer prices. In this model, inflation at a given distribution stage (producer, consumer and import) in period t is assumed to involve several different components.

$$C\mathcal{O}_t^{oil} = E_{t-1}(\pi_t^{oil}) + \varepsilon_t^s \quad (5)$$

$$\tilde{y}_t = E_{t-1}(\tilde{y}_t) + a_{1i}\varepsilon_t^s + \varepsilon_t^d \quad (6)$$

$$\Delta e_t = E_{t-1}(\Delta e_t) + b_{1i}\varepsilon_t^s + b_{2i}\varepsilon_t^d + \varepsilon_t^e \quad (7)$$

$$Ↄ_t^{imp} = E_{t-1}\left(Ↄ_t^{imp}\right) + z_{1i}\varepsilon_t^s + z_{2i}\varepsilon_t^d + z_{3i}\varepsilon_t^e + \varepsilon_t^{imp} \quad (8)$$

$$Ↄ_t^{ppi} = E_{t-1}\left(Ↄ_t^{ppi}\right) + \beta_{1i}\varepsilon_t^s + \beta_{2i}\varepsilon_t^d + \beta_{3i}\varepsilon_t^e + \beta_{4i}\varepsilon_t^{imp} + \varepsilon_t^{ppi} \quad (9)$$

$$Ↄ_t^{cpi} = E_{t-1}\left(Ↄ_t^{cpi}\right) + \Omega_{1i}\varepsilon_t^s + \Omega_{2i}\varepsilon_t^d + \Omega_{3i}\varepsilon_t^e + \Omega_{4i}\varepsilon_t^{imp} + \Omega_{5i}\varepsilon_t^{ppi} + \varepsilon_t^{cpi} \quad (10)$$

Where $Ↄ_t^{oil}$ is oil price, $\tilde{y}_t$ is the outputgap, Δe is the first difference of the exchange rate, E_{t-1} is the expectation of a variable conditional on information available at previous period, s is supply, d is demand and t is the time period. The order of the variables in the model is extremely important. Each variable in the model is explained by both its own changes and the changes of variables before it.

VAR models that were developed by Sims (1980) as an alternative to conventional systems of the simultaneous equation are the generalized form of autoregressive models for more than one variable. VAR models are based on three basic assumptions (Watson and Teelucksingh 2002),

- There is no internal-external distinction between the variables in the system,
- There is no zero-type constraint,
- There is no economic theory on which the model is based.

Therefore, in the sample bivariate VAR(p) model, a lagged variable as much as p is added for both variables (Kirchgässner and Wolters 2007). A bivariate VAR(1) model including the variables Ↄ and Ω is shown in matrix number 11.

$$\begin{bmatrix} Ↄ_t \\ \Omega_t \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} + \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix} \begin{bmatrix} Ↄ_{t-1} \\ \Omega_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad (11)$$

Equations 12 and 13 are obtained when matrix number 9 is converted into the equation form. In the following equations, a represents the constant term, A represents the coefficients of the model, ε represents the error term.

$$Ↄ_t = a_1 + A_{11}Ↄ_{t-1} + A_{12}\Omega_{t-1} + \varepsilon_{1,t} \quad (12)$$

$$\Omega_t = a_1 + A_{21}Ↄ_{t-1} + A_{22}\Omega_{t-1} + \varepsilon_{2,t} \quad (13)$$

The main criticism for VAR models is that the model is not based on an economic theory as in the systems of simultaneous equations. In order to overcome this situation in SVAR models, the constraints suitable for economic theories are added to the VAR model, and structural shocks are used in the analysis. The sample bivariate structural VAR(1) model with independent variables Ↄ and Ω is shown in matrix number 14.

$$\begin{bmatrix} 1 & a_{12} \\ a_{21} & 1 \end{bmatrix} \begin{bmatrix} Ↄ_t \\ \Omega_t \end{bmatrix} = \begin{bmatrix} a_{10} \\ a_{20} \end{bmatrix} + \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix} \begin{bmatrix} Ↄ_{t-1} \\ \Omega_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad (14)$$

When matrix number 14 is written in the equation form:

$$Ↄ_t = a_{10} - \alpha_{12}\Omega_t + A_{11}Ↄ_{t-1} + A_{12}\Omega_{t-1} + \varepsilon_{1,t} \quad (15)$$

$$\Omega_t = a_{20} - \alpha_{21}Ↄ_t + A_{21}Ↄ_{t-1} + A_{22}\Omega_{t-1} + \varepsilon_{2,t} \quad (16)$$

The closed form of equations 15 and 16 can be represented as in equation 17:

$$B\Pi_t = \Gamma_0 + \Gamma_1\Pi_{t-1} + \varepsilon_t \quad (17)$$

When both sides of equation 17 are multiplied by B^{-1}, equation 18 is obtained:

$$\Pi_t = B^{-1}\Gamma_0 + B^{-1}\Gamma_1\Pi_{t-1} + B^{-1}\varepsilon_t \quad (18)$$

When the variables in equation 18 are defined as"$\beta_0 = B^{-1}\Gamma_0$", "$\beta_1 = B^{-1}\Gamma_1$" and "$\nu = B^{-1}\varepsilon_t$", the standard form of the model shown in equation 19 is obtained:

$$\Pi_t = \beta_0 + \beta_1\Pi_{t-1} + \nu_t \quad (19)$$

The analysis of variance decomposition is one of the most frequently used analyses to examine residuals by using the dynamic structure of VAR models. The interaction between the variables included in the VAR model can be observed by the analysis of variance decomposition. In other words, the analysis of variance decomposition shows the extent to which the prediction error variance of a variable is explained by other variables in the model (Brooks 2008).

$t+1$ reduced form of the bivariate VAR(1) model is shown in equation 20 (Cil 2018):

$$C\mathcal{O}_{t+1} = \beta_0 + \beta_1 C\mathcal{O}_t + \nu_{t+1} \quad (20)$$

The conditional expected value of the dependent variable in equation 21 is as follows:

$$E_t(C\mathcal{O}_{t+1}) = \beta_0 + \beta_1 C\mathcal{O}_1 \quad (21)$$

when it is rewritten for $C\mathcal{O}_{t+1}$:

$$C\mathcal{O}_{t+2} = \beta_0 + \beta_1 C\mathcal{O}_{t+1} + \nu_{t+2} = \beta_0 + \beta_1(\beta_0 + \beta_1 C\mathcal{O}_{t+1} + \nu_{t+1}) + \nu_{t+2} \quad (22)$$

The conditional expected value of equation 22 is as follows:

$$E_t(C\mathcal{O}_{t+2}) = (I + \beta_0) + \beta_0 + \beta_1^2 + C\mathcal{O}_t \quad (23)$$

The prediction error of equation 23 is as follows:

$$\nu_{t+2} = \beta_1 \nu_{t+1} \quad (24)$$

When it is generalized for n periods:

$$E_t(C\mathcal{O}_{t+n}) = (I + \beta_1 + \beta_1^2 + \cdots + \beta_1^{n-1})\beta_0 + \beta_1^n C\mathcal{O}_t \quad (25)$$

The prediction error of the equation generalized for n periods is as observed in equation 26:

$$\nu_{t+n} + \beta_1 \nu_{t+n-1} + \beta_1^2 \nu_{t+n-2} + \cdots + \beta_1^{n-1} \nu_{t+1} \quad (26)$$

The prediction errors can also be obtained by moving averages. The moving averages form of the structural model is as in equation 27 (Enders 2014):

$$C\mathcal{O}_t = \mu + \sum_{i=0}^{\infty} \beta_1^i e_{t-i} \quad (27)$$

If the prediction error for a period ahead is assumed as $\emptyset\varepsilon_{t+n-i}$, it can generally be represented as in equation 28:

$$C\mathcal{O}_{t+n} = \mu + \sum_{i=0}^{\infty} \emptyset_i \varepsilon_{t+n-i} \quad (28)$$

The prediction error for n periods ahead is as follows:

$$C\mathcal{O}_{t+n} - E_t(C\mathcal{O}_{t+n}) = \sum_{i=0}^{n-1} \Phi_i \varepsilon_{t+n-i} \quad (29)$$

The prediction error for n periods ahead of the sequence φ_t is presented below:

$$\varphi_{t+n} - E_t(\varphi_{t+n}) = \Phi_{11}(0)\varepsilon_{\varphi t+n} + \Phi_{11}(1)\varepsilon_{\varphi t+n-1} + \cdots + \Phi_{11}(n-1)\varepsilon_{\varphi t+1} + \Phi_{12}(0)\varepsilon_{zt+n} + \Phi_{12}(1)\varepsilon_{zt+n-1} + \cdots + \Phi_{12}(n-1)\varepsilon_{zt+1} \quad (30)$$

$\sigma_\varphi(n)^2$, the prediction error variance of φ_{t+n}, is calculated in the following way:

$$\sigma_\varphi(n)^2 = \sigma_\varphi^2[\Phi_{11}(0)^2 + \Phi_{11}(1)^2 + \cdots + \Phi_{11}(n-1)^2] + \sigma_\varphi^2[\Phi_{12}(0)^2 + \Phi_{12}(1)^2 + \cdots + \Phi_{12}(n-1)^2] \quad (31)$$

The prediction error variance calculated for n periods ahead can be divided into rates for each shock. $\sigma_\varphi(n)^2$ rates resulting from the shocks in sequences $\varepsilon_{\varphi t}$ and ε_{zt} are shown in equations 32 and 33:

$$\frac{\sigma_\varphi^2[\Phi_{11}(0)^2+\Phi_{11}(1)^2+\cdots+\Phi_{11}(n-1)^2]}{\sigma_\varphi(n)^2} \quad (32)$$

$$\frac{\sigma_z^2[\Phi_{12}(0)^2+\Phi_{12}(1)^2+\cdots+\Phi_{12}(n-1)^2]}{\sigma_\varphi(n)^2} \quad (33)$$

Variance decomposition shows the ratio of shocks from one variable to shocks from the other variable and is a useful tool for analyzing the correlations between economic variables (Enders 2014).

4. EMPIRICAL RESULTS

The most important assumption in econometric analyses, which include the time series, is the assumption that the variables included in the model are stationary. There are two main reasons why the stationarity assumption is important in time series analysis. Firstly, the behavior of a non-stationary time series can only be examined for the period under consideration. Therefore, it is not possible to generalize the results obtained for different time periods. Secondly, in the analyses performed with non-stationary series, the results of statistical and general significance tests are unreliable, and the presence of a relationship that does not actually exist can be found, which is called spurious regression in the econometric literature (Gujarati 2011).

In this study, the Augmented Dickey-Fuller (ADF) unit root test was used to test stationarity. The probability values of the unit root tests performed in both periods are shown in Table 3.

Table 3: ADF Test Unit Root Test Results

Brexit Period				Pre-Brexit Period			
LOIL	-1.3471	**ΔLOIL**	-5.6773***	**LOIL**	-2.1124	**ΔLOIL**	-5.9732***
OG	-3.0749	**ΔOG**	-7.9545***	**OG**	-3.1596	**ΔOG**	-12.8350***
LER	-2.8429	**ΔLER**	-6.9010***	**LER**	-1.6801	**ΔLER**	-7.7190***
LIMP	-1.9792	**ΔLIMP**	-5.8540***	**LIMP**	-1.7398	**ΔLIMP**	-8.5585***
LPPI	-1.1553	**ΔLPPI**	-5.0203***	**LPPI**	-1.4640	**ΔLPPI**	-6.0311***
LCPI	-3.5184*	**ΔLCPI**	-6.7934***	**LCPI**	-1.9350	**ΔLCPI**	-7.5859***

Note: L=Log, Δ = first difference.
***,**,* indicates significance at 1,5 and 10 percent respectively.
Models include trend and intercept. The maximum lag for the ADF test is selected with the Schwert (1989).

According to the ADF test results, based on the 5 percent significance level, it was determined that all variables were not stationary with the level values. However, they became stationary when their first-order differences were taken. In addition to the ADF test, the correlograms of the series were examined, and it was observed that all variables were not stationary with the level values.

It was based on the information criteria for the determination of lag length. The appropriate lag length was determined to be 3 for the Brexit period and 5 for the pre-Brexit period. After determining the optimum lag length using the information criteria, the basic assumptions of the estimated model were examined. In the models established, White (No Cross Terms) was used to test heteroskedasticity, and the LM test was used to test autocorrelation. As seen in Table 4 and Table 5, there is no autocorrelation and variance problem in models. Accordingly, it was observed that the selected lag length was correct and that the established model provided the basic assumptions. From this point of view, it was concluded that the results obtained through the estimated model were reliable.

Table 4: Autocorrelation Test Results

	Pre-Brexit Period			Brexit Period		
Lag	**Rao F-Stat**	**DF**	**Prob.**	**Rao F-Stat**	**DF**	**Prob.**
1	0.9103	(36, 130.1)	0.6172	0.9684	(36,51.1)	0.5342
2	0.8642	(36, 130.1)	0.6872	1.6712	(36,51.1)	0.0453**
3	1.1067	(36, 130.1)	0.3324	0.7714	(36,51.1)	0.7919
4	0.8522	(36, 130.1)	0.7050	0.6902	(36,51.1)	0.8778

***,**,* indicates significance at 1,5 and 10 percent respectively.

Table 5: Heteroskedasticity Test Results

Brexit Period			Pre-Brexit Period		
Chi-Sq	**DF**	**Prob.**	**Chi-Sq**	**DF**	**Prob.**
764.05	756	0.4116	1307.99	1,260	0.1692

The analysis of variance decomposition, which was examined theoretically in the previous section, was used to determine the relationship between the variables. In this context, it was examined how much of changes in prices were caused by changes in the exchange rate. The results of the decomposition analysis of variance for the VAR models tested hypothetically are as Table 6.

Table 6: The Rate of Explanation of Price Indices by the Exchange Rate

Period	Price İndex	t=1	t=4	t=8	t=12
Brexit Period	PPI	19.94	16.79	16.70	16.45
	CPI	3.49	3.59	6.52	6.41
Pre-Brexit Period	PPI	8.34	4.99	4.98	5.55
	CPI	1.83	1.96	3.40	4.44

According to the results obtained in Table 6, 5.55 percent of changes in producer prices and 4.44 percent of changes in consumer prices in the pre-Brexit period were explained by changes in the exchange rate. In the Brexit period, these rates were 16.45 and 6.41, respectively. In other words, the effect of Brexit on producer prices was more severe compared to consumer prices, and producer prices became more vulnerable to changes in the exchange rate.

When the analysis results were examined, it was observed that fluctuations in the exchange rate due to the uncertainty that occurred after the referendum were highly reflected, especially on consumer prices. When other studies in the literature were reviewed, it was observed that fluctuations in the exchange rate due to due to Brexit had similar characteristics with the exchange rate crises in developing countries. Mishkin (2002) offered the monetary authorities of countries the option to intervene in the exchange rate without leaving the inflation target on focus against the exchange rate fluctuations experienced in developing countries that adopted the inflation targeting regime. The UK's central bank should also consider this option in case the exchange rate increases cannot be controlled in the upcoming periods.

4. CONCLUSION

Along with the end of the Bretton Woods system and the countries abandoning the fixed exchange rate regimes and starting to implement the floating exchange rate regime, ERPT has become an extremely important issue. In particular, the political and economic developments that significantly affected the countries had a significant effect on the pass-through of the fluctuations in exchange rates to prices. Nowadays, ERPT has become an important indicator in evaluating the efficiency of monetary policies and the effects of the experienced political and economic events on national economies.

In this study, the effects of the Brexit process on ERPT were analyzed comparatively. According to the results obtained as a result of the analysis, the failure to resolve the Brexit process and the environment of uncertainty caused by this lack of solution had a weak effect on consumer prices. However, their effect on producer prices was extremely high. In other words, in the Brexit period, companies in the UK could not fully reflect the increase in production costs on consumer prices in order to maintain their share in the market. This situation caused a decrease in the profitability rates of the companies and created uncertainties about the future of the companies in the next years. It can be clearly observed by considering the economic indicators that this uncertainty has adverse effects on the UK's economy. However, the terms of the agreement should be determined precisely to examine the permanence of these adverse effects more properly.

Although the UK officially left the EU in the first month of 2020, the future of trade relations between the UK and the EU remains uncertain. Considering this environment of uncertainty and the COVID-19 pandemic that has caused the collapse in all world economies, it is not difficult to say that the UK economy will have hard times in the next period. Despite all these negative developments, new commercial partnerships expected to be established after Brexit are expected to generate significant dynamism both in the UK and different parts of the world.

REFERENCES

Baharumshah, A., Sirag, A., & Soon, S.-V. (2017). Asymmetric exchange rate pass-through in an emerging market economy: The case of Mexico. *Research in International Business and Finance*, 247-259.

Baqueiro, A., Diaz de Leon, A., & Torres, A. (2003). Fear of floating or fear of inflation? The role of the exchange rate pass-through. *BIS Papers* No:19, 338-354.

Belke, A., Dubova, I., and Osowoski, T. (2016). Policy uncertainty and international financial markets:the case of Brexit. *Applied Economics* 50 (34-35): 3752-3770. doi:10.1080/00036846.2018.1436152.

Bouakez, H., & Rebei, N. (2005). Has exchange rate pass-through really declined in Canada? *Bank of Canada Working Paper*, 2005-29.

Breinlich, H., Leromain, E., Novy, D., and Sampson, T. (2019). Exchange rates and consumer prices: evidence from Brexit. *CEPR Discussion Paper* 8001 (8): 1-50.

Brooks, C. (2008). Introductory Econometrics for Finance. Cambridge University Press.

Ca' Zorzi, M., Hahn, E., and Sanchez, M. (2007). Exchange rate pass-through in emerging markets. *ECB Working Paper* 739: 1-31.

Campa, J., and Goldberg, L. S. (2002). Exchange rate pass-through into import prices: a macro or micro phenomenon? *NBER Working Paper* 8934: 1-33.

Choudhri, E. U., and Hakura, D. S. (2006). Exchange rate pass-through to domestic prices: does the inflationary environment matter? *Journal of International Money and Finance* 25 (4): 614-639. doi:10.1016/j.jimonfin.2005.11.009.

Cil, N. (2018). Finansal Ekonometri. İstanbul: Der Yayınları.

Dhingra, S., Machin, S., and Overman, H. (2017). Local economic effects of Brexit. *National Institute Economic Review* 242 (1): 1-42. doi:10.1177/002795011724200112.

Dhingra, S., Ottaviano, G., Sampson, T., and Van Reenen, J. (2016b). The consequences of Brexit for UK trade and living standards. *Centre for Economic Performance* 2: 1-12.

Dhingra, S., Ottaviano, G., Sampson, T., and Van Reenen, J. (2016a). The impact of Brexit on foreign investment in the UK. *Centre for Economic Performance* 3: 1-10.

Enders, W. (2014). Applied Econometric Time Series. Wiley.

Goldberg, P. K., and Knetter, M. M. (1997). Goods prices and exchange rates: what have we learned. *Journal of Economic Literature* 5862: 1243-1272. doi:10.3386/w5862.

Gueorguiev, N. (2003). Exchange rate pass-through in Romania. *IMF Working Paper* 3 (130): 1-29.

Gujarati, D. (2011). Econometrics by Example. Palgrave Macmillan.

Hohlmeier, M., and Fahrholz, C. (2018). The impact of Brexit on financial markets—Taking stock. *İnternational Journal of Financial Studies* 6 (3): 1-9. doi:10.3390/ijfs6030065.

Hooper, P., and Mann, C. L. (1989). Exchange rate pass-through in the 1980s: the case of US imports of manufactures. *Brookings Papers on Economic Activity* 1: 297-337. doi:10.2307/2534500.

Jiménez-Rodríguez, R., and Morales-Zumaquero, A. (2016). A new look at exchange rate pass-through in the G-7 countries. *Journal of Policy Modeling* 38(5): 985-1000. doi:10.1016/j.jpolmod.2016.06.007

Ito, T., and Sato, K. (2006). Exchange rate changes and inflation in post-crisis Asian economies: VAR analysis of the exchange rate pass-through. *Journal of Money, Credit and Banking* 52 (6): 1407-1438. doi:10.1111/j.1538-4616.2008.00165.x.

Kirchgässner, G., and Wolters, J. (2007). Introduction to Modern Time Series Analysis. Springer.

Leigh, D., and Rossi, M. (2002). Exchange rate pass-through in Turkey. I*MF Working Paper* 2 (204): 1-18.

Loloh, F. (2014). Exchange rate pass-through in Ghana. Bank of Ghana Staff Working Paper.

McCarthy, J. (1999). Pass-through of exchange rates and import prices to domestic inflation in some industrialized economies. *BIS Working Papers* 79: 1-37.

Menon, J. (1996). The degree and determinants of exchange rate pass-through: market structure, non-tariff barriers and multinational corporations. *The Economic Journal* 106 (435): 434-444. doi:10.2307/2235258.

Mishkin, F. (2002). Structural issues for successful inflation targeting in transition countries. Conference on Monetary Policy in the Environment of Structural Changes. National Bank of Poland, Falenty, Poland.

Ocran, M. K. (2010). Exchange rate pass-through to domestic prices: the case of South Africa. *Prague Economic Papers* 4: 291-306. doi:10.18267/j.pep.378.

Otani, A., Shiratsuka, S., & Shirota, T. (2003). The decline in the exchange rate pass-through: evidence from Japanese import prices. *Monetary and Economic Studies*, 53-82.

Parsons, C. R., and Kiyotaka, S. (2008). New estimates of exchange rate pass-through in Japanese exports. *International Journal of Finance and Economics* 13 (2): 174-183. doi:10.1002/ijfe.337.

Schiereck, D., Kiesel, F., and Kolaric, S. (2016). Brexit: (Not) another Lehman moment for banks? *Finance Research Letters* 19: 291-297. doi:10.1016/j.frl.2016.09.003.

Schwert, G. (1989). Tests for unit roots: A Monte Carlo investigation. *Journal of Business and Economic* Statistics 7 (2): 147-159.

Sims, C. A. (1980). Macroeconomics and reality. *Econometrica* 48 (1): 1-48. doi:10.2307/1912017.

Stulz, J. (2007). Exchange rate pass-through in Switzerland: Evidence from vector autoregressions. *Swiss National Bank Economic Studies* 4, 1-32.

Taguchi, H., & Bolortuya, J. (2019). Inflation targeting and the pass-through effect in Mongolia. *Business and Economic Research*, 9 (2), 57-71.

Taylor, J. B. (2000). Low inflation, pass-through, and the pricing power of firms. *European Economic Review,* 44 (7): 1389-1408. doi:10.1016/S0014-2921(00)00037-4.

Watson, P., and Teelucksingh, S. (2002). A Practical Introduction to Econometric Methods: Classical and Modern. University of the West İndies Press.

Welfens, P. J. (2018). BREXIT aus Versehen: Europaische Union zwischen Desintegration und neuer EU. Wuppertal: Springer.

Welfens, P. J., and Baier, F. J. (2018). Brexit and foreign direct investment: key issues and new empirical findings. *International Journal of Financial Studies* 6 (2): 1-21. doi:10.3390/ijfs6020046.

Winters, L., and Fernandes, A. (2018). The effect of exchange rate shocks on firm-level exports: evidence from the Brexit vote. *Centre for Economic Policy Research* DP13253: 1-30.

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2021 VOLUME 10 ISSUE 2

A CAUSALITY ANALYSIS ON FACTORS AFFECTING HOUSING PRICES: CASE OF TURKEY

DOI: 10.17261/Pressacademia.2021.1405
JBEF- V.10-ISS.2-2021(2)-p.58-71

Zeynep Colak
Canakkale Onsekiz Mart Universty, Biga Faculty of Economics and Administrative Sciences, Department of Business, Canakkale, Turkey.
zolak.84@gmail.com , ORCID: 0000-0003-0058-6809

Date Received: March 29, 2020 **Date Accepted:** June 12, 2021

To cite this document
Colak, Z., (2020). A causality on factors affecting housing prices: case of Turkey. Journal of Business, Economics and Finance (JBEF), 10(2),58-71.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2021.1405

ABSTRACT

Purpose- Crises can manifest themselves in many areas such as in political, social and economic areas, in the ordinary course of life. Especially in the practices related to the economic field, the crisis reaches a global scale and can affect many countries. Within the scope of the limitless dimensions of globalization, problems experienced in one country affect other countries as well. The aim of this study is to show the relationships between housing prices (Housing prices in Turkey after the 2008-2009 global financial crisis was subjected) and exchange rate, consumer price index (CPI), deposit interest rate, index of industrial production, employment.

Methodology- In this study, quantitative research method is used and the study has the feature of correlational research. The VAR model was used in the study and the stability of the data was tested with ADF (Augmented Dickey Fuller) and Phillips Perron (PP) unit root tests.

Findings- In the study, the long and short term relationships between housing price and the exchange rate, consumer price index, deposit interest rate, industrial production index and employment rate after the 2008-2009 global financial crisis impact for the period of 2010 January- 2019 December were examined with Johansen Cointegration and Granger Causality analyzes. The results show that there are long term relationships among the variables and there is a one-way short term relationship from deposit interest rate, USD / TL rate, industrial production index, CPI and employment to housing price index. According to the Johansen Cointegration test result, there is a long-term relationship between variables excluding CPI.

Conclusion- As a conclusion of the analyses, it is seen that macroeconomic variables have an effect on the increase of house prices in Turkey during the financial crisis and post-financial crisis period. Changes in house price and deposit interest rates, dollar/TL exchange rate, industrial production index, CPI and employment rates play a decisive role in the decrease or increase in house prices. This will have a major impact on the increase in housing demand and, as a result, the development of the construction sector. In this study, similar results were obtained from national and international studies.

Keywords: Housing prices, housing price index, Granger causality analysis, Johansen cointegration analysis.
JEL Codes: G10, E44, C01.

1. INTRODUCTION

Crises can manifest themselves in many areas in the usual course of life. When it occurs within the political social economic field, it is in a position to affect more than one person. Especially in the applications of the economic field, the crisis reaches the quality of global dimensions and can affect many countries (Eryüzlü et al., 2020). Financial problems caused by mortgages in the last period of 2007 in the USA resulted in a global crisis in the last quarter of 2008 (Engin et al., 2016).

The positive situation of the houses, which are seen as both a necessity and an investment tool, with the price increase in the 2000s, and the ability of banks to issue easy loans for the purchase of housing, have led people to buy houses. In particular, the rise of housing purchases for investment has caused house prices to rise. There has been a decrease in demand with the high level of house prices, and a systemic collapse with the failure to pay the loans on time (Dilber et al., 2016).

Within the scope of the limitlessness of the dimensions of the phenomenon of globalization, when the literature on the 2008 global financial crisis is examined with the effect of the problem in one country on other countries, the introduction of a network of chained relations formed by interrelated or triggering factors constitutes the framework of this study. The aim of this study on house prices in Turkey after the 2008-2009 global financial crisis; to show that the relations between the exchange rate, consumer

price index (CPI), deposit interest rate, industrial production index and employment rate have an impact on house prices. The fact that there are studies covering these dimensions in the literature and that there has not been a study in which all of these dimensions are analyzed together reveals the scope and importance of the study. In the research part of the study, the fact that there was no data entry on housing prices between 2008 and 2010 covers the period between 2010 and 2019, and this is seen as a limitation of the work.

In the second part of the study, exchange rate, deposit interest rate, consumer price index (CPI), industrial production index and employment rates are evaluated as factors affecting house prices and their reflections in the literature are discussed. The third part is the research area and the house price indices realized in Turkey in 2010-2019; exchange rate, deposit interest rates, industrial production index, employment and CPI variables, which are thought to be related to house price indices, are examined. The fourth part, which is the last part of the study, includes analysis results and evaluations.

2. FACTORS AFFECTING HOUSING PRICES

2.1. Effect of Exchange Rates

In addition to affecting the domestic developments of a country, the exchange rate follows a different course due to the phenomenon developing in other countries. This is an important argument in terms of making sense of the extent of globalism. This instant reactionary mobility in the exchange rate also affects house prices. The instantaneous variability in house prices is closely related to which of the fluctuating exchange rates or fixed exchange rate applications are selected in the country's economic monetary policy (Badurlar, 2008).

In Zhu (2006), which investigated the housing financing structure in Indonesia, Singapore, Thailand and Korea, which adopted the fluctuating exchange rate practice in Asia, it concluded that exchange rates had a significant impact on house prices. In the study discussed by Eryüzlü and Ekici (2020), house prices are not an effective argument above the exchange rate in the short term; changes in the exchange rate have been identified as an important variable in the short term in determining house prices in Turkey. In their analysis Çetin and Doğaner (2017), reveal the relationship between the construction confidence index and house prices in Turkey. The fact that housing is a basic need constitutes the most important part of the spending items per household (Szeidl et al., 2004:105).

In their study in Dilber et al. (2016), they examined the factors in the house price index for Turkey. Accordingly, the most important share showing the decrease or increase in the house price index belongs to the exchange rate; other determinants of this situation are housing interest rates and inflation, respectively. In the period after the 2008 global financial crisis, it is possible to say that macroeconomic determinants have an impact on the increase or decrease in the house price index in Turkey. Instantaneous changes in interest rates, inflation and exchange rate remain decisive in the increase or decrease in house prices.

2.2. Deposit Interest Rates

Interest rates can be decisive on many assets as well as have an impact on housing prices. The increase or decrease in house prices affects investments made in the housing sector, borrowing of households or investment decisions and can also be determinant at the point of demand. The demand for housing includes economic activities in total (Zammit, 2010). In this context, the housing market; It can be the workplace of policymakers and researchers in determining growth, job creation and economic activities. The fact that the housing sector was seen as the cause of the 2008 global financial crisis suggests that more careful action should be made in investments in this area. The contribution of the housing sector to the economic field such as the creation of labor force in Turkey, the provision of contracting services abroad, its effectiveness in economic growth cannot be ignored. (Ayhan, 2018).

Short-term fluctuations in interest rates have significant effects on the housing sector and prices. This effect is capable of affecting all economic applications within the economic sphere. Short-term interest rates are associated with housing loans and house prices. The balance of payments in the maturity structure is also the decisive factor in housing loan prices. With monetary expansion and decreases in the price of housing loans, increases in mortgage demand are expected. This process increases the prices of houses with increased demand and the collateral value of housing loans, and increases the asset position and lending power of banks (Jorda et al., 2015: 37). Expansionary monetary policy practices reduce long- or short-term interest rates and reduce capital use costs. As a result, investments and total demand are increasing; otherwise, when the contractionary monetary policy is implemented, interest rates increase, while investments and total demand decrease (Canbay et al., 2020). Economic growth and increase in income affect the demand for housing loans and housing prices. Housing loan maturity structuring and interest rates in housing loans have an important effect on housing prices (Coşkun, 2016).

Within the scope of monetary policies implemented by central banks, the number of studies aimed at analyzing the effects of change in interest rates on house prices and economic activities covers an important area in the literature. There are many studies in the literature that examine these effects with similar variables. These studies, which are generally carried out using VAR methodology, include Iacoviello (2005), Goodhart and Hofmann (2008), Jarocinski and Smets (2008), Assenmacher-Wesche and Gerlach (2008), Carstensen, Hülsewig and Wollmershäuser (2009), Demary (2009), The studies of Milcheva and Sebastian (2016), Hofmann and Peersman (2017) are important in this context.

Canbay and Mercan (2020) in their work, shocks in interest rates, loan volume and growth have had a significant impact on house prices; it finds that house prices have no significant impact on growth, loan volume and interest rates. From here, it is more of a result for Turkey than a cause; in order for house prices to be a factor in economic growth, the need to maximize the functioning of financial markets arises. Halıcıoğlu (2007) stated that real income, urbanization and house prices rates are the determinants of housing demand; Üçal and Gökkent (2009) used consumer price index; Akkaş and Sayılgan (2015) on housing loan interest shocks; Coşkun and Ertuğrul (2016) determined that the housing rent index and the building cost index are the determinants of house prices.

2.3. Consumer Price Index (CPI)

The 2008 global financial crisis and global inflation brought about a re-discussion of the tie between inflation and real estate returns (Lee, 2013). The effects of inflation on housing prices and housing demand cause different opinions and many investigations. It has been analyzed that one of the factors in the increases in house prices is consumer prices as well as inflation accordingly (Poterba, 1992). The study by Andrews (2010) found that the fluctuation in inflation was a boost to house prices.

The impact of inflation on housing demand and house prices is shaping house prices. People who invest in housing attach importance to the protection of the market value of the housing and its capacity to increase its value. In this context, it can be said that there are many studies in the literature focusing on the ability of real estate prices to protect against inflation (Anari et al., 2002; Goetzmann et al., 2006; Zhou et al., 2010; Lee, 2013).

In the studies of Erol et al. (2008) and Ibrahim et al. (2009), it is emphasized that housing investments have the ability to protect against the risk of high inflation. In addition, Hossain et al. (2009), Kuang et al. (2015) the existence of a positive relation between inflation and house prices; Arestis et al. (2014) the existence of a negative relation between house prices and inflation; Christou et al. (2018) reveal the existence of a meaningful relationship between inflation and house prices. Korkmaz (2019) in the study of 26 regions of Turkey for the period 2010:01-2019-01 concluded that there is a relationship between house prices and inflation and that there are inflationary pressures on house prices, especially in some regions.

2.4. Industrial Production Index

Unpretermined changes in industrial production, money supply or interest rates and a certain delay determined by the speed of the spread can also affect house prices (Coşkun, 2016). Karadaş and Salihoğlu (2020) discussed the macroeconomic factors affecting housing prices in their study and showed that interest rates for housing loans, exchange rate and consumer price index affect negatively, while industrial production index affects positively house prices.

Islamoglu et al. (2019:97) revealed the relationship between the number of houses sold, the industrial production index and the construction costs index, population, building occupancy permit, consumer price index with the house price index for the period 2010:Q1- 2017:Q4 in Istanbul, Ankara and Izmir. The building occupancy permit was found to be statistically meaningless while negatively affecting house prices It has been found that the relationship between the house price index and other variables such as housing supply, industrial production index and construction cost variables is also statistically meaningless.

2.5. Employment Rates

Macroeconomic factors and the relationship between the house price index are an important research area especially for developing countries. Apergis et al. (2003) evaluated the house prices in Greece in their research in this direction. In their study, they stated that macroeconomic determinants such as employment, housing loan rates, inflation and money supply have a dynamic effect on house prices. According to the findings, it has been revealed that house prices respond to macroeconomic arguments.

Adams et al. (2010) discussed the relationships between house prices and employment rate, industrial production, real GDP and loan interest rates in their work based on 15 OECD countries. They showed that the macroeconomic variables included in the study positively affected house prices.

Lebe et al. (2014) examined the determinants of housing demand by classifying them as short and long term and found that the factors that positively affected housing demand were per capita income and industrialization; they have determined that it negatively affects the agricultural employment rate and interest rates

3. Methods

3.1. Research Pattern

In this study, the relationships between housing prices that are shaped after the 2008-2009 global financial crisis impact and the factors (Exchange rate, deposit interest rate, consumer price index (CPI), employment and industrial production index) that might have an effect on housing prices were examined. In determining the time interval; 2010 January was selected as the beginning date because of its' being after 2008-2009 global financial crisis. 2019 December was selected as the end time because of its' being the last date before Covid-19 pandemic that affected not only housing sector but also almost all sectors in the world. This study in which quantitative research method is used has the feature of correlational research. Correlational research studies are conducted to reveal relationships between two or more variables and provide clues about cause-effect relationship (Büyüköztürk et al., 2018).

3.2. Data set

In the research, housing prices that occurred in the period of 2010-2019 and the variables of exchange rate, consumer price index (CPI), deposit interest rate, employment and industrial production index which are likely to affect housing prices were used.

$$\Delta ln\_hpit = \beta 0 + \beta 1 \Delta ln\_dirt + \beta 2 \Delta ln\_exct + \beta 3 \Delta ln\_indprdct + \beta 4 \Delta\Delta ln\_cpi + \beta 5 \Delta ln\_emplyt \quad (1)$$

In the equations the meanings of abbreviations are as follows;
"hpi" for the housing prices;
"exc" for $ / TL exchange rates;
"dir" for interest rates on deposits;
"indprdc" for industrial production indexes;
"emply" for employment rates;
"cpi" for consumer price indexes in Turkey.
"Δ" statement indicates that first order difference is applied to the relevant variable;
"ΔΔ" statement indicates that second difference is applied to the relevant variable;
The expression "ln" indicates that a logarithmic transformation is applied to the relevant variable.

All of the data in the study were taken from the official website of the Central Bank of Turkey. Descriptive statistics for the variables in the study are as in Table 1.

Table 1: Descriptive Statistics of the Variables in the Study

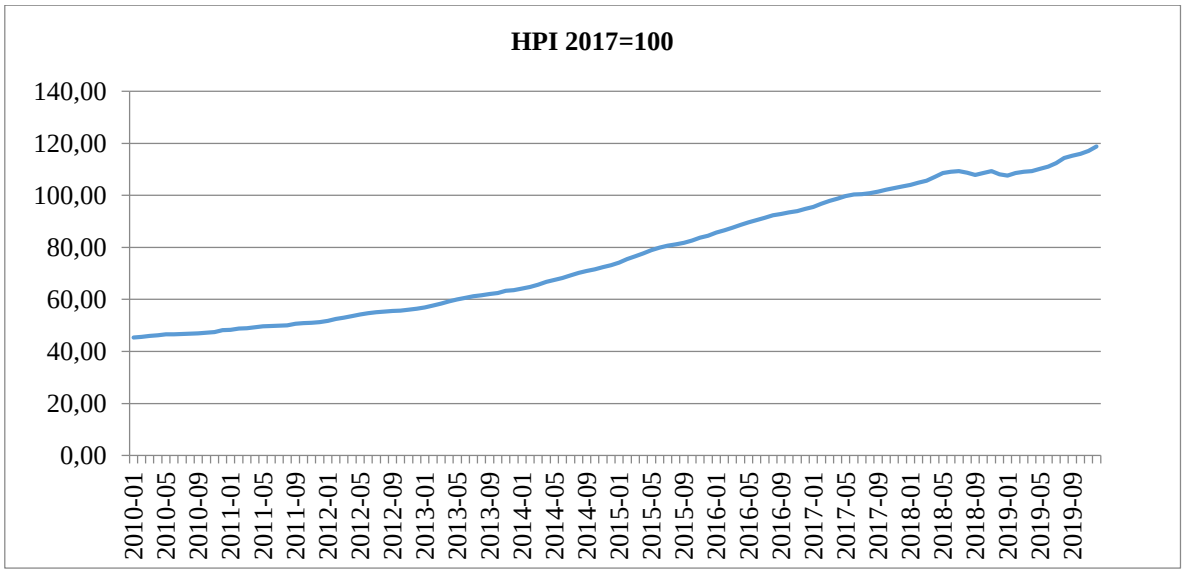
Variable	Minimum	Maximum	Mean	Standard Deviation
hpi	45,36	118,76	77,07	23,49
dir	5,95	24,11	10,84	4,09
exc	1,42	6,37	2,89	1,39
indprdc	56,84	129,99	95,95	16,78
cpi	174,07	440,50	267,45	74,78
emplyt	39,20	48,35	44,99	2,10

When the data in Table 1 is analyzed, for the period January 2010 - December 2019;

The mean of the housing price index is 77.07; the minimum value is 45.36 (January 2010) and the maximum value is 118.76 (December 2019); the mean of the deposit interest rate is 24.11; the minimum value is 5.95% (May 2013) and the maximum value is 24.11% (October 2018); the mean for USD / TL exchange rate is 2.89; the minimum value is 1.42 (October 2010) and its maximum value is 6.37 (September 2018); the mean of the industrial production index is 95.95; Its minimum value is 56.84 (January 2010) and its maximum value is 129.99 (December 2017); the mean of the consumer price index (CPI) is 267.45; its minimum value is 174,07 (January 2010) and its maximum value is 440,50 (December 2017); the mean for the employment rate is 44.99%; it is seen that the minimum value is 39.20% (January 2010) and the maximum value is 48.35% (June 2018).

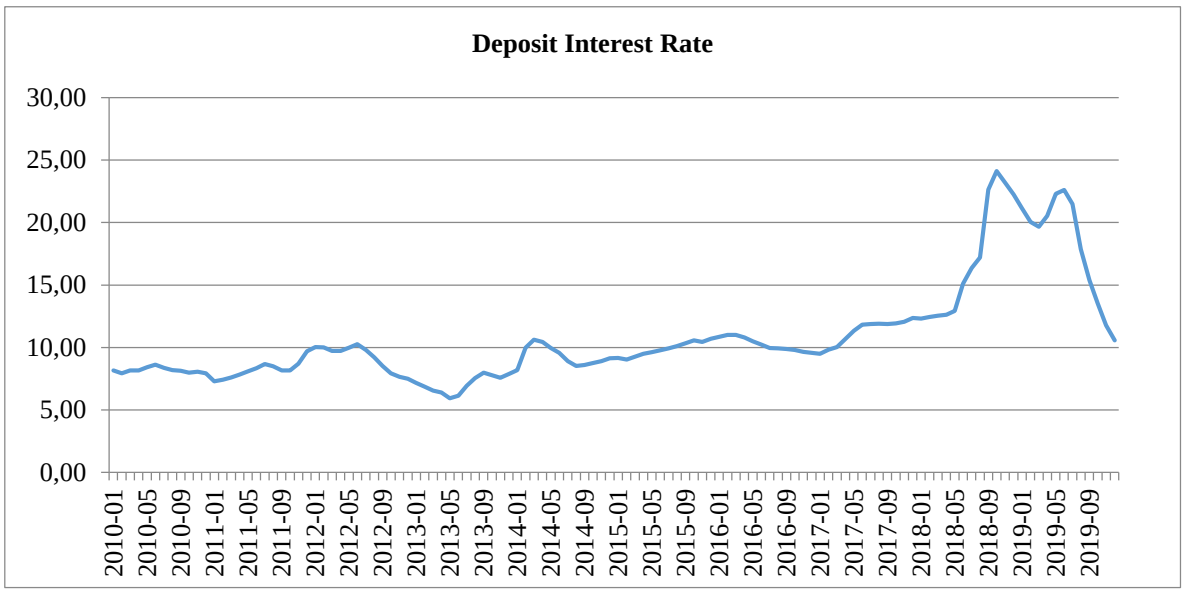
The figures of the related variables used in the study are presented below, respectively.

Figure 1: House Price Indexes for January 2010-December 2019



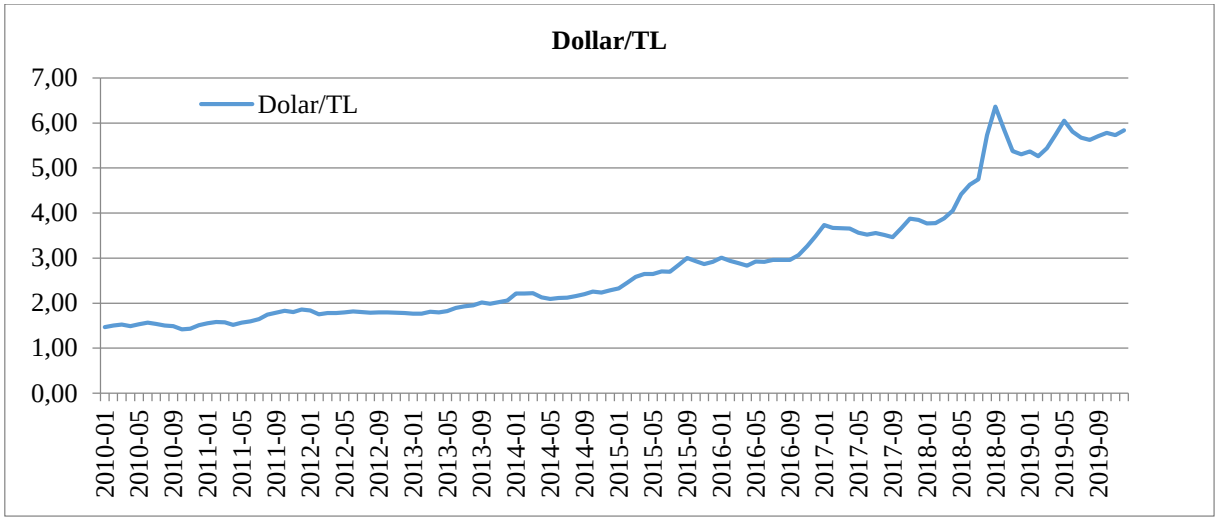
The figure of the housing price index for the period January 2010-December 2019 is as in Figure 1. It is seen that the housing price index has a steady increasing trend in general, except for the horizontal course between 2018 June-2019 April.

Figure 2: Deposit Interest Rate for January 2010-December 2019



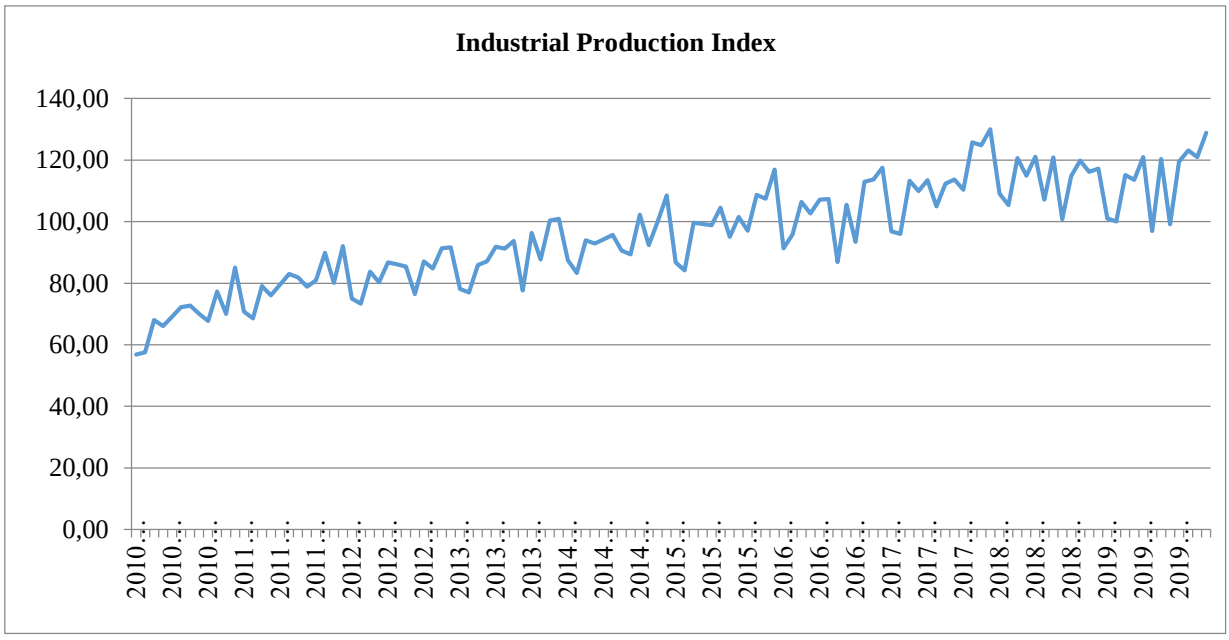
The figure of the deposit interest rate for the period January-2019 December 2010 is as in Figure 2. It is observed that the deposit interest rate, which fluctuates between January 2010 and January 2017, follows a generally horizontal course and has a slight increasing trend between January 2017 and May 2018. But from May 2018 until October 2018 it rises very sharply and after that period it has a sharp decline trend except for the rising period between March 2019 and June 2019.

Figure 3: USD / TL Exchange Rate for January 2010 - December 2019



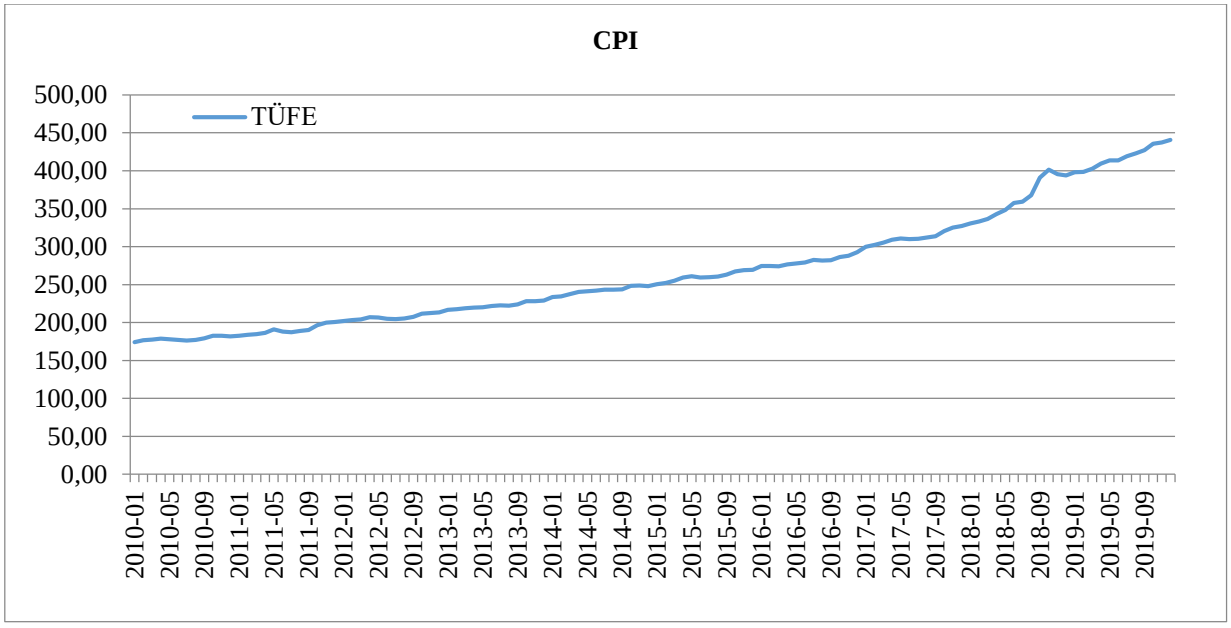
The figure of the USD / TL exchange rate for the period January-2019 December is as in Figure 3. It is observed that the USD / TL exchange rate, which generally has a slight upward trend between January 2010 and July 2014, shows a more linear upward trend in the 2014 July - 2017 October period. It is seen that the dollar / TL exchange rate, which rises very sharply between October 2017 and September 2018, follows a fluctuating course since September 2018.

Figure 4: The Industrial Production Index for January 2010-December 2019



The figure of the industrial production index for the period of January 2010-December 2019 is as in Figure 4. It is seen that the industrial production index has a fluctuating and slightly rising trend in general for the whole period.

Figure 5: The Consumer Price Index (CPI) for the 2010 January-2019 December Period



The figure of the consumer price index for the period January 2010-December 2019 is as in Figure 5. It is seen that it is in a stable, moderate upward trend in general between January 2010 and December 2019.

Figure 6: Employment Rate for January 2010-December 2019

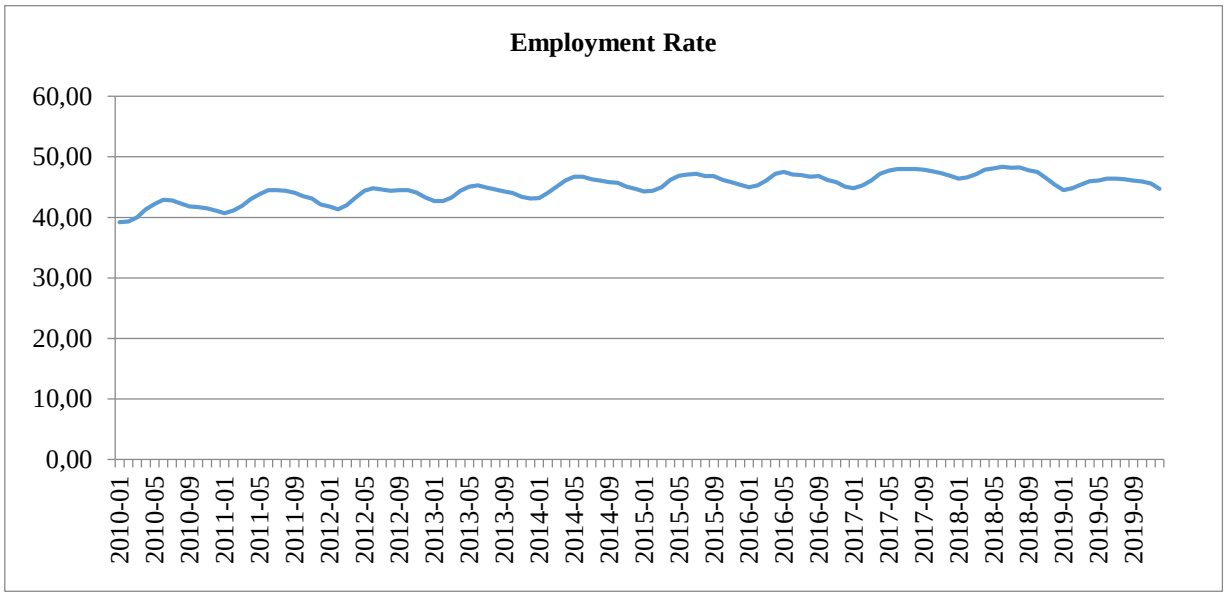


Figure of the employment rate for the period January 2010-December 2019 is as in Figure 6. It is observed that the employment rates follow a fluctuating course between January 2010 and December 2019, and generally has a slightly rising trend. In addition, the rate thatgenerally increases in the first 6 months and decrease in the last 6 months shows that the employment rate has a seasonality.

4. ANALYSIS

For the reliability of the VAR model results, first, stationarity of the data was tested (Güriş et al., 2017). The stationarity of the data was tested with ADF (Augmented Dickey Fuller) and Phillips Perron (PP) tests.

Table 2: Results of Unit Root Tests

Related Variable	ADF		PP	
	Test Stat.	Probability Value (p)	Test Stat.	Probability Value (p)
Δln_hpi	-7.232547	0.000	-18.34560	0.000
Δln_dir	-5.183385	0.000	-24.46354	0.000
Δln_exc	-7.346835	0.000	-7.236796	0.000
Δln_indprdc	-7.309320	0.003	-8.968543	0.000
ΔΔln_cpi	-6.152753	0.000	-13.19883	0.000
Δln_emply	-11.59814	0.000		

The ADF and PP unit root test results of the variables used in the study are shown in Table 2. Accordingly, when logarithm and first degree difference processes are applied to housing price index, deposit interest rate, exchange rate, industrial production index and employment rate they get stationary. For the CPI data, after logarithm and second degree processes, it gets stationary ($p<0.05$) (Güriş, 2017). After data's stationarity checks, the appropriate lag length for the VAR model was calculated.

Table 3: Appropriate Lag Length Calculation

Delay Length	LogL	LR	FPE	AIC	SC	HQ
0	1439.762	NA	3.27e-20	-27.84004	-27.68656	-27.77787
1	1586.277	273.1160	3.83e-21	-29.98596	-28.91161*	-29.55081
2	1667.956	142.7405	1.59e-21	-30.87294	-28.87771	-30.06480
3	1729.042	99.63415	9.93e-22	-31.36003	-28.44393	-30.17891
4	1778.611	75.07567	7.89e-22	-31.62351	-27.78653	-30.06940
5	1816.228	52.59081	8.09e-22	-31.65491	-26.89705	-29.72781
6	1870.559	69.62798	6.17e-22	-32.01085	-26.33212	-29.71077
7	1916.404	53.41227	5.77e-22	-32.20203	-25.60241	-29.52896
8	1966.934	52.98214	5.19e-22	-32.48415	-24.96366	-29.43809
9	2030.124	58.89578	3.89e-22	-33.01211	-24.57075	-29.59307
10	2103.574	59.90066	2.60e-22	-33.73929	-24.37705	-29.94726
11	2142.185	26.99079	3.85e-22	-33.79001	-23.50689	-29.62499
12	2195.020	30.77733	5.07e-22	-34.11689	-22.91290	-29.57889
13	2270.428	35.14165	5.47e-22	-34.88210	-22.75723	-29.97111
14	2400.903	45.60289	2.96e-22	-36.71656	-23.67081	-31.43259
15	2691.267	67.65768*	1.45e-23*	-41.65567*	-27.68905	-35.99871*

As can be seen in Table 3, the most suitable lag length is calculated as "15". The error term for the specified lag length should provide some assumptions. The assumption of no autocorrelation was tested with the LM autocorrelation test.

Table 4: Results for LM Test

Delay Lenght	LRE Stat.	sd	Probability (p)	Rao F-Stat.	sd	Probability (p)
1	61.83610	36	0.0047	2.372003	(36, 7.2)	0.1146
2	91.12061	36	0.0000	8.443617	(36, 7.2)	0.0031
3	66.08320	36	0.0016	2.866232	(36, 7.2)	0.0721
4	45.02390	36	0.1439	1.082883	(36, 7.2)	0.4984
5	43.32916	36	0.1871	0.996040	(36, 7.2)	0.5545

6	68.74562	36	0.0008	3.223417	(36, 7.2)	0.0532
7	70.83510	36	0.0005	3.532657	(36, 7.2)	0.0416
8	56.99330	36	0.0144	1.904942	(36, 7.2)	0.1870
9	46.48247	36	0.1133	1.162662	(36, 7.2)	0.4515
10	55.84974	36	0.0185	1.807661	(36, 7.2)	0.2085
11	47.42148	36	0.0964	1.216632	(36, 7.2)	0.4223
12	41.01012	36	0.2601	0.886662	(36, 7.2)	0.6321
13	57.40372	36	0.0132	1.940994	(36, 7.2)	0.1797
14	52.58483	36	0.0366	1.553976	(36, 7.2)	0.2799
15	31.30910	36	0.6912	0.527641	(36, 7.2)	0.9021

The LM test results are listed in Table 4. As seen in Table 4, the fifteenth-order LM probability value of the VAR (15) model is greater than 0.05 according to both LRE statistics (p = 0.69) and Rao statistics (p = 0.9021) showing that there is no autocorrelation problem (Güriş, 2017). Whether there is a heteroskedasticity problem in the created VAR model was checked with White test.

Table 5: Results for White Test

Integrated Test

Chi-square Stat.	**df**	**Probability (p)**
1237.272	1260	0.6708

Separate Components

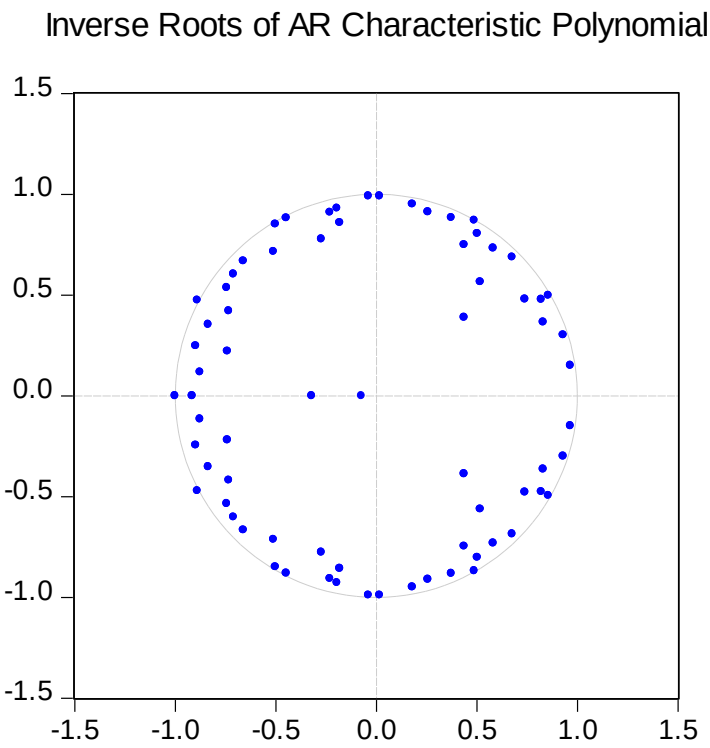
Dependent	**R^2**	**F(60,52)**	**Probability (p)**	**Chi-square Stat. (60)**	**Probability (p)**
res1*res1	0.639788	1.539321	0.0568	72.29600	0.1327
res2*res2	0.583136	1.212349	0.2398	65.89438	0.2803
res3*res3	0.545131	1.038646	0.4465	61.59985	0.4186
res4*res4	0.532395	0.986751	0.5223	60.16068	0.4699
res5*res5	0.638286	1.529336	0.0596	72.12636	0.1357
res6*res6	0.555178	1.081680	0.3878	62.73516	0.3795
res2*res1	0.549371	1.056572	0.4216	62.07896	0.4019
res3*res1	0.574790	1.171542	0.2808	64.95127	0.3083
res3*res2	0.583751	1.215420	0.2369	65.96386	0.2783
res4*res1	0.522645	0.948894	0.5798	59.05891	0.5101
res4*res2	0.455256	0.724295	0.8863	51.44393	0.7764
res4*res3	0.529741	0.976288	0.5381	59.86071	0.4808
res5*res1	0.406732	0.594168	0.9739	45.96068	0.9092
res5*res2	0.540517	1.019511	0.4739	61.07842	0.4370
res5*res3	0.559517	1.100872	0.3631	63.22546	0.3632
res5*res4	0.540464	1.019292	0.4743	61.07239	0.4372
res6*res1	0.512899	0.912569	0.6356	57.95764	0.5507

res6*res2	0.557534	1.092052	0.3743	63.00132	0.3706
res6*res3	0.480089	0.800287	0.7983	54.25011	0.6848
res6*res4	0.532206	0.986000	0.5234	60.13925	0.4707
res6*res5	0.519030	0.935248	0.6008	58.65040	0.5252

Table 5 contains the results of the White test. As a result of the White test, it is seen that the integrated test probability value and the seperate components probability values are greater than 0.05. This shows that the error terms have constant variance, in other words, there is no heteroskedasticity problem (Güriş, 2017).

Whether / not the VAR model fulfills stability assumption is tested by examining the places of the inverse roots of the AR Characteristic polynomial in the unit circle.

Figure 7: Stability Graph of Created VAR Model



As can be seen in Figure 7, the inverse roots of the AR characteristic polynomial are located within the unit circle boundaries showing that the model does not pose any problem in terms of stability (Özgen & Güloğlu, 2004).

Johansen cointegration test was applied to determine long term relationships after the assumptions check. Consumer price index wasn't included in the cointegration test because of its being stationary at the second level. The results are in Table 6.

Table 6: Results for Johansen Cointegration Test

H0	Trace Stat.	0.05 Critical Value	p	Max-Eigen Stat.	0.05 Critical Value	p
No cointegration (r=0)	334.8253	76.97277	0.0001	149.2862	34.80587	0.0000
At most 1. (r≤ 1)	185.5391	54.07904	0.0000	70.67980	28.58808	0.0000
At most 2 (r≤ 2)	114.8593	35.19275	0.0000	58.09442	22.29962	0.0000
At most 3 (r≤ 3)	56.76484	20.26184	0.0000	37.10350	15.89210	0.0000
At most 4 (r≤ 4)	19.66134	9.164546	0.0004	19.66134	9.164546	0.0004

Both trace and max-eigen statistics show that cointegration exists among the variables, in other words there are long term relationships among the related variables ($p<0.05$). Finally, Granger causality test was performed to see the short term relationships among the variables. The results are in Appendix 1.

When "Housing price index" is determined as the dependent variable, it is seen that the deposit interest rate, the USD / TL exchange rate, the industrial production index, the CPI and the employment rate are the reasons for the "Housing price index" ($p<0.05$).

In the equations in which the independent variable is determined as the "Housing price index", it is seen that the probability values of the "Housing price index" are greater than 0.05 ($p>0.05$). In other words, the housing pricing index is not a cause of the deposit interest rate, the USD / TL exchange rate, the industrial production index, the CPI and the employment rate.

5. CONCLUSION

In determining housing prices in Turkey, the housing price index and deposit interest rates, the Dollar / TL rate, industrial production index, CPI and employment rates are important variables. When the factors in determining house prices for Turkey are examined, while the most important share of the house price index showing the decrease or increase belongs to the exchange rate, the other determinants of this situation are housing interest rates and inflation, respectively. It is possible to say that macroeconomic determinants have an impact on the increase or decrease in the house price index in Turkey during the 2008 global financial crisis and after this period. Interest rates, inflation and instantaneous changes in the exchange rate remain decisive in increasing or decreasing house prices.

In the study, the long and short term relationships between housing price and the exchange rate, consumer price index, deposit interest rate, industrial production index and employment rate after the 2008-2009 global financial crisis impact for the period period of 2010 January - 2019 December were examined with Johansen Cointegration and Granger Causality analyzes. The results show that there are long term relations among the variables and there is a one-way short term relationship from deposit interest rate, USD / TL rate, industrial production index, CPI and employment to housing price index. According to the Johansen Cointegration test result, there is a long-term relation between variables excluding CPI.

In Apergis et al. (2003) study, the dynamic effects of macroeconomic variables such as inflation, employment loan rates and CPI on new house prices in Greece were analyzed. According to the results obtained, housing prices respond to all macroeconomic variables considered. The study also confirms the positive demand-side effect of the CPI on house prices. As a result of the study conducted by Lotz et al. (2013) for South Africa, it has been observed that there is a cointegration relation between house prices and the CPI in the long term. The results of these studies are similar to our findings. The results of the industrial production index variable, Valadez (2010), Kepili et al. (2011), Zandi et al. (2015) 's results. In this study, similar results were obtained from national and international studies.

As a result of the analyses, it is seen that macroeconomic variables have an effect on the increase of house prices in Turkey during the financial crisis and post-financial crisis period**.** Changes in house price and deposit interest rates, dollar/TL exchange rate, industrial production index, CPI and employment rates play a determining role in the decrease or increase in house prices. This will have a major impact on the increase in housing demand and, as a result, the development of the construction sector. With the measures to be taken by the government, there will be an increase in housing demand and therefore in house prices. Among these measures, in order to increase the housing investment demand, there are practices such as increasing the housing loan

volume by decreasing the housing loan interest rates and extending the maturities, providing tax advantages and keeping the inflation at a certain level.

The study was limited to the case of Turkey which means that the findings may not be generalizable to other countries. Therefore, the study needs to be repeated in different countries to compare the findings.

REFERENCES

Adams, Z.ü & Füss, R. (2010). Macroeconomic determinants of international housing markets. *Journal of Housing Economics*, 19 (1), 38-50.

Akkaş, M. E., & Sayılgan, G. (2015). Konut fiyatları ve konut kredisi faizi: Toda-Yamamoto nedensellik testi. *Journal of Economics, Finance & Accounting*, 2 (4), 572-583.

Anari, A., & Kolari, J. (2002). House prices and inflation. *Real Estate Economics*, 30 (1), 67-84.

Andrews, D. (2010). Real house prices in oecd countries: the role of demand shocks and structural and policy factors. OECD Economics Department Working Paper, No: 831.

Apergis, N., & Rezitis A. (2003), "Housing prices and macroeconomic factors in Greece: prospects within the EMU. *Applied Economics Letters*, 10, 799-804.

Arestis, P., & Gonzalez, A.R. (2014). Bank credit and the housing market in OECD countries. *Journal of Post Keynesian Economics*, 36 (3), 467-490.

Assenmacher-Wesche, & K. Gerlach, S. (2008). Monetary policy, asset prices and macroeconomic conditions: a panel-var study. *National Bank of Belgium Working Paper Research,* 149, 1-37.

Ayhan, F. (2018). İnşaat sektörünün Türkiye ekonomisine etkilerine ilişkin bir analiz. (Ed. Ayhan O., M.R. İnce, S. Demir), Dünden Bugüne Ekonomi Yazıları İçinde (318-345), Umuttepe Yayınları, Kocaeli.

Badurlar, İ. Ö. (2008). Türkiye'de konut fiyatları ile makro ekonomik değişkenler arasındaki ilişkinin araştırılması. *Anadolu Üniversitesi Sosyal Bilimler Dergisi*, 8 (1), 223-238.

Büyüköztürk, Ş., Çakmak, E. K., Akgün, O. E., Karadeniz, S., & Demirel, F. (2018). Bilimsel Araştırma Yöntemleri. Pegem Akademi Yayınları, Eskişehir.

Canbay, Ş., & Mercan, D. (2020). Türkiye'de konut fiyatları, büyüme ve makroekonomik değişkenler arasındaki ilişkinin ekonometrik analizi. *Yönetim ve Ekonomi Araştırmaları Dergisi*, 18 (1), 176-200.

Carstensen, K., Hülsewig, O., & Wollmershäuser, T. (2009). Monetary policy transmission and house prices: European cross-country evidence. Cesifo Working Paper, No. 2750, Center for Economic Studies and IFO Institute, Munich.

Christou, C., Gupta, R., Nyakabawo, W., & Wohar, M.E. (2018). Do house prices hedge inflation in the US? A quantile cointegration approach. *International Review of Economics and Finance*, 54, 152-156.

Coşkun, Y. (2016). Konut fiyatları ve yatırımı: Türkiye için bir analiz. *Niğde Üniversitesi İktisadi Ve İdari Bilimler Fakültesi Dergisi*, 9 (2), 201-217.

Coşkun, Y., & Ertuğrul, M. (2016). House price return volatility trends in Turkey and Istanbul, Ankara, and Izmir. *Journal of European Real Estate Research*, 9 (1).

Çetin, G., & Doğaner, A. (2017). İnşaat sektörü güven endeksi ve konut fiyat endeksi arasındaki ilişki: Türkiye için ampirik analiz. *İktisat Politikası Araştırmaları Dergisi*, 4 (2), 155-165.

Demary, M. (2009). The link between output, inflation, monetary policy and housing price dynamics. Munich Personal Repec Archive Mpra Paper No: 15978, University Library of Munich, Germany.

Dilber, İ., & Sertkaya, Y. (2016). 2008 Finansal krizi sonrası Türkiye'de konut fiyatlarının belirleyicilerine yönelik analiz. *Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi,* 4 (1), 11- 30.

Engin, C., & Göllüce, E. (2016). 2008 Küresel finans krizi ve Türkiye üzerine yansımaları. *Kahramanmaraş Sütçü İmam Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi,* 6, 27- 40.

Erol, I., & Tirtiroglu, D. (2008). The inflation-hedging properties of Turkish REITS. *Applied Economics,* 40 (20), 2671-2696.

Eryüzlü, H., & Ekici, S. (2020). Konut fiyat endeksi ve reel döviz kuru ilişkisi: Türkiye örneği. *İktisadi İdari ve Siyasal Araştırmalar Dergisi*, 5 (12), 97-105.

Goetzmann, W. N., & Volaitis, E. (2006). Simulating real estate in the investment portfolio: model uncertainity and inflation hedging. Yale International Centre for Finance Working Paper, No:06-04, 1-39.

Goodhart, C., & Hofmann, B. (2008). House prices, money, credit, and the macroeconomy. *Oxford Review of Economic Policy*, 24 (1), 180-205.

Güriş, S., Akay, E.Ç., & Güriş, B. (2017). Eviews ile Temel Ekonometri. Der Yayınları, İstanbul.

Halıcıoğlu, F. (2007). The demand for new housing in Turkey: an application of ARDL model. *Global Business and Economics Review*, 9 (1), 62-74.

Hofmann, B., & Peersman, G. (2017). Monetary policy transmission and tradeoffs in the United States: Old and new. BIS Working Papers No: 649, 1-27.

Hossain, B., & Latif, E. (2009). Determinants of housing price volatility in Canada: a dynamic analysis. *Applied Economics*, 41 (27), 3521-3331.

Iacoviello, M. (2005). House prices, borrowing constraints, and monetary policy in the business cycle. *American Economic Review*, 95 (3), 739-764.

Ibrahim, I., Sundarasen, S.D., & Shayuti, A.F. (2009). Property investment and inflation hedging in residential property: the case of district of Gombak, Selangor d.e. the Iup. *Journal of Applied Finance*, 15 (2), 38-45.

İslamoğlu, B.and Nazlıoğlu, & Ş. (2019). Enflasyon ve konut fiyatları: İstanbul, Ankara ve İzmir için panel veri analizi. *Siyaset, Ekonomi ve Yönetim Araştırmaları Dergisi*, 7 (1), 93-99.

Jarocinski, M., & Smets, F. (2008). House prices and the stance of monetary policy. ECB Working Paper, 891.

Jorda, O., Schularick, M., & Taylor, A. M. (2015). Betting the house. *Journal of International Economics*, 96, 2-18.

Karadaş, H. A., & Salihoğlu, E. (2020). Seçili makroekonomik değişkenlerin konut fiyatlarına etkisi: Türkiye örneği. *Ekonomik ve Sosyal Araştırmalar Dergisi,* 16 (1), 63- 80.

Kepili, E. I. Z. & Masron, T. A. (2011). Real estate–foreign direct investment–growth in Malaysia: Re-framing eclectic paradigm. *IPEDR*, 7, 110-114.

Korkmaz, Ö. (2019). The relationship between housing prices and inflation rate in Turkey. *International Journal of Housing Markets and Analysis*, 13 (3), 427-452.

Kuang, W., & Liu, P. (2015). Inflation and house prices: theory and evidence from 35 major cities in China. *International Real Estate Review*, 18 (1), 217-240.

Lebe, F., & Akbaş, Y. E. (2014). Türkiye'nin konut talebinin analizi: 1970-2011. *Atatürk Üniversitesi İktisadi ve İdari Bilimler Dergisi*, 28 (1), 57-83.

Lee, H. K. N. (2013). A cointegration analysis of inflation and real estate returns. *Journal of Real Estate Portfolio Management*, 19 (3), 207-223.

Lotz, R. I. ve Gupta, R. (2013). The long-run relationship between house prices and ınflation in South Africa: an ARDL approach. *International Journal of Strategic Property Management,* 17, 188-198.

Milcheva, S., & Sebastian, S. (2016). The housing market channel of monetary policy transmission in the Euro Area. *Journal of European Real Estate Research*, 9 (1), 76-97.

Özgen, F.B., & Güloğlu, B. (2004). Türkiye'de iç borçların iktisadi etkilerinin var tekniğiyle analizi. *METU Studies in Development*, 31, 93-114.

Poterba, J. M. (19929. Tax reform and the housing market in the late 1980s: who knew what, and when did they know it. Real Estate and Credit Crunch, Federal Reserve Bank of Boston Conference Series No: 36, 230-251.

Szeidl, A., & Chetty, R. (2004). Consumption commitments and asset prices. Society for Economic Dynamics. No. 354.

Central Bank of the Republic of Turkey, Elektronic Data Delivery System (TCMB EVDS), Https://Evds2.Tcmb.Gov.Tr/İndex.Php?/Evds/Seriemarket/Access Date: May 12th, 2020.

Üçal, M. S, & Gökkent. G. (2009). Macroeconomic factors affecting real estate markets in Turkey: a VAR analysis approach. Briefing Notes İn Economics, 80, 1-10.

Valadez, R. M. (2010). The housing bubble and the GDP: a correlation perspective. *Journal of Case Research in Business and Economics*,3, 1-18.

Zandi, G., Mahadevan, A., Supramaniam, L., Aslam, A., & Theng, L. K. (2015). The economical factors affecting residential property price: the case of Penang island. *International Journal of Economics and Finance*, *7*(12), 45-55.

Zammit, V. (2010). Asymmetries in the monetary transmission mechanism in the Euro area: the case of the housing market. *Bank of Valletta Review*, 42, 76-107.

Zhou, X., & Clements, S. (2010). The inflation hedging ability of real estate in China. *Journal of Real Estate Portfolio Management*, 16 (3), 267-277.

Zhu, H. (2006). The structure of housing finance markets and house prices in Asia. *BIS Quarterly Review*, December, 55-69.

APPENDIX 1: Granger Causality Test Results

The Dependent Variable	Excluded Variable	Chi-square Stat.	df	Probability (p)
Δln_hpi	Δln_dir	56.08538	15	0.0000
	Δln_exc	86.30392	15	0.0000
	Δln_indprdc	59.20449	15	0.0000
	ΔΔln_cpi	87.38956	15	0.0000
	Δln_emply	40.21184	15	0.0000
	All	346.8900	75	0.0004
Δln_dir	Δln_hpi	19.10273	15	0.2091
	Δln_exc	95.94800	15	0.0000
	Δln_indprdc	58.72552	15	0.0000
	ΔΔln_cpi	49.51421	15	0.0000
	Δln_emply	28.14151	15	0.0207
	All	304.3538	75	0.0000
Δln_exc	Δln_hpi	17.99078	15	0.2632
	Δln_dir	13.25528	15	0.5826
	Δln_indprdc	27.13335	15	0.0277
	ΔΔln_cpi	32.73341	15	0.0051
	Δln_emply	14.22632	15	0.5084
	All	92.79184	75	0.0800
Δln_sanayiue	Δln_hpi	12.20819	15	0.6632
	Δln_dir	19.12737	15	0.2080
	Δln_exc	7.149198	15	0.9534
	ΔΔln_cpi	5.629513	15	0.9853
	Δln_emply	21.70168	15	0.1159
	All	83.83491	75	0.2270
ΔΔln_cpi	Δln_hpi	11.40836	15	0.7231
	Δln_dir	9.138055	15	0.8702
	Δln_exc	31.81130	15	0.0068
	Δln_indprdc	9.825507	15	0.8306
	Δln_emply	11.07653	15	0.7472
	All	97.13472	75	0.0438
Δln_emply	Δln_hpi	10.06821	15	0.8154
	Δln_dir	14.47721	15	0.4897
	Δln_exc	11.03828	15	0.7499
	Δln_indprdc	17.25596	15	0.3038
	ΔΔln_cpi	17.08514	15	0.3138
	All	92.02636	75	0.0884

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2021 VOLUME 10 ISSUE 2

THE EFFECT OF CHAOS MODERN STRATEGIC MANAGEMENT TECHNIQUES ON FIRM PERFORMANCE

DOI: 10.17261/Pressacademia.2021.1406
JBEF- V.10-ISS.2-2021(3)-p.72-87

Yildiz Unsal[1], Erkut Altindag[2]
[1]Beykent University, Institute of Social Sciences, Department of Business, Istanbul, Turkey.
yildiz.ozturk@outlook.com , ORCID: 0000-0002-8635-8649
[2]Beykent University, School of Economics and Administrative Sciences, Istanbul, Turkey.
erkutaltindag@beykent.edu.tr , ORCID: 0000-0003-0173-0454

Date Received: March 11, 2021 **Date Accepted:** June 21, 2021

To cite this document
Unsal, Y., Altindag, E., (2021) The effect of chaos modern strategic management techniques on firm performance. Journal of Business, Economics and Finance (JBEF), 10(2), 72-87.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2021.1406

ABSTRACT

Purpose- The main aim of the study is to reveal the effects of chaos theory and blue ocean theory, which are modern strategic management techniques, on the general performance of firms. According to the literature, financial and growth performances are expected to increase, especially in firms developing an inimitable production system that produces innovative products and services. In this context, the research focused on identifying firms using these techniques and measuring their performance by employing the survey method.

Methodology- In the relational screening model, which is one of the quantitative data-based screening models, data collected from 204 people selected by the random sampling method from Istanbul province using the Chaos Theory Survey, Blue Ocean Scale, and Performance Analysis Scale were analyzed.

Findings- According to the data obtained from the results, there is a positive relationship between chaos theory and blue ocean strategy and firm performance. In other words, the growth and financial performances of firms that integrate new-generation management practices into their companies increase significantly.

Conclusion- According to the data obtained from this study, it is thought that managers who know and can apply chaos strategy may contribute to enhancing the firm's performance. It is believed that blue ocean strategy may help firms identify new ways that will make competition in the existing market meaningless. Furthermore, it is thought that testing chaos and blue ocean strategies in the context of Turkey can guide firms in the strategy determination stage.

Keywords: Chaos theory, Blue Ocean strategy, firm performance.
JEL Codes: L10 L12 L13

1. INTRODUCTION

As a result of developing technology and increasing diversity in the service sector, the ability of firms to survive in the business world requires a successful management model. Nowadays, along with the increase in competition, firms need qualified managers and employees to survive. Managers should be able to apply an appropriate strategy and use modern management techniques successfully to increase firm performance. Firms should also be open to innovation to compete with other firms in the market. Managers who can apply modern strategic management techniques and a firm's culture that is open to innovation are needed for high firm performance. The main aim of this study was to investigate whether chaos theory and blue ocean approach, which are modern strategic management techniques, had effects on the performance of firms.

It is very important that firms can apply strategic approaches that are open to new ideas, innovative and able to create a new order under the changing conditions in order to increase their performance. For this purpose, managers should adopt innovations and should be able to use modern management methods instead of conventional methods. Under today's competitive conditions, it has also become more important for firms to have managers who are open to new ideas, know the blue ocean strategy and have a grasp of chaos theory. At this point, it is also of great importance for firms to be able to create an innovative firm culture to achieve success.

In this study in which chaos theory and blue ocean strategy, which are modern strategic management techniques, were examined, the effects of these modern management techniques on firm performance were investigated. If they had effects, what kinds of effects, positive or negative, they had was investigated. The shift from the conventional management approach to the modern management approach that has been differentiated under today's changing competition conditions has created a platform where many different practices are experienced for organizations. Modern and postmodern approaches are a system of thought that criticizes scientific approach and knowledge, has a perspective to address everything relatively, and is mainly open to individuals' creativity, difference and interpretations. This approach, which finds freedom suitable instead of imposing the truth and envisages the evaluation of events in their course by refusing to find the truth and to make a prediction by scientific research, has also significantly affected practices in organizations

2. CONCEPTUAL FRAMEWORK

2.1. Chaos Theory

The chaos theory proposed by the US-born mathematician and meteorologist Edward Norton Lorenz (1917-2008) is a paradigm that offers a new perspective for the business world, far from being just a theory. This concept, chaos theory, which can be dated back to the ancient Greek and Chinese civilizations, primarily concerns mathematics and physics and then meteorology, economics, and business disciplines and has also changed the approaches of employees in management and organization discipline, is an important example of interdisciplinary study. Important studies on the theory were conducted by the French mathematician Henri Poincare before Lorenz. Other contributors to the theory were Kurt Lewin (unfreezing, changing and refreezing) and Rene Thom (disaster theory) (Koçel, 2005: 492: Gökmen, 2009: 67).

Chaos theory, which is considered as an irregularity, undesirable situation and based on the assumption that there is also something unknown, although everything is known, emphasizes that we should look at events from different perspectives and should collect data continuously for effective management. However, since there may be continuous and sudden changes in these collected data, they do not enable us to make a correct prediction but just bring us a little closer to correct prediction (Yakut, 2018), and we should keep in mind that chaos is not a disaster (Ertürk, 2012: 860; Armour, 2016; Arıcıoğlu and Karabıyık, 2019).

Along with the use of chaos theory in management, management approaches before and after the chaos should be examined to understand the circumstances that have caused it and how the process has taken place. In this way, the main features and dynamics of the change in the management approach can also be found out. It is known that a scientific method is primarily important in the conventional management approach. It is clear that science affects all kinds of perspectives. It was inevitable that scientific theories such as quantum and relativity, which emerged in the early 20th century, also affected the management field in the same way. Chaos theory, which is a new formation in science (Eden, 1994: 6; Burns, 2009), has now brought the perspective in which the connection, interaction, and harmony among social actors have come to the forefront, and thus, individuals should be provided with more freedom, initiative, and self-realization opportunities and should have a say in management, rather than authority and hierarchical relationships. The chaos approach is a more flexible, linear (Fatih, 2018) and non-hierarchical abstract thought against the dominant management approach (Yüksel, and Esmer, 2019). This new formation has led to the requirement that managers should adopt organization that can comply with environmental changes more easily with an integrated approach suitable for teamwork instead of detailed plans, inspection, and routine activities. Individuals at the management level should enter into a process that attaches importance to the individual and, therefore, organizational development and continuous learning, and thus, is not closed to change (Çavuş et al.), is open to adaptation to it (Öge, 2005: 301, and can take place in the long term by moving away from the conventional management approach and with a common vision, and they should virtually create "organized chaos" (Turunç, 2008: 62).

Traditional leadership theories may be insufficient for today's organizational expectations in the future. Future leaders should understand chaos theory and should be able to use it to interpret organizational events. The fact that managers who know chaos theory offer solutions to problems more easily has been revealed by the studies. Therefore, it is clear that one dimension of chaos theory should be leadership (Altun, 2001: 454-455: Galacgac and Singh, 2016: 521).

Chaos theory has four main propositions (Erol, 2009: 134):

- There is a sensitive commitment to the initial point.
- Every order tends to be destroyed. This law, namely entropy, can be roughly explained as follows: "everything goes downhill." According to Rudolf Clasius (1854), all natural processes are exposed to entropy (Eden, 1994: 6).
- New order results from the disorder. Although combined elements initially seem to be irregular and stacked, they establish regular relationships after a while.

- There are asymmetrical relationships. Asymmetric order develops in an unpredictable direction through a self-organizing process (Thiétart and Forguez, 1995: 19).

Chaos theory now has a definition different from the mechanical universe of modernity that does not allow coincidence, and its linear geometry. Chaos theory, which has fractal, non-linear, and ontologic features, argues that the interaction between different systems cannot be measured in a controlled manner when they meet each other (Çıraklı, 20017) because it is not clear which variable interacts with what, and in this context, chaos theory invalidates the classical science's prediction of estimating the consequences of intervention to a variable (Demirtaş, 2000: 356).

Chaos theory is associated with nonequilibrium theory, self-organization theory, non-linear dynamics, complex systems, and complex adaptive systems (Gökmen, 2009: 66). Furthermore, it is also related to the concepts of determinism, butterfly effect, randomness, complexity, coincidence, and ambiguity (Kahyaoğlu, 2015; Öztürk and Kızılkaya, 2017).

2.2. Blue Ocean Strategy

The severe competition caused by globalization has seriously affected businesses, and innovations made by them in the existing market have become insufficient (Kişi, 2017). Therefore, firms need to create new markets that will make competition meaningless. Businesses have to create a new market and develop blue ocean strategies with an innovative approach, instead of competing in the existing red oceans (Kazdal, 2013: 76).

Blue ocean strategy is a term developed by W. Chan and Renee Mauborgne at INSEAD and Harvard universities. The blue ocean strategy recommends that firms should develop strategies to make competition meaningless instead of competing in their environment. It recommends that they should create new demand; in other words, they should create a market place and make a radical difference. The blue ocean strategy recommends that they should offer different and higher value to their customers at a low cost. Firms should make some eliminations and reductions within themselves by evaluating their own conditions to offer high value at a low cost, or in other words, to make value innovativeness (Leavy, 1996; Rau, 2012) (Kalkan et al., 2009: 1-12).

In a conversation with Kim and Mauborgne, authors of the "Blue Ocean Strategy," they were asked why blue and red colors were chosen for the oceans, and they stated that the competition struggles of firms made the environment bloody; therefore, it was called red, on the other hand, blue color symbolized the entire universe. The term blue ocean is a term used to describe a large, deep and unexplored area (Kim and Mauborgne, 2005: 106).

When organizations created more detailed business processes and developed strategies to establish more effective control mechanisms on employees in order to increase efficiency that is effective in profitability, which is their purpose of establishment, and to provide a competitive advantage, qualified employees who got bored from it started to move away. This bloody and contentious competition area began to lose its functionality. In such a case, it was attempted to get out of the red ocean, and the blue ocean strategy was developed. The blue ocean strategy was developed by Mauborgne and Kim (Akdemir and Ömür, 2016). In their study, they examined a period longer than a century and thirty different industrial areas, they analyzed 150 strategic moves and demonstrated that the leading firms of the future could be successful in the uncontentious market place, namely the blue ocean (Baltaş, 2015; Yiğit, 2015).

The blue ocean strategy is also a modified strategy and draws attention to the importance of low cost. This strategy proposes a radical strategy to the product range and market limitations for consumers. Firms should increase the standard of service higher than average and provide higher opportunities than competing firms. The blue ocean strategy recommends that firms should develop a strategy that is capable of determining their environment instead of the determination of their strategies by the environment (Kalkan et al., 2009: 1-12; Baykal and Mızrak, 2019). Although the strategy has existed for a very long time, it has been named recently.

Blue sky and sea represent freedom, peace and eternity. Blue also represents reliability, honesty, and quality. On the other hand, while red is a symbol of power, excitement and power, it has also been symbolized as the color of hell and devilry as well as being a color that is frequently associated with danger such as blood and fire in nature (Mazlum, 2011: 131). When the blue ocean strategy is mentioned, the connotation of blue is positive.

The principles of the blue ocean strategy determined by Kim and Mauborgne (2010: 45-144) and the ways to achieve them offered by them are as follows:

- Reconstruct market boundaries
- Focus on the big picture, not numbers
- Reach beyond the existing demand

- Get the strategic sequence right

The steps of the blue ocean strategy and the things to evaluate in each step are presented in Table 1 (Kim and Mauborgne, 2014: 118-119).

Table 1: Steps of the Blue Ocean Strategy

STEP	**QUESTION TO ANSWER**
1. BUYER BENEFIT	Does the idea contain an extraordinary buyer benefit?
2. PRICE	Does the price of the product appeal to the audience?
3. COST	Is the determined strategic price in line with the cost target?
4. ACCEPTANCE	What are the obstacles encountered in the acceptance phase of the idea? Are these obstacles addressed from the beginning of the process?
CONCLUSION: THE COMMERCIAL APPLICABLE BLUE OCEAN THOUGHT	

It will be helpful to compare the blue ocean strategy with the red ocean strategy to understand its place among competition strategies (Table 2).

Table 2: Comparison of the Red Ocean Strategy and the Blue Ocean Strategy

Red Ocean Strategy	**Blue Ocean Strategy**
Competition in the current market area	Creating a conflict-free marketplace
Competing in the competition	Don't make competition unreasonable
Using the current claim for itself	Creating and obtaining new demands
Exchange value-cost	Breaking the value-cost exchange
To harmonize the entire system of company activities with the strategic choice between differentiation and low cost	To harmonize the entire system of the company's activities while trying to realize differentiation and low costs

Source: Güneş, Serkan. "Değer Yaratma Bağlamında Güncel Dört Yenilik Modeli [Four Contemporary Innovation Models in the Context of Creating Value]", *Sanat ve Tasarım Dergisi,* 2011, Sayı Nu.7, kutuphane.dogus.edu.tr/mvt/ pdf.php? recid=12172&pdf=0012162 (23 Mayıs 2015). Inspired by Kim and Mauborgne (2005).

A number of strategic actions are performed to realize the principles of the blue ocean strategy. These tools are the value renewal and the four-action framework.

Interestingly, blue ocean strategists who did not set competition as a criterion for themselves adopted a different strategy logic called value renewal. The reason why this strategy was called value renewal was that businesses created a new and uncontentious market place by focusing on making competition meaningless by creating value for purchasers and themselves, instead of focusing on outperforming the competition (Kim and Mauborgne, 2014: 12).

Four questions posed by the four-action framework, which is a tool to create a new value, to reduce the contradiction between differentiation and low cost, and their goals are as follows (Table 3) (Ergen, 2015: 10):

Table 3: Four-Action Framework

Handle / Destroy	What factors should the industry meet naturally?
Decrease	What factors should be reduced below the industry standard?
Increase	What factors should be increased that the industry has not previously proposed?
Create	What factors should be created above the industry standard?

Source: Ahu Ergen, "Stratejik Düşünce Yaratma: Mavi Okyanusa Yelken Açmak [Creating Strategic Thinking: Sailing the Blue Ocean]", *Bahçeşehir Üniversitesi Dergisi,* http://pazarlama.org.tr/dergi/yonetim/icerik/ makaleler/21-published.pdf (21 Temmuz 2015: 10).

The firm called "Cirque du Soleil" operating in the circus industry (Kim and Mauborgne; 2014: 3-4, Baltaş; 2015), Yellow Tail producing wine in Italy (Hein, 2005), and iPhone can be shown as the examples of the application of the blue ocean strategy.

Along with the concept of blue ocean, the term "blue ocean leadership" emerged for leaders who can apply this strategy to the literature. According to Dorf, blue ocean leaders should create their leadership canvases by analyzing their environment well. Leadership in the role model profile becomes important at this point. Furthermore, it is also important that they make efforts to institutionalize new leadership practices. Dorf, who stated that poor leadership practices were surprising in many firms studied,

indicated that blue ocean leadership canvases could provide more concrete examples of business life for ideal leadership (Dorf, 2014: 60-72).

According to Kim and Mauborgne (2010: 150), there are four organizational barriers to strategy formulation, which are the Cognitive barrier (status quoism), Resource barrier (limited resources), Political barrier (against strong stakeholders), and Motivational barrier. While employees' inability to see that radical change is necessary constitutes the cognitive barrier, businesses' problems and difficulties in reaching certain resources constitute the resource barrier, the factors that discourage and demoralize employees constitute the motivational barrier, and strong resistance to change by looking out for various interests constitutes the political barrier (Kim and Mauborgne, 2014: 150).

It is paradoxical to define the shift from the red ocean strategy to the blue ocean strategy. If the blue ocean strategy is positioned as a strategy that should be preferred, it becomes difficult to explain a large number of organizations in the red ocean. In their study on 108 newly established organizations, Kim et al. (2004) found that 84 percent of them felt much more comfortable in red oceans, and only 14 percent of them made efforts to create new markets and industries. Moreover, although the share of red ocean followers in total profit was higher in number by 39%, the ratio of those who adopted the blue ocean was 38%. They explained the reason why the red ocean strategy was still preferred as follows: The rules of war are valid in any environment with competitors, and the strategy is determined as the sharing of a particular region by those who fight for that region. In the blue ocean strategy, there is no competitor. It is necessary to find new lands instead of sharing the existing land. In this case, it is clear that those who remain in the red ocean must defeat their enemies to be successful. Of course, competition is important. However, the point to remember is to explore blue oceans where there is no or scarcely any competition and to keep them blue, and this is a strategy that should be focused on.

2.3. Firm Performance

Performance is quite a controversial issue with regard to what it is on it. It may be quantitative or qualitative. Even if the same operation occurs, the performance of the job or the person who does that job may be low or high with different perspectives, or performance criteria can be shaped according to expectations. Regardless of the criteria used in firm performance or no matter which method is used in which measurement, the qualities of a good performance measurement are as follows: It should give information, provide improvement, be understandable, current and timely, be meaningful, be flexible, be appropriate (Zerenler, 2003: 204-205).

The studies measured the firm performance in four dimensions: yield, product quality, profitability, and market share (Özutku and Çetinkaya, 2012: 356; Karamustafa et al., 2009: 100-119). These criteria, which are the most commonly used criteria in the measurement of organizational performance, are also the goals of an organization's existence. Mutluay and Turaboğlu (2013: 66) took as a basis the rates obtained from financial statements and profitability as a criterion while measuring the firm performance, and they used ROCE (Return on Net Capital Employed) as a performance criterion.

In general, it appears that seven criteria are used as criteria in firm performance in the literature. These criteria are efficiency, utilization of yield and inputs, productivity, quality, innovation, quality of working life, profitability and budget compliance (Akal, 2000: 15). In addition to these performance criteria, Zerenler and İraz (2006: 262) also mentioned the criteria of customer satisfaction, cost reduction, capacity increase, increased productivity of employees, sales increase, production of salable products, and increased social responsibility.

In their study, Meyer and Gupta (1994: 309-369) stated that performance and performance appraisal were paradoxical and that different firms used different performance appraisal methods formed in the literature, and they explained these methods as follows (Elitaş et al., 347-368):

- Lynch-Cross Performance Pyramid: It is a two-dimensional approach that focuses on "what" an organization will achieve and "how" an organization will achieve it. The left side of the pyramid consists of external customer-oriented scales, and the right side of it consists of organization-oriented internal criteria. The mission and vision of the organization are at the top of the pyramid. Organizational performance indicators are market (commercial and financial measures) and financial (profit, cash flow, balance sheet and income tables, the place of products put on the market in the last year in total sales, etc.).
- Balanced Scorecard Technique Approach: This measurement, which was included in the literature with the article "The Balanced Scorecard-Measures That Drive Performance" published by Kaplan and Norton in the Harward Business Review, measures firm performance in four dimensions: financial dimension, customer dimension, internal function dimension, and learning and growth dimension (Elitaş et al., 347-368; Kaplan and Norton, 1996: 53-79).

- The Stakeholder Scorecard Approach: In this model developed by Atkinson et al. (1997), firm performance is based on stakeholders. This method, which focuses on integrating the needs and expectations of the organization's stakeholders (customers, employees, suppliers, partners, and society) properly and on measuring how they do them, focuses not only on financial and non-financial performance indicators but also on the relationship between the organization and stakeholders (Ağca, 2006: 178).
- Performance Prism Approach: In this performance measurement method, which was proposed by Kennerly and Neely mostly as the "second generation" performance measurement management, there is a different factor on each of the five surfaces of a prism: stakeholder satisfaction, strategies, processes, capabilities, and stakeholder contribution. Its biggest advantage over other methods is that it takes into account all stakeholders of the organization (investors, customers, employees, suppliers, legislators) and their demands and needs.

In addition to these firm performance measurement methods, there are also Rate of Return on Investment (ROI), Sink and Tuttle Model, Brand Valuation, Customer Value Analysis, Activity-based costing (ABC), Economic Value Added (EVA), and the Perfection Model (Yüreğir and Nakıboğlu, 2007: 549-557).

3. STUDIES ON CHAOS THEORY, BLUE OCEAN STRATEGY, AND FIRM PERFORMANCE

A small number of studies examining the relationship between chaos theory, blue ocean strategy, and firm performance was a limitation of this study. However, the studies on these concepts were included to contribute to the studies on chaos theory and blue ocean strategy.

In his case study on Blue Ocean on 14 firms stating that they used the blue ocean strategy in Malaysia, Mohammed (2009: 30-34) examined the blue ocean strategy in four categories (Kim and Maugborgne's four actions: eliminate, reduce, raise, and create) and revealed that these firms fulfilled the requirements of the strategy. These four actions are called eliminate, reduce, raise, and create.

In their study on value-based innovation models in the blue ocean strategy in Italy, Borgianni et al. (2012: 123-142) analyzed Motorola Iridium as an example of failure and Nintendo Wii organization as an example of success, and they attempted to reveal the share of New Value Propositions in this success and failure and emphasized the importance of its place in the blue ocean strategy. According to them, new propositions were a type of value-based innovation.

In their study on 41 different types of retail stores in Holland between 1982 and 2000 (the retail sector was chosen because it is very competitive and innovative), Burke et al. (2009) compared the blue ocean strategy with Porter's five power models and found that the blue ocean strategy was more sustainable. Nevertheless, they emphasized that the strategy needed to be adopted by organizations was a mixture of both. While a competitive strategy is followed to reduce profit erosion for the existing markets, it is possible to set sail for the blue ocean strategy for untouched markets.

In his study, Chang (2010: 219-223) examined the blue ocean strategy applied for bandit mobile phones, an anonymous brand sold by MediaTek in the People's Republic of China, and he found that the organization created a different strategy canvas with this strategy and that especially the tablet industry tended to imitate it. MediaTek's strategy can be an example of innovation management. Chang also stated that a good blue ocean strategy should be inimitable and that it could be done only by creating value.

In their study on the applicability of the blue ocean strategy in the B2B (Business to Business) industry, Cirjevskis et al. (2011: 201-215) worked with SIKA AG firm serving in the chemical industry and ALEXANDRA PLUS LLC firm serving in the industrial treatment industry and showed that the blue ocean strategy was also functional in organizations operating in the B2B sector.

In their study, Giannoulis et al. (2012: 118-128) aimed to associate the business strategy formulation of Schumpeter's idea with the information system development, and they provided guidance on how to adopt this strategy by creating various blue ocean strategy maps.

Kovaleski (2010) explains the results of Nintendo's conference about the blue ocean strategy as follows: When Nintendo started to become weak in its competition in the video game industry, it developed a new tactic instead of continuing this competition. They targeted different groups, such as women, adults and families, rather than producing more options for the traditional target group (male youth). There is now Wii that will attract even those who do not play video games on the platform. This is an example of the blue ocean strategy.

Lindic et al. (2012: 928-938) examined the effect of the blue ocean strategy, which is an example of entrepreneurship, on very large-scale growth. Their starting point was that the size of the firm was important in determining strategies and the effect of

each strategy on firms of all sizes was different. They concluded that the blue ocean strategy could also be effective in organizations that desired rapid growth.

Wengel et al. (2010: 56) examined the blue ocean strategy on the model created by Schumpeter based on data of the Colombian National Department of Statistics on the economies of size of some of 8000 firms in Colombia over a 12-year period. These organizations that were examined through innovation and economy of scale, which were considered to have effects on productivity by Schumpeter, showed that the blue ocean strategy was effective on total efficiency and productivity.

In their study, Tu et al. (2014: 1-23) aimed to determine how the blue ocean strategy was used in sustainable product design and what kind of effect the Bottom/Base of the Pyramid (BOP) had on creating job opportunities that may affect the customer profile in Taiwan, and their conclusions are as follows: 1. Since the consumption characteristics and behaviors of customers belonging to the subgroup are different, it should be taken into consideration in product design. 2. Since there is a broad market for this customer profile in Taiwan and regional and low income differences affect consumption, a general market assessment should be performed to identify real business opportunities. 3. High quality and low price are the most important criteria to influence the customer. 4. It should be considered that distribution channels also affect the use of customers and the recycling of products.

Becker (2013: 472-476) attempted to explain the transition of the Canadian film production and distribution company called IMAX from normal-length and screened films to producing Holywood movies in the IMAX format through the story analogy "Who Moved My Cheese?". In this story telling the struggle of two people named Mırın and Kırın and two little mice named Koklarca and Koşarca to find cheese in a labyrinth, the labyrinth is the metaphor of the place where our struggle for life takes place, and cheese is the metaphor of our wishes and desires. In this story, the problems that an individual would experience when he/she did not adapt to change and did not easily forget the old days and turn towards innovation, and the fact that recognizing small changes might increase adaptability were explained through a metaphor. Becker also compared IMAX's change in the film industry to these story heroes struggling to find a new one to replace the depleted resource.

Barwise et al. (2012: 24-27) attributed the rise of Samsung in the mobile phone market and its superiority over iPhone and Nokia to the blue ocean strategy. They explain this growth with four main reasons:

- Making clear and precise promises to the customer
- Gaining customer's confidence by fulfilling this promise
- Leading the sector by always growing and moving their promises forward
- Being in search of creating a different advantage with an understanding of innovation other than the popular opinion

According to Barwise et al. (2012: 27), it is not possible for the color of the ocean to remain blue. At any moment, each mobile phone company may fall behind the competition again in this blurred ocean by falling into the situation of Motorola or Nokia.

Kim et al. (2008: 522-533) conducted a study to analyze the blue ocean strategy in the business model of Cheil Jedang' s-Global Logistics Service (CJ-GLS) organization, which is headquartered in Seoul, South Korea, and provides worldwide logistics service, and they provided very significant information on how this organization achieved a competitive advantage by using information technologies in their transition from the red ocean strategy to the blue ocean strategy. In this case analysis study, the competitive advantage achieved by the blue ocean strategy was discussed by interviewing the organization's CEO and CIO and focusing on the core competence of the organization. They showed building a highly motivated information strategy team, senior management leadership, and an open mindset as the key points for success.

Gündüz (2019) indicated that the use of the blue ocean strategy not only in the management of firms but also in the management of higher education would contribute to education by opening new horizons. Furthermore, Gündüz (2016, 2018) also stated that a firm using a blue ocean strategy would be imitated immediately and explained how to get back into the blue ocean in such a case through an example of a "game of escaping from a house."

Many studies were conducted on chaos theory. The study carried out by Bright et al. (2005: 291 305) on the place of chaos theory in career prediction is interesting. Career development depends on many factors, takes place at different speeds and levels under different conditions and has a very complex structure. It is necessary to start from the assumptions of chaos theory in career planning.

Pryor et al. (2009: 39-50) used the "game" metaphor for a career. In their study, they aimed to contribute to career counseling by associating the game metaphor with chaos theory. Game analogies may help in understanding chaos theory. In their study in which they attempted to explain how the implementation of chaos theory would be helpful especially for the customer profile,

interested in sports and coming to get career counseling, they emphasized that the continuous change in the contemporary business life and the complexity and uncertainty caused by the interconnection of systems should be overcome, which could be possible only by career development.

In their study, Speakman et al. (2012: 67-77) made a proposition based on chaos theory as an alternative model to crisis management by indicating that the crises and disasters in the tourism sector could not be explained by linear systems and that contemporary crisis management models were therefore limited. The swine flu (AH1N1) experienced in Mexico in 2009 was one of the biggest crises in the tourism sector, and they stated in their studies how modern crisis management methods were ineffective during this period. A campaign called "Vive Mexico" was launched to overcome this crisis, and the sector was revived again. While the authors emphasized that this practice was not surely very new as a marketing strategy, they stated that their study was aimed at emphasizing the importance of adopting the principles of chaos theory since the tourism sector was especially very chaotic.

Akmansoy et al. (2014: 510-518) indicated that the paradigm of chaos theory was also applied in social sciences as well as in natural sciences, and they examined the effect of this theory in the field of education. In their case study conducted with 30 faculty members of Burdur Mehmet Akif University Faculty of Education, Faculty of Arts and Sciences, and Faculty of Veterinary Medicine, they studied the "butterfly effect" in education and drew attention to what a small mistake might cause. The questions to which they sought answers were "How does a mistake affect the student's future education?", "How does a negativity in the university affect the student's attitude towards the university?", "How is education affected by students at different levels?", etc.. They stated that considering chaos theory in the field of education would give university administrators a different spirit.

In their case study, Özen et al. (2013: 130-135) discussed in what ways solutions could be found in certain events with the rules of chaos theory from the perspective of an education director and a student. Addressing educational issues from the perspective of chaos theory may also help managers in the field of education to overcome the problems they face in education that witnesses rapid changes, by giving them a different perspective.

4. DATA AND METHODOLOGY

In this study, firm performance was considered as a dependent variable and chaos theory and blue ocean strategy were considered as independent variables, and their effect on firm performance was examined. No mediating variable was used. Sociodemographic variables were included in the scale questionnaires by considering that they could only shed light on later studies. The effect of sociodemographic variables was not included within the scope of this study.

H1. There is a positive relationship between the factors of chaos theory and firm performance.

H2. There is a negative relationship between the factors of the red ocean strategy and firm performance.

H3. There is a positive relationship between the factors of the blue ocean strategy and firm performance factors.

People working in any sector constituted the main population of the study. Random sampling was performed, without considering in which sector they worked. The sampling method based on accessibility was preferred, and students in the institute where the researcher was doing a master's degree and the staff of the hospital where she worked were selected as a sample.

In determining the relationship between chaos theory, blue ocean strategy and firm performance; chaos theory and blue ocean strategy were used as independent variables and firm performance as dependent variables. Data entries were entered with a 7 point Likert scale, and all measurement tools were made ready for descriptive statistics and T-test.

In this study, firstly general information about the business and then information about the person are given. About the enterprise, the name of the enterprise, the boundaries of its field of activity, the sector in which it operates, the number of employees and the year of establishment were asked. About the employees, name and surname, department, title, age, gender, education level, total working time, working time in this workplace were asked. There are thirteen questions in total. Three hundred questionnaires were distributed, and 204 of them were collected. Since all data were sufficient, there was no unused questionnaire.

5. EMPIRICAL RESULTS

Two hundred four participants from Istanbul province selected by the random sampling method were included in the study. In the study, firstly, general information about the business and then sociodemographic information about the people were also included. While 2.5% of the firms where participants were working were in the food/beverage/tobacco sector, 1.5% of them were in the clothing/textile/leather sector, 0.5% of them were in the automotive industry, 32.4% of them were in the health sector,

0.5% of them were in the chemical/oil/tire industry, 45.6% of them were in other sectors, and 17.2% of them were in the information sector. The majority of the participants in the study consisted of people between the ages of 26-30, in other words, young people by 34.3%. They were followed by participants between the ages of 31-35 by 20.6%. It can be said that the participants were mostly young and middle-aged. There was a close gender distribution among 204 participants consisting of 82 female (40.2%) and 114 male (55.9%) individuals. With regard to educational status, while 6.4% of the people who participated in the study were high school graduates, 2.5% of them were college graduates, 34.3% of them were university graduates, 54.4% of them had a master's degree, and 2.5% of them had a doctoral degree. According to this result, it can be stated that it was regarded that the employed people within the scope of the study would have a very high educational level.

Reliability and Validity of Measurement Tools and Analysis of the Resulting Factors

The 26-item Chaos Theory Survey, the 10-question Blue Ocean Strategy Survey and the 11-question Performance Evaluation Survey used in this study were tested for construct validity by factor analysis and reliability techniques.

Within the scope of the study, the survey results obtained from a total of 204 participants were examined by reliability analysis using the SPSS program, and the overall reliability level for 47 questions was found to be 0.906, which was well above the limit value of 0.700. The fact that the participants who have filled out the questionnaires perceive the questions correctly and give similar answers are the main factors that reliability analysis tries to measure. The scale reliability, which is determined to be 0.900 and above in the experimental studies, provides an excellent background to continue the study and to perform other analyses. However, the reliability analysis of each sub-factor was checked one by one except for the overall scale in order to leave no room for the scientific gap. Adequate values were obtained by performing the reliability analysis of all scales (Table 4).

Table 4: Reliability Analysis of All Scales

Reliability Analysis	
Factor	**Cronbach's Alpha**
Chaos (26)	0.881
Ocean (9)	0.800
Performance (11)	0.873

While examining the blue ocean scale, the question number one was removed from the analysis because reliability analysis was decreased to 0.630 when this question was included in the scale. The first question was excluded from the analysis because there was a possibility that it could not be understood by readers, or there was an error of design. Thus, the next analysis can bring objective comments.

Two independent and one dependent variable were included in the model created in this empirical study. The chaos approach, which was the first independent variable, consisted of 26 questions, and the blue and red ocean variable consisted of nine questions. The firm performance, which was included as a dependent variable in the study, consisted of 11 questions. While it was planned to divide the chaos approach scale into four factors consisting of planning, communication, teamwork, and leadership, the ocean scale was planned to be divided into two factors consisting of the blue and red ocean. While the variables were included in factor analysis, the KMO levels were also evaluated.

The chi-square values of KMO ratios, including all three variables, are presented in Table 5.

Table 5: KMO and Chi Square Values

Variable	KMO	Ki Kare
Chaos	0.931	3466.504
Ocean	0.727	781.316
Performance	0.922	1760.998

In the reliability test performed for the collected data, Cronbach's alpha coefficients were found to be 0.881, 0.800, and 0.873, respectively, for the Chaos Theory Survey, Blue Ocean Survey, and Performance Evaluation Survey. Since the result of Bartlett's test of sphericity performed for the data group was found to be $p<0.001$, it was found out that there was a significant relationship between the items of the scale. Since the KMO values were observed to be well above the limit value, the exploratory factor analysis, in which factor loads of each variable are determined, was performed for all three scales (Table 6, Table 7, Table 8).

Table 6: Chaos Theory Factors and Factor Loads (Varimax Rotated Factor Matrix)

CHAOS THEORY	1	2	3	4
Factor 1 PLANNING				
9. We plan for other situations.	0,628			
10. We consider problem solving strategies.	0,562			
13. We apply systematic approach to problem solving.	0,558			
14. We make a global assessment of the situation.	0,525			
15. We re-evaluate to prevent errors.	0,710			
17. We know the importance of expressing the problem.	0,739			
19. In the event of a crisis, we do team work.	0,709			
20. We give importance to delegation of authority.	0,611			
23. We have the ability to organize a team.	0,665			
24. We have priority tasks.	0,712			
25. Otherwise, we call our friends for help.	0,791			
26. We make predictions or plans for the future.	0,702			
Factor 2 COMMUNICATION / TEAM WORK				
4. We have a good communication opportunity.		0,548		
6. We act voluntarily while asking for help.		0,815		
7. Our communication with our colleagues is very good.		0,687		
8. We work with a team.		0,613		
11. We communicate with our trainers in crisis management.		0,536		
12. We have communication skills.		0,613		
Factor 3 INITIATIVE				
1. Employees have the opportunity to apply the theory of chaos.			0,637	
2. Employees have a good teamwork skill and duty authority.			0,678	
3. There are moments when we have more control and less concern.			0,704	
Factor 4 LEADERSHIP				
16. We do not make predictions.				-0,567
21. There are leadership problems in our company.				-0,736
22. Employees need a leader.				-0,839

Note: Table 6 shows the factor loads of the sub-expansions of chaos theory.

The results show that the chaos values are divided into factors within themselves, just as expected. The chaos approach is divided into 4 sub-factors. While determining the variables assigned to the factor, the variables whose factor load was below 0.500 were excluded from the analysis.

Table 7: Ocean Scale Factor Analysis

OCEAN	1
Factor 1 RED OCEAN	
3.We do our best to win the competition.	0,654
5. We struggle to win the existing demand.	0,670
7. We make the cost seem insignificant.	0,736
10. We gather all the companies' activities and systems in a common area and offer them at low cost.	0,541
Factor 2 BLUE OCEAN	
2. We create a competitive marketplace.	0,319
4. We live in the area where there is no competition.	0,505

6. We struggle as a company to create and capture non-demand.	0,703
8. We do not care about the cost value.	
9. We collect each selected activity and system of the companies at a common point.	0,571

The results show that the ocean values are divided into factors within themselves. The ocean scale is divided into 2 sub-factors within itself. While determining the variables assigned to the factor, the variables whose factor load was below 0.500 were excluded from the analysis. Especially since the consecutive questions at the ocean scale contain opposite meanings, a high level of contrast was observed in the factor analysis.

Table 8: Firm Performance Factors and Factor Loads (Varimax Rotated Factor Matrix)

FIRM PERFORMANCE	1
Factor 1	
Your average net profitability before tax	0,850
Net income from your core activities	0,870
Financial success of new products you put on the market	0,817
Your overall financial success	0,852
Average annual increase in your sales	0,869
Increase in the number of new products you put on the market.	Discarded
Increase in your market share compared to your leading competitors	0,798
Increase in the number of your employees	0,674
Increase in the number of new customers	0,654
In general, your position in the competitive environment in the market.	0,863
Your profitability level in general.	0,856

The emerging results indicated that the ocean and chaos values were divided into factors within themselves, as it was expected. The chaos approach was divided into four sub-factors, and the ocean was divided into two sub-factors. While determining the variables assigned to each sub-factor within the scope of factor analysis, the variables with a factor load below 0.500 were excluded from the analysis. A high level of contrast was observed in factor analysis, especially since sequential questions in the ocean scale included opposite meanings. Before starting the correlation analysis, each factor was averaged and named. Thus, two independent variables were transformed into six different independent variables along with their sub-factors, which was positively reflected for the enrichment of the research model.

When the results of the correlation analysis performed on the scales within the scope of these statements (Table 9) were examined, it was observed that the first three factors of the chaos approach and the blue ocean sub-factor were mutually correlated with the firm performance. For example, it was observed that the performances of firms that focused on blue ocean techniques, operated in areas where there was no competition, and attached importance to innovation were correlated at the level of 0.582. This significant positive correlation indicated that investments in the blue ocean might quickly and positively affect business performance. Another remarkable detail was that an intense correlation was found between the first three factors of the chaos approach and the blue ocean factor. When these two techniques are used together, it can be assumed that they will have a more significant effect on performance. However, it will be necessary to examine the results of regression analysis to make a definite judgment about it.

Table 9: Correlation Analysis Between Cases

Dimensions		Chaos F1	Chaos F2	Chaos F3	Chaos F4	Red Ocean F1	Blue Ocean F2	Firm Performance F1
Chaos Factor 1 PLANNING	p	1	0,765**	0,647**	-0,301**	0,538**	-0,013	0,546**
	s		0	0	0	0	0,851	0
	N	204	204	204	204	204	204	204

Chaos Factor 2 CONTACT/ TEAM STUDY	p	0,765**	1	0,622**	-0,271**	0,454**	-0,023	0,459**
	s	0		0	0	0	0,739	0
	N	204	204	204	204	204	204	204
Chaos Factor 3 INITIATIVE	p	0,647**	0,622**	1	-0,180**	0,388**	0,037	0,436**
	s	0	0		0,01	0	0,603	0
	N	204	204	204	204	204	204	204
Chaos Factor 4 LEADERSHIP	p	0,301**	-0,271**	-0,180**	1	-0,137	0,259**	-0,306**
	s	0	0	0,01		0,051	0	0
	N	204	204	204	204	204	204	204
Ocean Factor 1 RED OCEAN	p	0,538**	0,454**	0,388**	-0,137	1	0,265**	0,582**
	s	0	0	0	0,051		0	0
	N	204	204	204	204	204	204	204
Ocean Factor 2 BLUE OCEAN	p	-0,013	-0,023	0,037	0,259**	0,265**	1	0,036
	s	0,851	0,739	0,603	0	0		0,611
	N	204	204	204	204	204	204	204
Firm Performance Factor 1	p	0,546**	0,459**	0,436**	-0,306**	0,582**	0,036	1
	s	0	0	0	0	0	0,611	
	N	204	204	204	204	204	204	204

Note: * Correlation (relationship) at the 0.05 level & ** correlation (relationship) at the 0.01 level is significant

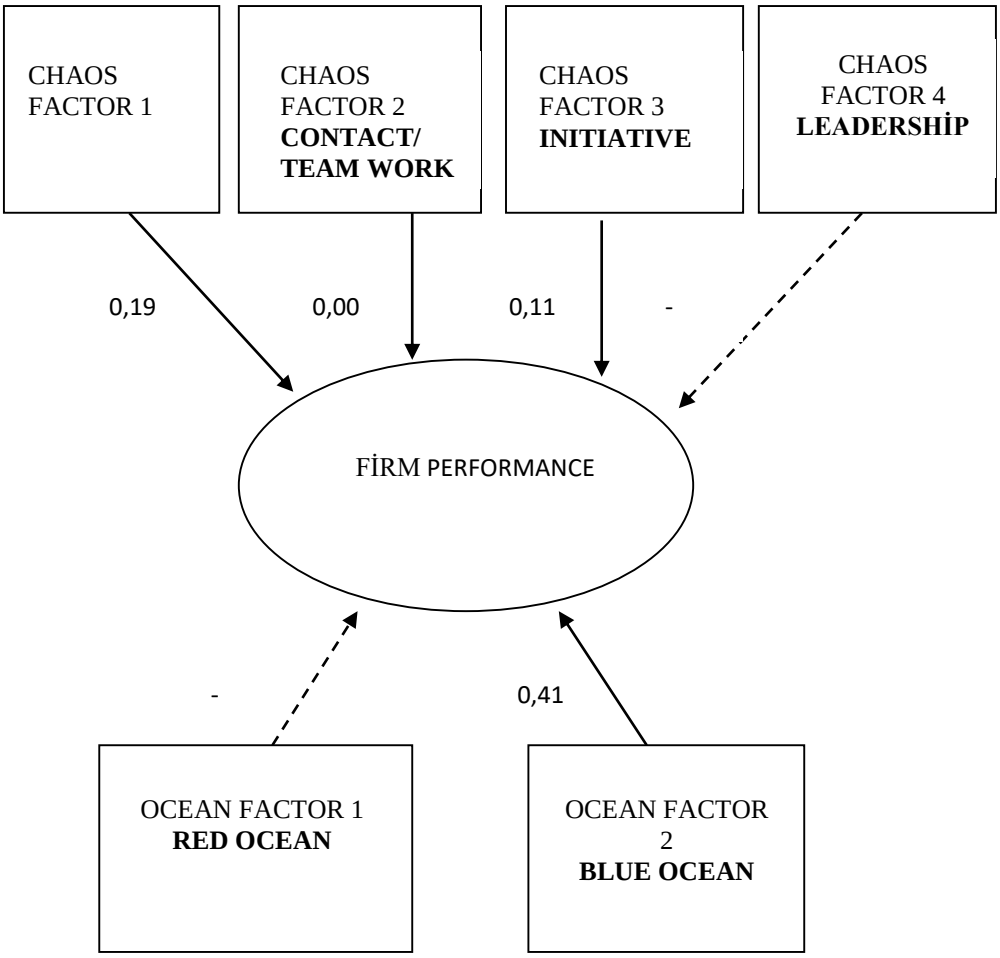
The regression analysis performed for all scales is presented in Table 10.

Table 10: Regression Analysis for All Scales

Coefficient						
Model		Non-standard Coefficient		Standard Coefficient	t	Sig.
		B	Std. Hata	Beta		
RESEARCH MODEL	(Constant)	1,947	0,45		4,329	0
	PLANNING	0,199	0,096	0,192	2,067	0,04
	COMMUNICATION / TEAM WORK	0,004	0,088	0,004	0,047	0,962
	INITIATIVE	0,124	0,074	0,119	1,66	0,098
	LEADERSHIP	-0,136	0,05	-0,159	-2,755	0,006
	BLUE OCEAN	0,431	0,069	0,418	6,274	0
	RED OCEAN	-0,028	0,047	-0,035	-0,61	0,543
Model Summary:		R^2: 0,450	Adjusted R^2: 0,433		Estimated S.H.: 0,79	

When the beta coefficients of the variables in the model were examined, it was observed that three sub-factors had an effect on the dependent variable. While planning, one of the sub-dimensions of the chaos strategy, and blue ocean positively affected the performance, leadership had a negative effect on performance. It is observed that these three factors can explain 45% of changes in the dependent variable. This ratio is high at a level that is very rarely observed in numerical studies in social sciences, indicating how strongly the research model was designed. Another factor that may be surprising in the analysis results was that the red ocean factor was not found to be significant, although it tended to be negative. The assumption that firms that competed in the existing markets and did not attach importance to research and development activities would perform poorly, which was expected before the study, was found to be insignificant. This result does not show that the red ocean approach has a negative effect on business performance. In other words, while the blue ocean directly and positively affects the business performance, the presence of the business in the red ocean has no effect on the performance.

Figure 1: Model of Research



The model obtained in the study is presented in Figure 1. The correlations between the cases were determined by regression analysis. While dashed lines indicate a negative correlation, straight lines indicate a positive correlation.

6. CONCLUSION

Nowadays, firms should make competition meaningless to continue their existence in the existing market and to increase their performance in order to achieve success under ever-changing world conditions. The increased competition with globalization poses a threat for firms, and therefore, firms need innovative approaches and the ability to manage change. They have to constantly improve themselves and ensure their stability in the market in order to respond to the demands and needs of consumers early and in a timely manner. Therefore, they should be able to apply new management models other than the conventional management approach. They need modern management strategies to keep up with the changing age and to increase creativity outside the hierarchical order. In our study, since firms need good managers to increase their performance, managers need people who are open to innovation, support creativity and manage this situation in an irregularity.

Firms should be aware of the concept of chaos and have the ability to think about the butterfly effect and its consequences with the actions to be taken in order to maintain financial superiority, which is their goal of existence under changing conditions. In order for businesses to be open to innovation and catch up with age, they should know the concept of BOS and have an organizational culture that is open to innovation, and therefore, they should have managers who are aware of them.

At the beginning of this study, it was started based on the following known issues:

- Chaos theory and blue ocean strategy are effective among modern strategic management techniques.
- Firms that adopt chaos theory have high performance.
- Firms that adopt the blue ocean strategy have high performance.
- Contributions of this study to the literature are as follows:
- Chaos theory positively affects the performance of firms.
- The blue ocean strategy positively affects the performance of firms.
- The red ocean strategy negatively affects the performance of firms.
- The validity of the theories was retested.

In this study, the historical development of the blue ocean strategy and chaos theory, how they can provide benefits, and successful examples in previously applied businesses were also included to better understand the BOS and Chaos Theory and to provide benefits for business managers. In this context, it can be said that this study may provide benefits for business owners, employees, and managers to achieve success in today's business world.

Recommendations to researchers: In this study, two independent variables were considered as Chaos Theory and BOS, and firm performance was used as the dependent variable. More objective data will be obtained if this study can be conducted with different firms and a higher number of participants.

Recommendations to managers: Managers should be able to apply modern strategic management techniques so that firms can increase their performance in the competitive business world. In this context, it will be beneficial for them to receive education and to do research on this issue. According to the results of the study, it was revealed that BOS and Chaos Theory had an effect on firm performance by 45%, which is a very high rate. In the study, although there was an expected result in line with the blue ocean and chaos theory hypotheses, the red ocean strategy was not found to be significant, although it had a negative trend.

REFERENCES

Ağca, V., and Ender T. (2006). Multidimensional performance evaluation models and a balanced scorecard application. *Afyon Kocatepe Üniversitesi İİBF Dergisi*, 8 (1): 173-193.

Akal, Z. (2000). İşletmelerde Performans Ölçüm ve Denetimi: Performance Measurement and Control in Business. *Ankara: Milli Prodüktivite Merkezi Yayınları*.

Akdemir Ö, (2016). The changing profile of entrepreneurs in the knowledge age. *İstanbul Üniversitesi Siyasal Bilgiler Fakültesi Dergisi*,(55), 55-65.

Akmansoy, V., and Kartal S., (2014). Kaos teorisi ve eğitime yansımaları: Mehmet Akif Ersoy Üniversitesi örneği. *Kuram ve Uygulamada Eğitim Yönetimi*, (14), 499-518.

Altun, S. (2001). Kaos ve yönetim. *Kuram ve Uygulamada Eğitim Yönetimi*, Sayı Nu.28, 451-469.

Arıcıoğlu, M., and Karabıyık H. (2019). Örgütlerin geleceğine bir önerme olarak kaos teorisi ve kaos olgusunu anlamak. *Medeniyet ve Toplum Dergisi*, 3(29): 145-156.

Armour, P. (2016). Chaos is no catastrophe. *Communications of the ACM*, 59(4).

Baltaş, A. (2007). Rekabette Kalıcı Fark Yaratmak. *http://www.acarbaltas.com/ makalelerphp? id= 82#.VWD3v0b7LIU*

Bartlett, S. (1950). Tests of significance in factor analysis. *British Journal of Psychology, Statistical Section*, (3): 77-85.

Barwise, P., and Séan M. (2012). Innovation beyond Blue Oceans. *Market Leader, (*4): 24-27.

Baykal, E., and Mızrak, F. (2019). Leading factors contributing international organizations to be agile and blue ocean strategy: an evidence from Turkish civil aviation sector. *Stratejik ve Sosyal Araştırmalar Dergisi*, 3 (3): 465-490.

Becker, H. (2013). IMAX Move to Hollywood: Blue Ocean Strategy or a case of who moved my Cheese. *Global Conference on Business and Finance Proceedings*, 8 (2): 472-476.

Borgianni, Y, Gaetano, C., and Federico, R., (2012). Investigating the patterns of value-oriented innovations in blue ocean strategy. *International Journal of Innovatiıon Science*, 4 (3): 123-142.

Bright, E. H., and Robert G. L., (2005). The chaos theory of careers. *The Career Development Quarterly*, (53): 291-305.

Burke, A., André S. and Roy T., (2010). Blue ocean vs. five forces. *Harward Business Review, (88): 28.*

Burns, S., (2009). Chaos theory and leadership studies: exploring uncharted seas. *Journal of Leadership & Organizational Studies*, 9 (2): 42-56.

Chang, S. (2010). Bandit cellphones: a blue ocean strategy. *Technology in Society*, (32): 219-223.

Cirjevskis, A., Genadijs H. and Valērija L. (2011). How to implement blue ocean strategy (BOS) in B2B sector. *Business Management and Education,* 9 (2): 201-215.

Çavuş, F., İnce, Z., Yakut, E., Akbulut, M., and Kalkan, A. (2016). Kaos ve durumsallık: bir değerlendirme. *Kahramanmaraş Sütçü İmam Üniversitesi Sosyal Bilimler Dergisi*, 13 (2): 207-210.

Çıraklı, Ü., Dalkılıç, S. and Hacıhasanoğlu, T. (2017). Kaos teorisi, karmaşıklık teorisi, karmaşık uyarlamalı sistemler: sağlık hizmetleri açısından bir derleme. 3(6), 330-343.

Demirtaş, H. (2000). Kriz yönetimi. *Kuram ve Uygulamada Eğitim Yönetimi,23 (*6): 353-373.

Dorf, M. (2014). Blue Ocean Leadership. *Harward Business Review, 60-72.*

Eden, A., (1994). Katastrof ve Kaos Teorileri Hakkında. *http://www.Matematikdunyasi.org/arsiv/PDF_eskisayilar/ 1994 _1_6_11_KATASTROF.pdf*

Elitaş, C., and Veysel A. (2006). Firmalarda çok boyutlu performans değerleme yaklaşımları: kavramsal bir çerçeve. *Afyon Kocatepe Üniversitesi Sosyal Bilimler Dergisi*, 8 (2): 347-368.

Ergen, A. (2015). Stratejik düşünce yaratma: mavi okyanusa yelken açmak. *Bahçeşehir Üniversitesi Dergisi, http://pazarlama.org.tr/dergi/yonetim/icerik/ makaleler/21-published.pdf.*

Erol, M. (2009). Düzen, kaos ve değişme. *Türkiyet Araştırmaları, 125-155.*

Ertürk, A. (2012). Kaos kuramı. *Kastamonu Eğitim Dergisi*, 20 (3): 849-868.

Fatih, H. (2006). Kaos teorisi ve yönetimde yeni yaklaşımlar. *Süleyman Demirel Üniversitesi, Vizyoner Dergisi,* 9(22): 161-168.

Galacgac, J., and Singh, A., (2016). Implications of chaos theory. *Chaotic Modelling and Simulation*, (4): 515-527.

Giannoulis, C. and Jelena Z. (2012). Linking strategic innovation to requirements: a look into blue ocean strategy. *Sandhkul ve Seigerroth (Ed.) 5th IFIP WG 8.1 Working Conference, PoEM*, 118-128.

Gökmen, A. (2009). Kaos teorisinin genel bir değerlendirmesi. *Hitit Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 2 (1): 61-79.

Gündüz, Ş. (2016). How to make blue ocean turning into red ocean blue again: a case study of a room escape game. *ADVED*

Gündüz, Ş. (2018). Preventing blue ocean turning into red ocean again. *Journal of Human Sciences*, 15(1): 1-7.

Gündüz, Ş. (2019). Yükseköğretimde mavi okyanuslar. *Üniversite Araştırmaları Dergisi*, 1(3): 116-120.

Güneş, S. (2011). Değer yaratma bağlamında güncel dört yenilik modeli. *Sanat ve Tasarım Dergisi*, 1 (7): 71-89.

Hein, K. (2005). Yellow tail tells its tale. *Brandweek*, 30-46.

Kahyaoğlu, M. (2015). Kaos teorisi çerçevesinde bireysel yatırımcı davranışının analizi. *İşletme Bilimi Dergisi*, 3 (1): 38-51.

Kalkan, A., and Alparslan M., (2009). Rekabet savaşından çıkış yolu: değer yeniliği, kâr ve insan önermeleri. *Mehmet Akif Ersoy Üniversitesi Sosyal Bilimler Dergisi*, (1): 1-12.

Kaplan, R. and David P. (1996). Linking the balanced scorecard to strategy. *California Management Review*, 39 (1): 53-79.

Karamustafa, O., Varıcı İ. and Er, B. (2009). Kurumsal yönetim ve firma performansı: IMKB kurumsal yönetim endeksi kapsamındaki firmalar üzerinde bir uygulama. *Kocaeli Üniversitesi SBE Dergisi*, (17): 100-119.

Kazdal, Ö. (2013). Aile şirketlerinde çağdaş yönetim modellerinin uygulanması üzerine Istanbul ilinde ampirik bir araştırma. *Yüksek Lisans Tezi. T. C. Beykent Üniversitesi, SBE*, 76.

Kim, W., and Renée M., (2014). Mavi Okyanus Stratejisi. *İstanbul: CSA Global Publising*, (11): 3-12.

Kim, W., and Renée M., (2004). Blue Ocean Strategy. *Harvard Businesss Review*. 82-10.

Kim, W., and Renée M., (2005). Blue Ocean Strategy: From Theory to Practice. *California Management Review*, 45 (3): 106.

Kim, W., and Renée M., (2015). Blue Ocean Strategy'nin Yazarları W. Chan Kim ve Renee Mauborgne ile Söyleşi. *moodle.technion.ac.il, 118-119.*

Kim, C., Kyung H. and Jaekyung K. (2008). A strategy for third-party logistics systems: a case analysis using the blue ocean strategy. *Omega, the International Journal of Management Science,* (36): 522-533.

Kişi, N. (2017). Etkili rekabet için mavi okyanus liderliği. *Uluslararası Akademik Yönetim Bilimleri Dergisi*: (4), 202-210.

Koçel, T. (2005). İşletme Yöneticiliği. 10. Basım, *İstanbul: Arıkan Basım Yayım*, 492.

Leavy, B. (1996). Design thinking – a new mental model of value innovation. *Strategy &Leadership*, 38(3): 5-14.

Lindic, J., Mojca B., and Helena K. (2012). Higher growth through the blue ocean strategy: implications for economic policy. *Research Policy*, (41): 928-938.

Lorenz, E. (1995). The Essence of Chaos. *United Kingdom: UCL Press*.

Mazlum, Ö. (2011). Rengin Kültürel Çağrışımları. *Dumlupınar Üniversitesi SBE Dergisi*, (31): 125-138.

Meyer, V. and Vipin G. (1994). The Performance Paradox', in Straw. *Research in Organizational Behavior*, 16 (3):309-369.

Mohammed, Z. (2009). Analysis of the Use of the Blue Ocean Strategy, Case Study Analysis on 14 Different Analysis. *Research Bulletin of the Faculty of Economics*, 28-34.

Mutluay, A. and Tuncay, T. (2013). Döviz Kuru Değişimlerinin Firma Performansına Etkileri: Türkiye Örneği. *BDDK Bankacılık ve Finansal Piyasalar*, 7 (1): 59-78.

Öge, S. (2005). Düzen mi Düzensizlik (Kaos) mi? Örgütsel Varlığın Sürdürülebilirliği Açısından bir Değerlendirme. *Selçuk Üniversitesi SBE Dergisi*, (13):285-303.

Özen, H., and Süleyman, K. (2013). An Applicaton of Chaos Theory to Educational Administrator's Behavior: Overwhelming the Cheating Crisis on An Exam. *International Journal of Academic Research*, 5 (3): 130-135.

Öztürk, Z. and Kızılkaya, S. (2017). Chaos Complexity Theory at Management. *International Online Journal of Education and Teaching*, 4(3): 259-264.

Özutku, H., and Çetinkaya, M. (2012). Stratejik İnsan Kaynakları Yönetimi ve Firma Performansı Arasındaki İlişkide İçsel ve Dışsal Uyumun Moderatör Etkisi: Türk Otomotiv Sektöründe Bir Alan Araştırması. *Ege Akademik Bakış,* 12 (3): 351-367.

Pryor, G. L., and Jim E. H. (2009). Game as a Career Metaphor: A Chaos Theory Career Counselling Application. *British Journal of Guidance & Counselling*, 39-50.

Rau, J. G. (2012). With Your Idea, are You Trying to Navigate the Red Ocean or the Blue Ocean Inventors. *Digest, InventorsDigest.com*.

Speakman, M. and Richard S. (2012). A Chaos Theory Perspective on Destination Crisis Management: Evidence from Mexico. *Journal of Destination Marketing & Management*, 1(1): 67-77.

Thiétart, R. and Bernard F. (1995). Chaos Theory and Organization. *Organization Science, 6(1): 1-145.*

Tu, J., Min-Chieh S., Chuan-Ying H., and Jian-Hao L. (2014). Developing Blue Ocean Strategy of Sustainable Product Design and Development for Business Opportunities of BOP Groups in Taiwan. *Mathematical Problems in Engineering, Mathematical Problems in Engineering, 1-23.*

Turunç, Ö. (2008). Uluslararası Güvenlık Düzlemine Yönetim Bilimi Penceresinden Farklı bir Bakış Stratejik Kaos Yönetimi Yaklaşımı. *Güvenlik Stratejileri Dergisi*, (8): 45-72.

Wengel, J., Ferreira-Villegas, G. B., Pérez-Hernández, G., & Suárez-Cruz, L. M. (2010). Schumpeter and the blue ocean strategy. Revista de la Maestría en Derecho Económico, 6(6), 53-85.

Yakut, H., (2018). Kaos Teorisi ve Yönetimde Yeni Arayışlar. *Süleyman Demirel Üniversitesi Vizyoner Dergisi*, 9(22): 161-168.

Yiğit, S. (2015). Değer İnovasyonu: İnovasyonla Değer Oluşturmak. *Ekonomik ve Sosyal Araştırmalar Dergisi*, (11): 227-244.

Yüksel, M and Esmer, Y. (2019). İşletme Yönetiminde Kaos Yaklaşımı: Teorik Bir Bakış. *Opus Uluslararası Toplum Araştırmaları Dergisi*, (18): 937-952.

Yüreğir, O. and Nakıboğlu,, G. (2007). Performans Ölçümü ve Ölçüm Sistemleri: Genel Bir Bakış. *Ç. Ü. Sosyal Bilimler Dergisi*, 16(2): 545-562.

Zerenler, M. (2003). Kriz Dönemlerinde İşletmelerde Üretim Süreci Esnekliğinin Şirketlerin Performans ve Yaşam Sürelerine Etkileri. *Doktora Tezi, Selçuk Üniversitesi, SBE*.

Zerenler, M., and Rifat I., (2006). Kriz Dönemlerinde Ürün ve Süreç Esnekliğinin İşletme Performansına Etkileri: Küçük ve Orta Ölçekli Tekstil İşletmelerinde Bir Araştırma. *Erciyes Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 1(21): 247-267.

PressAcademia
www.pressacademia.org/journals/jbef
JBEF
ISSN 2146-7943
Journal of Business, Economics and Finance YEAR 2021 VOLUME 10 ISSUE 2

THE TWIN DEFICITS AND ECONOMIC GROWTH IN SELECTED AFRICAN COUNTRIES

DOI: 10.17261/Pressacademia.2021.1407
JBEF- V.10-ISS.2-2021(4)-p.88-102

Abebe Aragaw
Marmara University, Development economics and economic growth, Istanbul, Turkey.
a.derbie@yahoo.com , ORCID: 0000-0001-8491-5635

Date Received: March 22, 2021 **Date Accepted:** June 16, 2021

To cite this document
Aragaw, A., (2021). The twin deficits and economic growth in selected African countries. Journal of Business, Economics and Finance (JBEF), 10(2), 88-102.
Permanent link to this document: http://doi.org/10.17261/Pressacademia.2021.1407

ABSTRACT

Purpose- The purpose of this paper is to examine the twin deficit hypothesis and its effect on economic growth for selected African countries using panel data ranging from 1988 to 2018.

Methodology- bootstrap panel Granger causality tests and dynamic panel threshold analysis are applied to find out the budget deficit and current account deficit causal relationships and their effect on economic growth.

Findings- Results of the bootstrap panel Granger causality tests confirmed mixed results. Out of 27 countries, results of 16 countries support the Ricardian equivalence hypothesis; this shows that there is no Granger causality running from budget deficit to current account deficit and vice versa. In addition, the results of the dynamic panel threshold model show that the budget deficit-GDP per capita relationship is not linear. Thus, a budget deficit of less than 0.152 percent has a significant positive effect on economic growth. Besides, regime-independent regressors such as current account deficits and government debt have a significant negative impact on GDP per capita. Investment spending, broad money, and political stability, on the other hand, have a significant positive effect.

Conclusion- To sum up, bootstrap panel Granger causality results support no Granger causality running from budget deficit to current account deficit and vice versa. In addition, the dynamic panel threshold analysis suggests that a budget deficit of less than 0.152% and a lower current account deficit growth-enhancing.

Keywords: Twin deficit hypothesis, Granger causality, budget deficit, current account deficit, economic growth, threshold analysis.
JEL codes: E12, H60, H62

1. INTRODUCTION

A tendency for the budget deficit and current account deficit to move in the same direction or simultaneous occurrence of budget and current account deficit is the twin deficit. Twin deficits captured the attention of politicians, economists, and academic Scribblers since the 1980s, and they considered it as a major macroeconomic concern in any economy (Cavallo, 2005).

Theoretically, the budget deficit has a widespread effect on macroeconomic variables. Initially, budget deficit reduces national savings and rounds all over macroeconomic variables. The lower national saving triggers lower investment and lower capital accumulation and results in lower economic growth (Ball & Mankiw, 1995). Most importantly, persistent budget deficit retards capital accumulation and economic growth, even when the economy is at a full-employment level (Friedman, 2005; Zuze, 2016). Conversely, Keynesians argued that budget deficit results from higher government spending increases domestic output and motivates the economy in the short run through its effect on private and public consumption expenditures. Some empirical studies (Erkin, 1988; Cinar et al., 2014; Taylor et al., 2012) also found support to a Keynesian view, positive relationship between budget deficit and economic growth. On the contrary, the Ricardian equivalence hypothesis argued that deficit is merely a postponement of taxes and has no significant effect on aggregate demand. In this setting, the budget deficit is neither good nor bad concerning its impact on economic growth. For example, Rangarajan and Srivastava (2005) and Nelson and Singh (1994) reached a conclusion that budget deficit has an insignificant effect on aggregate demand if households are perfect-foresight.

Furthermore, developing countries fail to cover the costs of technology transfers, import of intermediate goods, and investment goods from the export revenues. For that matter, they are persistently in a current account deficit, and the deficit is regarded as one of the causes for unsteady growth because it is external debt used to finance the gaps (Cural, 2010). However, current account deficits or trade deficits are not always a reflection of an economic problem. When a transition is made from poor agricultural economies into modern industrial economies, fixed costs are financed by foreign borrowing. In such cases, the current account deficit or trade deficit is a sign of economic development (Mankiw N. G., 2010).

On the other hand, the theoretical and empirical studies that examined the causal relationship between budget deficit and current account deficit are categorized into four groups. The first group is the follower of the Keynesian view, which stated that budget deficit has a statistically significant impact on the current account deficit. They argued that budget deficit causes current account deficit through the interest and exchange rate channels. In a small open economy IS-LM framework, an increase in the budget deficit would cause interest rates to rise, resulting in capital inflows. This again leads to an appreciation of the exchange rate due to the higher demand for domestic financial assets (capital inflows) and eventually increases the current account deficit (Baharumshah et al., 2006).

The second group of the literature failed under the Ricardian Equivalence Hypothesis, which states no causal relationship between the two deficits. In other words, there is no budget deficit led Granger causality and vice versa. Barro (1988) indicated that changes in government revenues or expenditures have no real effects on the real interest rate, investment, and the current account balance. The third group argued that the causality runs from current account deficit to budget deficit (reverse causality), especially to those limited domestic resource and commodity-based exporter countries (Sobrino, 2013; Aloryito & Senadza, 2016). While the fourth group argued as there is bidirectional causality (feedback) running from budget deficit to current account deficit, and vice versa. With this regard, several studies are conducted under the subject twin deficit hypothesis: the majority of these studies were for higher-income countries using the time series approach, and it was the US budget deficit that motivated them. This paper, however, investigates the overlooked African economy. Perhaps most importantly, the ambiguous issue of past literature is using static panel data models for causality and co-integration studies. But by definition, Granger causality occurs when past values of covariates influence the present value of endogenous variables (See Granger, 1969; Konya 2006; Dumitrescu and Hurlin, 2012; Tekin, 2012; Kar et al., 2011).

The debate, however, is not only on the channel of causation between the budget deficit and the current account deficit, and their effect on economic growth alone. Thus, finding the appropriate estimation technique for macroeconomic panel data models is also a contentious topic. To this end, this paper tests whether the twin deficit hypothesis, reverse causality, no causality, and bidirectional causality holds for selected African countries employing three different bootstrap panel Granger causality tests. Results of panel Granger causality tests vary from country to country. Out of 27 countries, test results from 16 countries support the Ricardian equivalence hypothesis for all Granger causality testing methods. However, for some countries, the test results provide mixed results. In addition, the current account deficit and budget deficit- economic growth nexus is examined using a dynamic panel threshold model. Accordingly, results prove that the budget deficit-economic growth relationship is nonlinear, and the point estimate of the budget deficit threshold is 0.152%. The rest of the paper is organized as follows: Section two discusses a review of empirical studies. Section three deals with the data, variables, and methodology used. Section four presents empirical results, and the fifth section concludes.

2. REVIEW OF EMPIRICAL STUDIES

Neaime (2008), Lau & Tang (2009), Perera & Liyange (2012), and Zengin (2000) explored the twin deficit hypothesis separately for different countries, such as Lebanon, Cambodia, Sri Lanka, and Turkey using annual time series data and reached the same conclusion. The estimation results confirmed unidirectional short-term causality running from budget deficit to current account deficit, and they recommend governments to take a correction action over the budget deficit. Osoro et al. (2014) and Njoroge (2014) for Kenya and Sakyi&Opoku (2016) for Ghana investigate the long-mooted twin deficit hypothesis, and they placed themselves under the Keynesian umbrella.

Moreover, Mukhtar et al. (2007) and Ganchev (2010) investigate the causality and co-integration between the twin deficits for Pakistan and Bulgaria, respectively. Results in both countries confirmed a stable long-run relationship between the twin deficits, and consequently, bidirectional causality is detected. Using annual time series data ranging from 1980 to 2009 and the OLS estimation technique, Rauf & Khan (2011) checked the twin deficit hypothesis for Pakistan and proved that the current account deficit is the source of a budget deficit. As a result, to curb the budget deficit, the current account deficit should be minimized first. In contrast to unidirectional and bidirectional Granger causality results of the twin deficit hypothesis, studies conducted by Dewald& Ulan (1990) , Enders & Lee (1990), and Winner (1993) for US and Australia respectively confirmed the Ricardian equivalence hypothesis. Dewald& Ulan (1990) conclude as there is no systematic relationship between budget deficit and current

account deficit. Moreover, Enders & Lee (1990) utilized a two-country micro-theoretic model, and results support the Ricardian equivalence hypothesis.

Coming to the effect of twin deficits on economic growth, Genevieve (2020) analyses the short-run and long-run relationships between budget deficit and economic growth using ARDL bound test for Morocco. Findings reveal that budget deficit has a significant negative effect on the Moroccan economy. The same result is found by Fatima et al. (2011) for Pakistan, and it is the poor tax collection and share of defense and debt servicing that causes the budget deficit. Conversely, Cinar et al. (2014) ARDL model estimates support the Keynesian view, a significant positive effect of budget deficit on economic growth.

Deviating from the linear relationships, Slimani (2016) investigates a nonlinear relationship between budget deficit and economic growth. Findings show that budget deficit greater than 4.8% and budget surplus greater than 3.2% have a negative significant effect on developing countries economy. In the same vein, Aero & Ogundipe (2016) analyze the effects of budget deficit on Nigeria's economic growth from 1981 to 2014. Threshold Autoregressive model results confirmed a negative nonlinear relationship between fiscal deficits and economic growth in Nigeria. Accordingly, the threshold estimate which is conducive for economic growth is 5%. Lastly, Şahin & Mucuk (2014) analyze the effect of the current account deficit on economic growth for Turkey using a vector autoregressive regression model. Findings corroborate that the current account deficit affects economic growth negatively for the Turkish economy.

3. RESULTS AND DISCUSSION

3.1. Data and Variables

The panel dataset used in this paper is extracted from IMF world economic outlook, World Bank, and African development bank and covers a period ranging from 1988 to 2018. Using this data the twin deficit hypothesis and their relationship with economic growth is investigated for selected African countries. Variables under the study are selected considering the economic theory and empirical studies (Perera& Liyange, 2012; Mukhtar et al., 2007; Boubtane et al., 2013). The main variables are explained below. Budget deficit (%GDP): calculated as total government expenditures minus total tax revenues. A budget deficit occurs if government spending exceeds the tax revenue in a given period of time, usually a year. Current account deficit (%GDP): calculated as net export plus net transfer payments. A current account deficit occurs when the difference between revenues and costs from trade plus net transfers to the country is negative. Investment spending (% GDP): expressed as a ratio of total investment in current local currency to GDP in current local currency. Real GDP per capita: GDP is expressed in constant international dollars per person and computed by dividing constant price purchasing power parity GDP by total population. Gross government debt (%GDP): measures the gross debt of the government as a percentage of GDP. Broad money (%GDP): measures money supply that includes currency, deposits with an agreed maturity of up to two years, money market fund shares, and debt securities up to two years. Political stability and absence of violence: measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism.

3.2. The Econometric Model

As Hsiao (2006) articulates employing Panel data helps to construct and test more complicated behavioral models and to tackle particular forms of unobserved heterogeneity, than a single cross-sectional or time-series data set would allow. In addition to that, with panel data models, it is possible to exploit more degrees of freedom, more sample variability, higher efficiency, and accurate inference of model parameters.

Panel data models can be static panel data models or dynamic panel data models. The static panel data models like first differencing, fixed effect and random effect models practice OLS, LSDV, and GLS estimators, respectively. However, objectives like causality and co-integration need dynamic modeling. Because dynamic panel data models unraveled the more complex causal relationships through incorporating lag of the dependent variable, contemporaneous and lagged values of covariates (Baltagi, 2008). But, the dynamic panel is not also free from problems. Nickell bias and cross-sectional dependence are the common problems of dynamic panel models. To overcome these problems, Anderson & Hsiao (1981) employed the maximum likelihood estimation technique, Gaibulloev et al. (2014) used the least square dummy variable, and Arellano & Bond (1991) employed GMM estimation technique. Lastly, countries under this panel have similar economic conditions, regional integration, and social interactions, so they have something in common. Moreover, as Nickell (1981) articulated within-group estimator provides inconsistent and biased estimates when there is an endogenous covariate. Considering both cross-sectional dependence and Nickell bias, this study examines the direction of causality and the effect of covariates employing the dynamic panel model presented below.

3.3. The Dynamic Panel Model

Assume a dynamic panel model that depicts the relationship of the dependent variable y_{it} and a single covariate x_{it} with certain assumptions. Where, ηi denotes unobserved time-invariant heterogeneity, ε_{it} denotes idiosyncratic error term and x_{it} in equation (1) could also be a vector containing both contemporaneous and the lag of the covariates.

$$y_{it} = \alpha y_{it-1} + \beta x_{it} + \eta_i + \varepsilon_{it}; \quad i = 1 \dots \dots . N, t = 1 \dots \dots \dots . T \dots \dots \dots . (1)$$

$$\begin{cases} E(\varepsilon_{it}, \varepsilon_{js}) = 0 \ \ i \neq j \ t \neq s \\ E(\eta_i, \varepsilon_{jt}) = 0 \ \ for\ all\ i, j, t \\ E(x_{it}, \varepsilon_{js}) = 0 \ \ for\ all\ i, j, t, s \end{cases}$$

The above autoregressive model could have different problems if the individual specific effect η_i is correlated with x_{it},y_{it-1} and when the lag of the idiosyncratic error term is correlated with contemporaneous and lag of covariates (Kar et al., 2011). Using equation(1) to test the twin deficit hypothesis, Konya (2006) bootstrap panel Granger causality test, Dumitrescu and Hurlin (2012) heterogeneous panel Granger causality test (hereafter DH), and Emirmahmutoglu and Kose (2011) Granger causality test (hereafter EK) for heterogeneous mixed panels are employed. This helps us to check the sensitivity and robustness of results for different methods. The Bootstrap panel Granger causality analysis requires two preconditions. These are the cross-sectional dependence test and individual-specific heterogeneity test. The cross-sectional dependence test is checked using three different test statistics: the Breusch and Pagan (1980) LM test, the Pesaran (2004) CD test, and Pesaran et.al. (2008) LM adjusted test. Moreover, to test the null hypothesis of slope coefficient homogeneity against the alternative hypothesis, the standardized version of Swamy's (1970) test for slope homogeneity proposed by Pesaran and Yamagata (2008) is employed. Lastly, the optimal lag length is determined through Akaike information criterion (AIC) and Schwarz information criterion (SIC).

In particular, the bootstrap panel Granger causality test following Konya's (2006) method has various advantages. First, with this method no needs to pre check whether series are stationary or not. Second, it captures both cross-sectional dependence and individual heterogeneity. Third, this method provides panel Granger causality test results for each individual country. Investigation of the twin deficit hypothesis based on Konya (2006) bootstrap panel Granger causality method uses the bivariate SUR system equation below:

$$\left.\begin{aligned} CAB_{1,t} &= \eta_{1,1} + \sum_{l=1}^{mlCAB_1} \alpha_{1,1l} CAB_{1,t-1} + \sum_{l=1}^{mlBudget_1} \beta_{1,1l} Budget_{1,t-1} + \varepsilon_{1,1,t} \\ CAB_{2,t} &= \eta_{1,2} + \sum_{l=1}^{mlCAB_1} \alpha_{1,2l} CAB_{2,t-1} + \sum_{l=1}^{mlBudget_1} \beta_{1,2l} Budget_{2,t-1} + \varepsilon_{1,2,t} \quad \dots \dots \dots \dots \dots \dots \dots \dots . (2) \\ CAB_{N,t} &= \eta_{1,N} + \sum_{l=1}^{mlCAB_1} \alpha_{1,Nl} CAB_{N,t-1} + \sum_{l=1}^{mlBudget_1} \beta_{1,Nl} Budget_{N,t-1} + \varepsilon_{1,N,t} \end{aligned}\right\}$$

$$i = 1 \dots \dots . N, t = 1 \dots \dots \dots . T$$

$$\left.\begin{aligned} Budget_{1,t} &= \eta_{2,1} + \sum_{l=1}^{mlBudget_2} \alpha_{2,1l} Budget_{1,t-1} + \sum_{l=1}^{mlCAB_2} \beta_{2,1l} CAB_{1,t-1} + \varepsilon_{2,1,t} \\ Budget_{2,t} &= \eta_{2,2} + \sum_{l=1}^{mlBudget_2} \alpha_{2,2l} Budget_{2,t-1} + \sum_{l=1}^{mlCAB_2} \beta_{2,2l} CAB_{2,t-1} + \varepsilon_{2,2,t} \quad \dots \dots \dots \dots \dots \dots \dots \dots (3) \\ Budget_{N,t} &= \eta_{2,N} + \sum_{l=1}^{mlBudget_2} \alpha_{2,Nl} Budget_{N,t-1} + \sum_{l=1}^{mlCAB_2} \beta_{2,Nl} CAB_{N,t-1} + \varepsilon_{2,N,t} \end{aligned}\right\}$$

$$i = 1 \dots \dots . N, t = 1 \dots \dots \dots . T$$

Where CAB, is the current account deficit, $Budget$ is budget deficit, ηi is unobserved heterogeneity and εit is an idiosyncratic error term. Estimation of equations (2) and (3) hinges on the properties of the idiosyncratic error terms; if there is no contemporaneous correlation among countries; OLS estimation for each country separately works. Albeit if there is any contemporaneous correlation among countries, it is the SUR estimation carried out. Therefore in this paper, the SUR system equations are estimated. With respect to the SUR systems, in the country (I), there is one-way Granger causality running from $Budget$ to CAB if in equation (2) one of the slope parameters attached to $Budget$ (βs) are different from zero, by the same

token, there is one-way Granger causality running from CAB to $Budget$ if in equation (3) one of the slope parameters attached to CAB (βs) are different from zero. DH heterogeneous panel Granger causality test is based on vector autoregressive regression model and assumes no cross-sectional dependency. However, a recent development through the use of Monte Carlo simulation shows that even under the conditions of cross-sectional dependency, the DH test produces strong results. In addition, bootstrap critical values are used in alleviating problems related to cross-sectional dependence. Suppose a dynamic panel model that depicts the relationship of the budget deficit and current account deficit, observed for N countries and T periods with certain assumptions. Lag orders (K) are identical for all countries involved in the study, and the panel is balanced. Besides, the slope parameters of both current account deficit and budget deficit vary for each country.

$$\begin{cases} CAB_{i,t} = \sum_{K=1}^{K} \alpha i^k CAB_{i,t-k} + \sum_{K=1}^{K} \beta i^k Budget_{i,t-k} + \eta_i + \varepsilon_{it} \\ Budget_{i,t} = \sum_{K=1}^{K} \alpha i^k Budget_{i,t-k} + \sum_{K=1}^{K} \beta i^k CAB_{i,t-k} + \eta_i + \varepsilon_{it} \end{cases} \quad ---------- (4)$$

$$i = 1 \dots \dots . N, t = 1 \dots \dots \dots . T \quad E(\varepsilon_{it}, \varepsilon_{js}) = 0 \;\; i \neq j \; t \neq s$$

$$E(\eta_i, \varepsilon_{jt}) = 0 \text{ for all } i, j, t \quad E(x_{it}, \varepsilon_{js}) = 0 \;\; \text{for all} \;\; i, j, t, s$$

In the equation, K ,αi^k and βi^k indicate lag length, autoregressive parameter, and slope parameter, respectively. The null hypothesis indicates no Granger causality from budget deficit to current account deficit in all countries, while the alternative hypothesis indicates that there is Granger causality from budget deficit to current account deficit in at least one country. Technically speaking,

$$\text{H0}: \beta_i = 0 \text{ for all } i = 1,2 \dots \dots \dots N \text{ and H1}: \beta_i \neq 0 \text{for all } i = 1,2 \dots \dots \dots N$$

$$\text{H1}: \beta_i \neq 0 \text{ for all } N1 + 1, N1 + 2, \dots \dots . . N$$

The EK Granger causality test extends the LA-VAR approach of Toda & Yamamoto (1995) for heterogonous mixed panels. It can be applied for stationary, non-stationary, co-integrated, and non-integrated series. In short, it is a bivariate Toda & Yamamoto (1995) time series causality approach adapted to heterogeneous mixed panels. It considers both issues of cross sectional dependence and heterogeneity. To fix the estimation issues of cross-sectional dependency, and to have valid fisher test statistic, bootstrap critical values are used. We consider the level VAR model with $k_i + \text{ d max}_i$ lags in heterogeneous mixed panels:

$$\begin{cases} CAB_{i,t} = \sum_{j=1}^{k_i + \text{ d max}_i} \alpha_{11}, \text{ij} CAB_{i,t-j} + \sum_{j=1}^{k_i + \text{ d max}_i} \alpha_{12}, \text{ij} Budget_{i,t-j} + \eta^y{}_i + \varepsilon^y{}_{\text{i,t}} \\ Budget_{i,t} = \sum_{j=1}^{k_i + \text{ d max}_i} \alpha_{21}, \text{ij} Budget_{i,t-j} + \sum_{j=1}^{k_i + \text{ d max}_i} \alpha_{22}, \text{ij} CAB_{i,t-j} + \eta^x{}_i + \varepsilon^x{}_{\text{i,t}} \end{cases} \quad --- (5)$$

$$i = 1 \dots \dots . N, t = 1 \dots \dots \dots . T \quad E(\varepsilon_{it}, \varepsilon_{js}) = 0 \;\; i \neq j \; t \neq s$$

$$E(\eta_i, \varepsilon_{jt}) = 0 \text{ for all } i, j, t \quad E(x_{it}, \varepsilon_{js}) = 0 \;\; \text{for all} \;\; i, j, t, s$$

Where $\text{d max}_{i,}$ is maximal order of integration suspected to occur in the system for each$i$, andk_i is the lag structure. In simplicity, we focus on testing causality from budget deficit to current account deficit and vice versa.

$$\text{H0}: \beta_i = 0 \text{ for all } i = 1,2 \dots \dots \dots N \text{ and H1}: \beta_i \neq 0 \text{for all } i = 1,2 \dots \dots \dots N$$

$$\text{H1}: \beta_i \neq 0 \text{ for all } N1 + 1, N1 + 2, \dots \dots . . N$$

From the above three Granger causality test methods, DH and EK methods require a unit root test as a preliminary check. Moreover, the dynamic panel threshold model needs stationary series. This paper, therefore, utilizes the Levin– Lin–Chu (2002) and Fisher-type (Choi 2001) unit root tests. The fisher-type unit-root test mimics the augmented Dickey-Fuller test, and it does not require a balanced panel, as in the case of the Im–Pesaran–Shin (2003) unit root test (Choi 2001). Additionally, one can use different lag lengths in the individual ADF regression. To deal with cross-sectional dependence both the Levin–Lin–Chu (2002) and Fisher-type (Choi 2001) unit root tests are performed with the demean option. Furthermore, in this empirical application to

investigate the effect of twin deficits on economic growth, the dynamic panel threshold model is adopted. The economic growth model is borrowed from Adam & Bevan (2005).

$$y_{it} = y_{it-1} + \beta_1 x_{it}(\mathrm{q}_{it} < \emptyset_1) + \beta_2 x_{it}(\emptyset_1 \leq \mathrm{q}_{it} \leq \emptyset_2) + \beta_3 x_{it}(\mathrm{q}_{it} \geq \emptyset_2) + \eta_1 z_{it} + \varepsilon_{it} \ldots\ldots (6)$$

Where ε_{it}=$\mu_{it} + \gamma_{it}$, includes the fixed effect.

Equation (6) can be re write as follows:

$$y_{it} = \alpha y_{it-1} + \beta_1 x_{it}(\mathrm{qit} < \emptyset_1) + \eta_1 z_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots (7).$$

Where x_{it} is;

$$x_{it}(\mathrm{q}_{it}, \emptyset) = \begin{cases} x_{it} I(\mathrm{q}_{it} < \emptyset_1) \\ x_{it} I(\emptyset 1 \leq \mathrm{q}_{it} \leq \emptyset_2) \\ x_{it} I(\mathrm{q}_{it} \leq \emptyset) \end{cases}$$

The dependent variable, y_{it} (real GDP per capita in logarithm) is scalar, the threshold variable, q_{it} (budget deficit) is scalar and the regressor x_{it} (budget deficit) is explanatory variable which is threshold dependent and z_{it} is a vector of explanatory variables which are not dependent on a threshold variable. The vector of z_{it} is consist of regime independent variables like current account deficit (%GDP), public debt (%GDP), investment spending (%GDP), political stability and absence of violation or terrorism, broad money (%GDP) and lags of the dependent variable as instrument. While, ε_{it} is white noise idiosyncratic error term with zero mean and finite variance (σ^2), and $I(.)$ is the indicator function. As a first step, the linearity test is conducted through Wald tests, fisher tests, and likelihood ratio tests.

Once the threshold model is validated, in the second step, the dynamic panel threshold model has estimated through the Arellano & Bover (1995) generalized method of moment (GMM) technique. Because estimating equation (6) or equation (7) with LSDV provides biased and incorrect inferences. However, this problem is deciphered by using the forward orthogonal deviations transformation suggested by Arellano & Bover (1995), which avoids fixed effects and serial correlation in the transformed errors simultaneously. Instead of first differencing, the fixed effect is eliminated by subtracting the average of all future available observations of a variable.

4. RESULTS AND DISCUSSION

4.1. Data Driven Stylized Facts

This study covers 27 African countries. The main variables of interest are budget deficit, current account deficit, and economic growth. The budget balance and current account balance in these countries are persistently negative: they are in a deficit arena for more than two decades. Table (1) presents the mean values of budget balance, current account balance, and real GDP per capita for six periods. Each period contains the mean value of the variables for five years. Period (1) registered -3.6%, -5.97%, and $2475.383 budget balance, current account balance, and real GDP per capita, respectively. In period (2), both the budget deficit and current account deficit surpass 5% of the GDP (-5.67% and -6.59%) and whereas real GDP per capita drops from $2475.38 to $1995.23. Even if the current account deficit is continually increasing (except in period three), the budget deficit falls in the third, fourth, and fifth periods. Consequently, the real GDP per capita reached $3091 in period six, with a higher current account deficit (-8.5%).

Table 1: Summary of Main Variables

Period	GDP	Budget	CAB
1988-1992[1]	2475.3832	-3.613908	-5.9724742
1993-1997[2]	1995.2363	-5.6682003	-6.5900534
1998-2002[3]	2059.8243	-3.8243845	-4.3239778
2003-2007[4]	2293.0452	-3.0744694	-5.1621111
2008-2012[5]	2753.3262	-1.3005926	-5.9650667
2013-2018[6]	3091.7654	-3.7508254	-8.5893968

Source: Author's computation (2020) using world economic outlook (2019) data.

Table (2) presents the descriptive statistics of variables: the mean, standard deviation, minimum values, and maximum values of each variable are displayed. For the panel understudy, a maximum of 40% budget surplus, a minimum of 53% budget deficit, and -3.5% mean value of budget balance are recorded within the research period (1988 to 2018). Additionally, 40.8%, 98.8%, and -6.2% of current account surplus, deficit, and mean value are recorded within the research period. Real GDP per capita varies between $406.66 and $11869.53, with a mean value of $2485.51.

Table 2: Descriptive Statistics

Variable	Mnemonic	Mean	Std	Min	Max
Budget deficit (%GDP)	Budget	-3.549989	4.746069	-53.00001	40.34
Current account deficit (%GDP)	CAB	- 6.265217	8.656515	98.889	40.863
Investment (%GDP)	INV	20.74122	10.81672	2.323	82.478
Broad money (%GDP)	M3	28.72185	20.56682	0.99024	119.348
Political stability	PS	-0.8360701	0.7528189	-2.844653	1.04893
Debt (%GDP)	Debt	77.70033	62.62148	8.366	723.0097
Real GDP per capita	GDP	2485.518	2266.886	406.663	11869.53

Source: Author's computation (2020) using IMF, WB and AFDB data

4.2. Econometrics Estimation Results

4.2.1. Cross- Sectional Dependence, Slope Homogeneity and Unit Root Tests

The cross-sectional dependence tests deployed in this study are the LM, CD, and LM adjusted, and all of them are complementary, not competing. Results displayed in a table (3) are the outputs of cross-sectional dependence tests and slope homogeneity tests. The first segment of the table shows the result of cross-sectional dependence tests. Accordingly, the null hypothesis of no cross-sectional dependence is rejected with all methods. This indicates that any shock that occurred in one of the selected African countries transmitted to others. The second segment of the table (Δ and Δ adj test) shows Pesaran and Yamagata's (2008) slope homogeneity test results. According to the test results, the null hypothesis of slope homogeneity is rejected. Then results enforce to consider the heterogeneity in estimating the causation between budget deficit and current account deficit.

Table 3: Cross- Sectional Dependence and Slope Homogeneity Test

Cross-sectional dependence test		
Method	Test statistics	p-value
CD test	1.98	0.0478
LM test	660.2	0.0000
LM adjusted	31.85	0.0000
Slope homogeneity test		
Δ	7.862	0.000
Δ adj	8.272	0.000

Source: Author's computation (2020).

4.2.2. Unit Root Tests

As explained in the methodology part, DH and EK bootstrap panel Granger causality testing methods require stationary series as an initial requirement. Additionally, the dynamic panel threshold analysis also provides non-spurious estimates when the variables are stationary. For this matter, unit root test methods such as the Levin– Lin–Chu (2002) and Fisher-type (Choi 2001) are performed with a demean option.

Table 4: Levin-Lin-Chu and Fisher-Type (ADF) Unit-Root Tests

Variables	Levin-Lin-Chu unit-root test	Fisher type (ADF) unit-root test
Budget	-6.6174***	24.0555***
CAB	-6.7817***	21.1601***
INV	-5.4134 ***	14.8397***
M3	-1.9114**	12.4113***
PS	0.2047	9.2571***
Debt	-4.7997***	13.0194***
GDP	-1.8563 **	11.0212***

*** p<0.01, ** p<0.05, * p<0.1
Source: Author's computation (2020).

Accordingly, a panel unit root test based on Levin et al. (2002) and Fisher-type unit-root test results are presented in table (4) column 2&3, respectively. Results show that both methods reject the null hypothesis (variables are non-stationary) for all variables under study. That means the mean and variance of variables do not vary systematically with time. Finally, in all the methods, the optimal lag length is determined through the information criterion, and bootstrap critical values for 1000 replications are used (Poi, 2004).

4.2.3. Panel Data Granger Causality Test Results

Tables (5) and (6) present the results of the bootstrap panel Granger causality tests performed using the Konya (2006) method. The null hypothesis in both tables asserts that no Granger causality running from budget deficit to current account deficit, and vice versa. According to table (5), for many of the countries studied, the results do not reject the null hypothesis of no Granger causality running from budget deficit to current account deficit. Significant causation from budget deficit to current account deficit is recorded only for a single country, Cote d'Ivoire.

Table 5: Konya Granger Causality Test Results (H0: Budget Does Not Cause CAB)

		Bootstrap Critical Values		
Country	Test statistics	1%	5%	10%
Angola	27.375	759.098	315.733	181.546
Burundi	0.540	831.677	423.479	278.620
Benin	1.249	860.399	411.343	248.050
Burkina Faso	3.265	817.410	328.946	208.577
Central African Rep	0.308	576.758	252.007	146.428
Cote d'Ivoire	231.576**	472.347	231.250	166.004
Congo, Dem. Rep.	8.521	744.586	321.768	214.999
Egypt	0.003	1672.720	590.436	351.912
Ethiopia	24.070	1169.609	490.939	317.407
Ghana	2.155	827.914	420.126	305.170
Guinea	61.602	758.098	341.012	240.785
Guinea-Bissau	8.255	692.688	332.235	202.280
Kenya	21.520	700.332	352.576	260.756
Morocco	0.302	948.978	454.314	293.590
Madagascar	0.934	813.124	351.130	244.536
Mali	0.806	2198.707	376.298	199.347
Mauritania	1.617	819.609	396.927	263.882
Malawi	0.111	730.434	410.379	277.767
Niger	5.749	736.613	283.329	177.936
Rwanda	24.204	760.500	285.850	169.712
Sudan	22.224	821.347	350.318	210.593
Sierra Leone	0.123	948.878	343.547	220.814
Chad	0.696	1007.746	347.378	247.752
Togo	2.435	1119.416	393.662	282.213
Tunisia	29.421	764.602	409.897	272.273
Tanzania	55.338	772.208	339.915	232.864

Uganda	34.951	535.263	279.172	181.205

Source: Author's computation (2020) using GAUSS 20. Note: *** p<0.01, ** p<0.05, * p<0.1.

Results from table (6) also revealed that no Granger causality is running from current account deficit to budget deficit, except for Kenya. To sum up, there is not sufficient evidence to reject the null hypothesis, even at a 10% level of significance, for countries such as Angola, Burundi, Benin, Burkina Faso, Central African Rep, Congo, Dem. Rep, Egypt, Ethiopia, Ghana, Guinea, Guinea-Bissau, Morocco, Madagascar, Mali, Mauritania, Malawi, Niger, Rwanda, Sudan, Sierra Leone, Chad, Togo, Tunisia, Tanzania, and Uganda. And we noted that the Granger causality results of Konya's method are lopsided to the Ricardian equivalence hypothesis and contrasts with findings by Lau & Tang (2009), Rauf & Khan (2011), and Mukhtar et al. (2007). But, it supports the findings of Odim et al. (2014), Ogbonna (2013) and Ncanywa&Letsoalo (2019).

Table (7) and (8) successively report DH heterogeneous panel Granger causality test results and EK extended LA-VAR Granger causality test results. Table (7a) presents the one-way Granger causality recorded from budget deficit to current account deficit for countries such as Cote d'Ivoire, Guinea, and Tanzania. Similarly, table (7b) presents the one-way Granger causality recorded from current account deficit to budget deficit for countries such as Central Africa, Kenya, Mauritania, and Uganda, and bidirectional Granger causality recorded for Sudan. The remaining 16 countries support the Ricardian equivalence hypothesis.

Table 6: Konya Granger Causality Test Results (H0: CAB Does Not Cause Budget)

		Bootstrap Critical Values		
Country	**Test statistics**	**1%**	**5%**	**10%**
Angola	8.346	955.157	351.955	224.658
Burundi	0.022	749.253	368.169	255.158
Benin	0.763	786.046	291.622	186.692
Burkina Faso	1.886	460.630	208.162	134.773
Central African Rep	123.102	743.524	282.053	196.867
Cote d'Ivoire	2.711	694.624	292.082	192.767
Congo, Dem. Rep.	2.302	823.458	423.096	282.466
Egypt	12.734	766.840	340.436	218.843
Ethiopia	0.643	689.035	377.768	234.709
Ghana	24.451	794.029	361.825	246.776
Guinea	9.256	710.871	344.396	240.655
Guinea-Bissau	2.049	566.291	272.233	185.594
Kenya	228.715*	707.828	290.274	210.427
Morocco	0.335	692.474	280.021	165.651
Madagascar	2.563	563.387	301.442	207.156
Mali	9.275	701.609	299.660	218.913
Mauritania	60.412	846.367	364.536	229.048
Malawi	0.146	645.064	314.010	196.257
Niger	8.714	451.617	263.075	197.097
Rwanda	0.287	735.663	375.086	239.524
Sudan	32.785	1114.258	351.826	216.786
Sierra Leone	0.390	706.322	279.549	171.979
Chad	1.736	933.051	393.669	239.780
Togo	0.414	1071.230	548.077	381.160
Tunisia	7.168	487.661	283.624	209.017
Tanzania	17.705	582.400	304.949	204.592
Uganda	20.168	527.317	270.502	174.258

Source: Author's computation (2020) using GAUSS 20. Note: *** p<0.01, ** p<0.05, * p<0.1.

Table (8a) presents budget deficit-led Granger causality test results. Results corroborated that budget deficit-led Granger causality results are found for Angola, Cote d'Ivoire, Guinea, Guinea-Bissau, Tanzania, and Uganda. Table (8b) presents current account deficit-led Granger causality test results. And thus, significant Current Account deficit-led Granger causality is recorded for central Africa and Tunisia alone. While for Sudan, a bidirectional Granger causality result is reported.

Table 7: DH Granger Causality Test Results

	Budget does not cause CAB		CAB does not cause Budget	
	(a)		(b)	
Country	**Test statistics**	**P value**	**Test statistics**	**P value**
Angola	1.686	0.194	0.522	0.47
Burundi	0.000	0.988	0.303	0.582
Benin	0.73	0.393	0.002	0.967
Burkina Faso	0.078	0.78	0.010	0.921
Central African Rep	0.069	0.792	3.976	0.046**
Cote d'Ivoire	12.016	0.001***	0.089	0.765
Congo, Dem. Rep.	0.562	0.453	0.015	0.902
Egypt	0.172	0.678	1.075	0.3
Ethiopia	1.443	0.23	0.196	0.658
Ghana	0.098	0.754	1.350	0.245
Guinea	8.782	0.003***	0.022	0.882
Guinea-Bissau	0.815	0.367	0.019	0.891
Kenya	0.77	0.38	30.835	0.000***
Morocco	0.006	0.939	0.157	0.692
Madagascar	0.007	0.934	0.338	0.561
Mali	0.503	0.478	0.526	0.468
Mauritania	0.474	0.491	4.595	0.032**
Malawi	0.009	0.924	0.009	0.925
Niger	0.05	0.824	0.070	0.791
Rwanda	2.074	0.15	0.063	0.803
Sudan	7.643	0.006***	6.038	0.014**
Sierra Leone	0.153	0.696	0.116	0.733
Chad	0.158	0.691	0.028	0.866
Togo	0.61	0.435	0.003	0.958
Tunisia	1.042	0.307	2.134	0.144
Tanzania	3.445	0.063*	1.045	0.307
Uganda	1.692	0.193	3.879	0.049**
Panel Z_NT	2.462	0.014***	4.139	0.000***
Bootstrap cv (10%)	1.941		1.915	
Bootstrap cv (5%)	2.504		2.525	
Bootstrap cv (1%)	4.058		3.806	

Source: Author's computation (2020) using GAUSS 20. Note: *** p<0.01, ** p<0.05, * p<0.1

Generally, results of 17 countries for all panel Granger causality testing methods speak the same result. Out of 17 countries, 16 countries support the Ricardian equivalence hypothesis, and a single country, Cote d'Ivoire, supports budget deficit-led Granger causality. Whereas test results for nine countries are consistent for two methods. Specifically, Guinea and Tanzania causality test results support the Keynesian hypothesis (budget deficit-led Granger causality), Sudan and Kenya causality test results support bidirectional Granger causality, and Central Africa causality test results support the reverse Granger causality for DH and EK Granger causality test methods. While results for Angola and Guinea-Bissau confirm the Ricardian equivalence hypothesis for both Konya and DH Granger causality test methods. No significant causality was again recorded in Mauritania and Tunisia for Konya and EK Granger causality test methods. Moreover, a single country Uganda has different results for all testing methods. More or less, the findings of bootstrap panel Granger causality are mixed and lopsided to the Ricardian equivalence hypothesis and are consistent with Enders & Lee (1990), Winner (1993), and Emirmahmutoglu et al. (2014) findings.

Table 8: EK Granger Causality Test Results

	Budget does not cause CAB		CAB does not cause Budget	
	(a)		(b)	
Country	**Test statistics**	**P value**	**Test statistics**	**P value**
Angola	5.89	0.015**	1.073	0.300
Burundi	0.05	0.823	0.937	0.333
Benin	0.186	0.666	1.685	0.194
Burkina Faso	0.149	0.700	0.382	0.536
Central African Rep	0.915	0.339	4.379	0.036**
Cote d'Ivoire	3.349	0.067*	0.256	0.613
Congo, Dem. Rep.	0.08	0.777	0.122	0.727
Egypt	0.054	0.816	0.137	0.711
Ethiopia	1.06	0.303	2.366	0.124
Ghana	0.414	0.520	0.495	0.482
Guinea	7.552	0.006***	0.503	0.478
Guinea-Bissau	8.744	0.003***	1.388	0.239
Kenya	4.004	0.045**	19.917	0.000***
Morocco	1.05	0.305	0.107	0.744
Madagascar	0.02	0.887	0.125	0.724
Mali	0.361	0.548	0.114	0.736
Mauritania	0.938	0.333	2.044	0.153
Malawi	0.005	0.946	0.040	0.842
Niger	0.004	0.947	0.018	0.893
Rwanda	0.101	0.75	1.307	0.253
Sudan	31.546	0.000***	49.668	0.000***
Sierra Leone	0.017	0.896	0.044	0.833
Chad	0.005	0.942	0.826	0.363
Togo	0.844	0.358	0.138	0.711
Tunisia	0.093	0.76	3.666	0.056*
Tanzania	5.009	0.025**	1.576	0.209
Uganda	3.767	0.052*	0.821	0.365
Panel Fisher	108.944	0.000***	128.469	0.000 ***
Bootstrap cv (10%)	72.562		73.359	
Bootstrap cv (5%)	78.992		78.773	
Bootstrap cv (1%)	100.014		95.446	

Source: Author's computation (2020) using GAUSS 20. Note: *** p<0.01, ** p<0.05, * p<0.1.

4.2.4. Twin Deficits and Economic Growth Results

The dynamic panel threshold model stated in equation (6) is estimated to capture twin deficits- economic growth relationships. As a preliminary step, table (9) presents linearity test results because threshold analysis assumes a nonlinear relationship between variables. Results of the linearity test show that the null hypothesis is rejected for the entire three test statistics. Thus, the relationship that exists between budget deficit and economic growth is nonlinear.

Table 9: Linearity Test

Method	Test statistics	p-value
Wald Tests (LM)	12.81245	0.0768*
Fisher Tests (F)	1370.932	0.0000***
LRT Tests (LM)	12.91844	0.0741*

Source: Authors computation (2020) using R software. Note: *** p<0.01, ** p<0.05, * p<0.1

Tables (10) and (11) show the results of the dynamic panel threshold model. Table (11) reports the estimated budget deficit threshold level (0.152%), and any deviations below this level have a significant positive effect, whereas deficits above 0.152% do not affect economic growth. More specifically, a 1% increase in budget deficit increases real GDP per capita by about 0.62%. On the contrary, the result nullified the budget deficit- real GDP per capita nexus for a budget deficit above 0.152%. Even though the magnitude is lower, in comparison, our result is consistent with the results of Akosah (2013) and Slimani (2016). The budget deficit is detrimental if it surpasses 4% and 4.8%, respectively, for Akosah (2013) and Slimani (2016).

Table 10: Threshold Estimates

Threshold estimates	
γ	0.1522852
95% confidence interval	(0.0000761, 1.55893)
Effect of budget deficit	
β_1	0.0062165 **
	(0.0030005)
β_2	0.0049876
	(0.0033088)

Source: Author's computation (2020) using R software. Note: *** p<0.01, ** p<0.05, * p<0.1

Table (11) presents the effect of regime-independent regressors on economic growth. Current account deficits and government debt have a significant negative effect. A 1% increase in current account deficit and government debt decreases real GDP per capita by about 0.4% and 0.17%, respectively. Furthermore, a significant positive effect is reported for the lag value of real GDP per capita, investment spending (%GDP), broad money (%GDP), and political stability. Other things constant, 1% increase in a lag of real GDP per capita, investment spending, political stability, and broad money increases real GDP per capita by about 1.47%, 0.51%, 0.56%, and 0.4%, respectively. Thus, the result from the dynamic panel threshold model is against the conventional budget deficit growth-enhancing strategy and consistent with the findings of Adam & Bevan (2005) and Şahin & Mucuk (2014), for the effect of the budget deficit and current account deficit, respectively.

Table 11: Effect of regime independent regressors

Covariates	Coefficients	Standard error	P-value
Initial	0.0147048	0.0065160	0.0240257 **
CAB	-0.0039256	0.0018559	0.0344163 **
INV	0.0051700	0.0013685	0.0001582 ***
M3	0.0040562	0.0010748	0.0001607 ***
PS	0.0593146	0.0209092	0.0045572 ***
Debt	-0.0016962	0.0001938	0.000 ***
δ	0.0525698	0.0189732	0.005593 **
N= 27		Observations= 837	

Source: Authors computation (2020) using R software. Note: *** p<0.01, ** p<0.05, * p<0.1

5. CONCLUSION

This paper examines the twin deficit hypothesis and its effect on economic growth for selected African countries covering the period 1988 to 2018. For this purpose, Granger causality tests are performed using the seemingly unrelated regression model, vector autoregressive model, and lag augmented vector autoregressive model. Results of three different panel Granger causality test methods presented mixed results; results vary from country to country, out of 27 countries, results of 16 countries support the Ricardian equivalence hypothesis for all Granger causality testing methods. That means there is no Granger causality running

from budget deficit to current account deficit and vice versa. As if a budget deficit led Granger causality holds for Cote d'Ivoire in all methods, for the remaining countries, reverse causality, no causality, and bidirectional causality results are confirmed for two test methods. Results for nine countries are consistent for two methods, not for all. Specifically, Guinea and Tanzania test results support the conventional Keynesian hypothesis, Sudan and Kenya test results support bidirectional causality, and Central Africa test results support the reverse causality, for two Granger causality test methods. Whereas Angola, Guinea-Bissau, Tunisia, and Mauritania test results support the Ricardian equivalence hypothesis for two Granger causality test methods.

Additionally, the dynamic panel threshold model is estimated to detect the effect of the twin deficits and other explanatory variables on economic growth. Results revealed that the relationship between the budget deficit and real GDP per capita is nonlinear. The budget deficit threshold level is 0.152%, and any deviation below 0.152 percent has a significant positive effect on economic growth. Furthermore, findings indicate that current account deficit and debt have a detrimental effect on economic growth. On the other hand, enhancing investment spending, promoting financial institutions, and stable politics are beneficial in assuring economic growth. To sum up, this paper presented a straightforward answer to the research questions laid down. The bootstrap panel Granger causality results support the Ricardian equivalence hypothesis for many of the countries, allowing policymakers to gain new insights into the twin deficit hypothesis. Additionally, the dynamic panel threshold model suggests a budget deficit of less than 0.152 percent and a lower current account deficit. These findings are consistent with Buchanan (1976) with specific differences. Buchanan (1976) argued that aggregate spending might increase by the straightforward issue of money than a tax cut.

Finally, this paper cast light on the fiscal and trade policy of African countries. For decades, both budget deficit and current account deficit are the hallmarks of African economies. Africans, therefore, should carefully revise their fiscal policy either to restore the ever-lower tax income or to invest in productive ventures and minimize the budget deficit. Along with productive investments, big emphasis should be given to public debt and current account deficits because they have a detrimental effect on the economy. Lastly, switching from fiscal policy instruments to monetary policy instruments, for example, increasing the broad money supply is necessary. However, this all needs stable politics.

REFERENCES

Adam, C. S., & Bevan, D. L. (2005). Fiscal deficits and growth in developing countries. *Journal of Public Economics*, *89*(4), 571-597.

Aero, O., & Ogundipe, A. (2016). Fiscal deficit and economic growth in Nigeria: Ascertaining a feasible threshold. *International Journal of Economics and Financial Issues, 8*(3), 296.

Akosah, N. K. (2013). Threshold effect of budget deficits on economic growth in Ghana: An empirical analysis. *Available at SSRN 2289523*.

Aloryito, G. K., &Senadza, B. (2016). The twin deficits hypothesis: Evidence from Ghana. *International Journal of Business and Economic Sciences Applied Research, 9*(3), 55-62.

Anderson, T. W., & Hsiao, C. (1981). Estimation of dynamic models with error components. *Journal of the American Statistical Association*, *76*(375), 598-606.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*(1), 29-51.

Baharumshah, A. Z., Lau, E., & Khalid, A. M. (2006). Testing twin deficits hypothesis using VARs and variance decomposition. *Journal of the Asia Pacific Economy*, *11*(3), 331-354.

Ball, L., &Mankiw, N. G. (1995). What do budget deficits do? NBER working paper No. 5263

Baltagi, B. (2008). *Econometric analysis of panel data*.Chichester, UK:John wiley & Sons

Barro, R. (1988). The Ricardian approach to budget deficits. NBER working paper No. w2685

Boubtane, E., Coulibaly, D., & Rault, C. (2013). Immigration, unemployment and GDP in the host country: Bootstrap panel Granger causality analysis on OECD countries. *Economic Modelling*, *33*, 261-269.

Breusch, T. S., & Pagan, A. R. (1980). The Lagrange multiplier test and its applications to model specification in econometrics. *The Review of Economic Studies*, *47*(1), 239.

Buchanan, J. M. (1976). Barro on the Ricardian equivalence theorem. *Journal of Political Economy*, *84*(2), 337-342.

Cavallo, M. (2005). Understanding the twin deficits: New approaches, new results. FRBSF Economic Letter, Federal Reserve Bank of San Francisco issue jul22.

Cinar, M., Eroglu, I., &Demirel, B. (2014). Examining the role of budget deficit policies in economic growth from a Keynesian perspective. *International Journal of Economics and Finance, 6*(10), 191-200.

Choi, I. (2001). Unit root tests for panel data. *Journal of International Money and Finance*, *20*(2), 249-272.

Dewald, W. G., & Ulan, M. (1990). The twin-deficit illusion. *Cato Journal, 9(3)*, 689-707.

Dumitrescu, E., &Hurlin, C. (2012). Testing for Granger non-causality in heterogeneous panels. *Economic Modelling*, *29*(4), 1450-1460.

Emirmahmutoglu, F., Bolat, S., & Belke, M. (2014). The Dynamic Linkages of Budget Deficits and Current Account Deficits Nexus in EU Countries: Bootstrap Panel Granger Causality Test. *International Journal of Economic Perspectives, 8*(2).

Emirmahmutoglu, F., & Kose, N. (2011). Testing for Granger causality in heterogeneous mixed panels. *Economic Modelling*, *28*(3), 870-876.

Enders, W., & Lee, B. (1990). Current account and budget deficits: Twins or distant cousins? *The Review of Economics and Statistics*, *72*(3), 373-381.

Erkin, B. (1988). Government Expenditure and Economic Growth: Reflections on Professor Ram's Approach, A New Framework and Some Evidence from New Zealand Time Series Data. *Keio Economic Studies*, *25*(1), 59-66.

Fatima, G., Ahmed, A. M., & Rehman, W. U. (2011). Fiscal deficit and economic growth: An analysis of Pakistan's economy. *International Journal of Trade, Economics and Finance*, 501-504.

Friedman, B. (2005). Deficits and debt in the short and long run. NBER Working Papers 11630, National Bureau of Economic Research, Inc.

Gaibulloev, K., Sandler, T., & Sul, D. (2014). Dynamic panel analysis under cross-sectional dependence. *Political Analysis*, *22*(2), 258-273.

Ganchev, G. T. (2010). The twin deficit hypothesis: the case of Bulgaria. *Financial theory and Practice, 34*(4), 357-377

Genevieve, G. (2020). The impact of fiscal deficit on economic growth: Using the Bounds test approach in the case of Morocco, MPRA paper 98925.

Granger, C. W. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica*, *37*(3), 424.

Hsiao, C. (2006). Panel data analysis - Advantages and challenges. IEPR working papers 06.49, Institute of Economic Policy Research.

Im, K. S., Pesaran, M., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, *115*(1), 53-74.

Kar, M., Nazlıoğlu, Ş., & Ağır, H. (2011). Financial development and economic growth nexus in the MENA countries: Bootstrap panel Granger causality analysis. *Economic Modelling*, *28*(1-2), 685-693.

Konya, L. (2006). Exports and growth: Granger causality analysis on OECD countries with a panel data approach. *Economic Modelling*, *23*(6), 978-992.

Lau, E., & Tang, T. C. (2009). Twin deficits in Cambodia: Are there reasons for concern? An empirical study. *Monash University, Department of Economics, Discussion Papers, 11*(09), 1-9.

Levin, A., Lin, C., & James Chu, C. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics*, *108*(1), 1-24.

Mankiw, N. G. (2010). *Macroeconomics*, 7th edition. Worth Publishers.

Mukhtar, T., Zakaria, M., & Ahmed, M. (2007). An empirical investigation for the twin deficits hypothesis in Pakistan. *Journal of Economic Cooperation Among Islamic Countries, 28*(4).

Ncanywa, T., & Letsoalo, T. E. (2019). Which among twin deficits hypothesis, twin divergence, and Ricardian's equivalence hold in a developing country? *Journal of Public Affairs, 19*(2), e1904.

Neaime, S. (2008). Twin deficits in Lebanon: A time series analysis. Lecture and working paper series No. 2, 2008.

Nelson, M. A., & Singh, R. D. (1994). The deficit-growth connection: Some recent evidence from developing countries. *Economic Development and Cultural Change*, *43*(1), 167-191.

Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica*, *49*(6), 1417-1426.

Njoroge, E. K. (2014). Testing the twin deficit hypothesis for Kenya 1970-2012.*International Journal of Business and Economics Research*, *3*(5), 160.

Odim, O. U., Ngozi, O. C., & Lawrence, E. (2014). The Keynesian-Ricardian dichotomy on budget deficits in Nigeria. *IOSR Journal of Economics and Finance*, *5*(2), 69-78.

Ogbonna, B. C. (2013). Twin deficits or Ricardian equivalence hypothesis: Evidence from Nigeria. *Journal of Banking, 7*(1), 1-48.

Osoro, K. O., Gor, S. O., &Mbithi, M. L. (2014). The twin deficit and the macroeconomic variables in Kenya. *International Journal for Innovation Research, 2*(9), 64-84.

Perera, A., & Liyanage, E. (2012). An empirical investigation of the twin deficit hypothesis: Evidence from Sri Lanka. *Staff Studies*, *41*(1).

Pesaran, M. H. (2004). General diagnostic tests for cross-sectional dependence in panels. *Empirical Economics*, *60*(1), 13-50.

Pesaran, M. H., Ullah, A., & Yamagata, T. (2008). A bias-adjusted LM test of error cross-section independence. *The Econometrics Journal*, *11*(1), 105-127.

Poi, B. P. (2004). From the help desk: Some bootstrapping techniques. *The Stata Journal: Promoting communications on statistics and Stata*, *4*(3), 312-328.

Rangarajan, C., &Srivastava, D. K. (2005). Fiscal deficits and government debt in India: Implications for growth and stabilization. *Economic and Political Weekly*, 2919-2934

Rauf, A., & Khan, A. Q. (2011). An empirical study to find the relationship between trade deficit and budget deficit in Pakistan. *Academic Research International, 1*(3), 36.

Sakyi, D., & Opoku, E. O. (2016). The twin deficits hypothesis in developing countries: Empirical evidence for Ghana (Technical No. S-33201-GHA-1). *International Growth Centre*.

Slimani, S. (2016). Threshold effects of fiscal policy on economic activity in developing countries. *International Journal of Business and Social Research*, *6*(3), 20.

Sobrino, C. R. (2013). The twin deficits hypothesis and reverse causality: A short-run analysis of Peru. *Journal of Economics Finance and Administrative Science*, *18*(34), 9-15.

Swamy, P. A. (1970). Efficient inference in a random coefficient regression model. *Econometrica*, *38*(2), 311.

Taylor, L., Proano, C. R., De Carvalho, L., & Barbosa, N. (2012). Fiscal deficits, economic growth and government debt in the USA. *Cambridge Journal of Economics*, *36*(1), 189-204.

Tekin, R. B. (2012). Economic growth, exports and foreign direct investment in Least Developed Countries: A panel Granger causality analysis. *Economic Modelling*, *29*(3), 868-878.

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of Econometrics*, *66*(1-2), 225-250.

Winner, L. (1993). The relationship of the current account balance and the budget balance. *The American Economist*, *37*(2), 78-84.

Zengin, A. (2000). The twin deficits hypothesis (the Turkish case). *Zonguldak Karaelmas University, Turkey, 217-228*.

Zuze, M. (2016). Fiscal deficit-economic growth nexus in Zimbabwe: A vector auto regression analysis. *International Journal of Innovative Research and Development, 5*(6), 380-386.

Şahin, İ. E., & Mucuk, M. (2014). The effect of current account deficit on economic growth: The case of Turkey. *Proceedings of International Academic Conferences*, International Institute of Social and Economic Sciences.

APPENDIX: List of Countries Understudy

Burundi	Morocco	Chad	Guinea-Bissau
Benin	Madagascar	Togo	Kenya
Burkina Faso	Mali	Cote d'Ivoire	Mauritania
Congo, Dem. Rep	Malawi	Sudan	Tunisia
Egypt	Niger	Angola	Tanzania
Ethiopia	Rwanda	Central African Rep	Uganda
Ghana	Sierra Leone	Guinea	