Estimation of the Investment Function for the Türkiye Economy: New Empirical Evidence from Period Including the Covid-19 Outbreak

Türkiye Ekonomisi İçin Yatırım Fonksiyonun Tahmini: Kovid-19 Salgını İçeren Dönemden Yeni Ampirik Kanıtlar

Onur Çelik[1]

Abstract

In this study, the investment function was estimated for the Türkiye economy. In addition to testing investment function, the study also aimed to clarify how the Covid-19 outbreak affected investments in the reference period which contained the latest years from 1990 through 2022 stemming from the World Bank database. In empirical analysis, unit root tests and the Autoregressive Distributed Lag (ARDL) method were used to seek long run relationships. According to results obtained from the ARDL method, reference model was valid and the series in the model were co-integrated in the long and short run. It was observed that any shock occurring in the short term disappears in the third period (year) and moved to equilibrium. While the interest rate was a negative variable for investments -as expected-; no significant empirical result was found about the effect of the Covid-19 over investment. In the direction of results, firstly sensitive arrangements are recommended to policy-makers since coefficient elasticity of interest rate was quite high. Additionally, it has been seen that monetary policy needs to be renewed according to new economic conditions. For this reason, low interest rate policy should be implemented during shock periods, provided that it is revised later by taking into account the current conditions.

Keywords: Investment Function, Türkiye Economy, Interest Rate, The Covid-19.

Öz

Bu çalışmada Türkiye ekonomisi için yatırım fonksiyonu edilmiştir. Çalışmada, Dünya Bankası veri tabanından elde edilen veriler ile 1990-2022 dönemindeki yatırım fonksiyonunun yanı sıra, Kovid-19 salgınının yatırımları nasıl etkilediği de araştırılmıştır. Ampirik analizde, uzun dönemdeki ilişkiyi araştırmak için birim kök testleri ve ARDL yönteminden yararlanılmıştır. ARDL yönteminden elde edilen sonuçlara göre, referans model geçerlidir ve modeldeki seriler hem uzun hem de kısa dönemde eş bütünleşiktir. Kısa dönemde meydana gelen herhangi bir şokun üçüncü dönemde (yılda) ortadan kalktığı ve dengeye hareket ettiği görülmüştür. Faiz oranı yatırımlar açısından -beklenen doğrultuda- negatif bir değişken olarak bulunurken; Kovid-19'un yatırımlar üzerindeki etkisine ilişkin anlamlı bir ampirik sonuç bulunamamıştır. Sonuçlar doğrultusunda, faizin katsayı esnekliği oldukça yüksek olduğundan politika yapıcılara bu konuda öncelikle hassas ayarlamalar yapmaları önerilmektedir. Ayrıca para politikasının yeni ekonomik koşullara göre yenilenme ihtiyacı olduğu da görülmüştür. Bu nedenle mevcut durumlar dikkate alınarak daha sonra yeniden düzenlenmesi kaydıyla şok dönemlerinde düşük faiz politikası uygulanmalıdır.

Anahtar Kelimeler: Yatırım Fonksiyonu, Türkiye Ekonomisi, Faiz Oranı, Covid-19.

Araştırma Makalesi [Research Paper]

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Introduction

The importance of investments for developing economies is increasing and the lackness of capital makes investments a major element in economic systems. The investment lackness, especially in developing countries staggering due to capital deficit, represents the biggest obstacle to achieve the key purpose; high economic growth. Therefore, ways to accelerate investments are investigated and discussed in today's scientific environment with increasing popularity.

Economic systems experienced various economic downturns throughout economic history. As following to economic downturns, economists tended to investigate the underlying causes of those crises. As one of them, great economic crisis in 2008 resulted as inexorable high levels of unemployment and the slowing of capital accumulation in many countries. Afterward the crisis, naturally the determinants of investment was questioned by economic environments. Even today, the definitive nature of the investment decision seems puzzling and continuously keeps its unresolved position (Alexiou et al. 2016: 39). The investment term or in other words investing decision has been assigned with a multitude of definitions over the years. One of which defines the investment as the acquisition of an asset to provide a capital gain when it has been sold or creating a constant income including combination of them (Paaca, 2021: 453).

Any change in interest rates is another critical issue to evaluate the macroeconomic situation and to predict macroscopic economic conditions with the assumption of Western economists that interest rate in the market is closely linked with savings and interest rate (Li Suyuan and Khurshid, 2015: 81). Because interest rate which has power to influence the decisions of economics actors is one of the key tools that ensures the interaction among the financial structure and real economy (Hüsnüoğlu and Durkaya, 2023: 10). For the definition of interest rate, it can be called as the cost of using money. It is also the opportunity cost for lender being defined as the paying back to lender (Ajima and Fabian, 2015: 103).

Interest rates increase or decrease over time and their fluctuations affect asset returns in the economic system. Change in interest rates is one of major sources of stochastic variation about investment opportunities, its correlation with asset prices means a powerful intertemporal hedging tool (Guasoni and Wang, 2019: 215). In the general view, there are two major assumptions. One of which defines the link among interest rate and investments negatively due to high interest rates increase the cost of capital and decrease investments. The other is related to the possible positive effect of high interest rate on savings. Constrained domestic savings are influenced by high interest rates positively and the more domestic savings provide a higher level of investments in the economy (Greene and Villanueva, 1990: 40). The response of investments to changing of interest rates is in the significant position of any analysis for stabilization in the economy. Namely, the more sensitive the response of investments, the more potent is monetary policy and the weaker is fiscal policy (Hall et al. 1977: 61) and high level interest rate increases the real cost of capital factor and therefore decreases the private investment level (Bader and Malawi, 2010: 200). Besides, a broadly held conventional thought in macroeconomics indicates that investment should respond negatively to interest rates (Lin et al. 2018: 620). The idea that decreasing interest rates support spending for investments and economic growth in countries both developing and developed alike is coherent with two major approaches such as Keynesian and Neoclassical theories (Molho, 1986: 90).

In this paper, it was aimed to estimate the investment function for the Türkiye economy. For this purpose, those questions were asked to find their answers: Is the Classical/Keynesian investment function valid for the Türkiye economy? What is the interest rate and investment nexus in the reference period from 1990 to 2022? As contribution/novelty to scientific literature, in addition to making new discussions and analysis with the latest dataset, the question of how Covid-19 outbreak affected investment level for the Türkiye economy were tested. Because appropriate encouragement and arrangements to compensate for any shock over the economy made new evidence obligatory. With this content, the study consisted of 5 sections. Afterward the introduction, theoretical approaches for investment function was discussed briefly. As follows to the theoretical approaches in the literature, previous studies were presented in the literature review section. In the next sections, respectively, the empirical analysis section including model, dataset, methodology and empirical findings was described and the study finished with the conclusion section.

1. A Brief Summary for Investment Theories

An assumption that investments have a key position to provide economic growth is undoubtedly accepted. However discussions regarding investment channels still continue in the scientific literature. That is due to the fact that an investment decision has a very complex structure today. Nevertheless, there are a few major approaches to determine the function of investment decision in its theoretical background.

Investment spending is a channel which can affect the economy through monetary and fiscal policy. Investment decisions of firms depend on the cost of using capital, namely, interest or lending rate (Petkowska, 2008: 1). This assumption indicates the most general assumption for the determinators of investments. Although the theoretical lacuna

as regarded to uncertainty determining the investment decisions, the Classical economists and Karl Marx indicated that the difference among rate of profit and interes is a crucial function of investment. Additionally, Keynes did not think differently about the determinant of investment (Alexiou, 2016: 3). Theoretical approaches generally discussed investment decision within the scope of the determinants of investments. Interest rate is here considered as a cost factor in terms of private sector investments. Therefore it is accepted that interest rate and investment nexus is negative. However, as another approach, interest rate is defined as positive factor of investment through its increasing effect on savings (Hüsnüoğlu and Durkaya, 2023: 11).

Classical theory claimed that interest rate is an equilibrium determinant among the willingness to save and the investment demand. Here, investment was defined as the demand for investible funds. On the other hand, savings was described as the supply for investible funds. Therefore interest rate was associated with the price for investible funds equating between demand and supply (Xaba, 2018: 14). According to Classical interest rate theory, investment is affected by interest rate negatively and savings positively. Therefore low interest rate policy should be implemented to increase investments. However, this policy may discourage savings and deteriorate economic growth (Chuba and Ebhotemhen, 2019: 104). In the accelerator theory, Clark (1917) indicated that investments were affected by the output growth, prices of output and cost of using the capital. Theory also aimed to help create an economy by discussing how investment can change if demand, income or interest rate change.

In Keynesian theory, the marginal efficiency of capital (MEC) concept was emphasized by J. Maynard Keynes in his book. For the investment decision, comparing interest rate (r) and the MEC(d) is in the key position. He described the MEC as the rate of discount that makes the prospective returns from selling goods and services from investment equivalent to the supply-price of a capital-good. Thus, investment function is defined as (Crocco, 1998: 285):

$$I = f(d,r) \tag{Eq. 1}$$

The fundamental importance of the MEC is defined by J. Maynard Keynes as following (Keynes, 1936: 74):

> *"The schedule of the marginal efficiency of capital is of fundamental importance because it is mainly through this factor (much more than through the rate of interest) that the expectation of the future influences the present."*

Keynes stated that investment decision is the comparison among the MEC and the internal return of the investment and the interest rate makes it possible to know whether investment decision can be occured (Ntavoua, 2018: 240). In other words, based on comparison of marginal efficiency of capital and interest rate, the condition for investment decision is the situation that marginal efficiency of capital is higher than interest rate. (Hüsnüoğlu and Durkaya, 2023: 11). While the marginal efficiency of capital is known, investment demand will increase as the decrease in interest rates will make new investment projects more profitable (Cengiz, 2010: 117). As a result, investment would be always positive, though there was no change in the MEC or the Neoclassical theory then entered into the investment field. The theory further explicated the Keynesian theory. It indicated that investment is essentially the change in capital among two terms where the optimal capital stock in the mentioned period depends on output, prices, profits and the using cost of capital called as interest rate (Bano, 2018: 132; Jorgenson, 1963). The neoclassical approach defines investment as the rate of adjustment gap among the desired capital stock and the current stock. The desired capital stock (K*) is the stock that the private business sector would like to have in the long run. On the other hand K_{-1} shows the existing capital stock at the end of the previous period. The desired capital stock adheres to two factors such as rental cost of capital (rc) and the level of output (Y). Here, K* can be defined as f(rc,Y) (Hassan and Salim, 2011: 231-232).

Tobin's Q theory explicitly includes productivity shocks and capital adjustment costs into a dynamic optimizing content and produces predictions among investment and interest rates (Lin et al, 2018: 620). Investing firm optimally should have a Q rate higher than 1. If the firm's Q rate is lower 1,the marginal return on investment will be below the cost of capital. This situation shows that using the sources is inefficient (Canbaş et al. 2004: 58).

According to McKinnon-Shaw approaches, liberalization of the financial sector consisted of another perspective for investments. When an economy removes the controls literally, economic actors encounter a higher interest rate. Eventually, this will lead to increased investments by inducing savings in the economy (Orji et al. 2015: 663; McKinnon, 1973; Shaw, 1973). McKinnon-Shaw hypothesis also pointed out the savings as main factor for economic development and high interest rate policy that encourages savings should be implemented (Türkay and Demirbaş, 2012: 8).

The theories about investment decision evaluation claimed that investment was not only defined with interest rate but also other factors such as the MEC, income and prices were given as exogeneous variables of investment decision. Nevertheless, the assumption that interest rate is the strongest determinator of the investment apparently accepted as a consensus. Hence it will be worthwhile to investigate the validity of this assumption in order to contribute to scientific literature with new economic conditions such as the Covid-19 outbreak shock for economies.

2. Empirical Literature Review

It can be indicated that empirical studies concerning the effect of interest rate on investment are abundant. The richness of previous studies refers to the significance of the mentioned nexus in the scientific literature. Besides, the studies seem to be focused on different countries, periods and cases. They also showed long run, short run and causality relationship validity for interest rate/income level and investment nexus. One of those studies, Greene and Villanueva (1990) investigated the relationship between interest rate and investment for 23 developing countries from 1975 to 1987. Results significantly showed that investment is decreasing function of interest rate. Also the study indicated that income level increases investments in reference countries. Another study Guiso et al. (2002) unveiled formation for 3000 Italian firms about interest rate sensitivity and presented results as high interest rate sensitivity and negative nexus among interest rate and investments. Similarly Lin et al. (2018) tested Tobin's Q theory for firm level with thousands of firms. Results stated that interest rate decreases firm investment intention. They stated the result as high firm sensitivity against interest rate. Lugo (2008)'s study which researched empirically the period 1983:1-1994:4 with dataset monthly for Venezuela also concluded that an increase in interest rate reduced investments.

In terms of causal linkage among various indicators, Tan and Tang (2016), took ASEAN-5 countries into consideration for the period 1970-2012 with an empirical analysis. Evidence of the study informed that results differed according to countries and short/long run situations. Whereas Güloğlu et al. (2018) clearly stated that in both short and long run, one way causality linkage is valid for Türkiye economy for the period of 1973-2014. Shocks due to interest rate decreases investments.

As for long and short run distinction, Li Suyuan and Khurshid (2015) looked into Jiangsu Province, China over the period of 2003-2012. According to their consequences, interest rate impact on investment in the short run is obtained as positive and in the long run it is found as negative. Alexiou et al. (2016) inferred that interest rate and investment were cointegrated in the long run and interest rate decreased investments in 13 European Union Countries, period from 1980 to 2013. Income level was detected as a positive factor from the regression analysis. On the other hand, Bano (2018) applied empirical analysis for selected Pacific Island countries including dataset stemming from 1980 to 2016 and reached a positive short run and negative long run relationship among interest rate and investment. By taking the opportunity cost of holding cash into account, Ysmailov (2021) indicated different results. Ysmailov found that investments were affected by interest rate negatively in the short run and interest rate influenced investments positively in long term.

Meanwhile, a deviation from the general review, Türkay and Demirbaş (2012), in short run, found the relationship among interest rate and investment negatively, however, results for long run did not support the significant nexus of interest rate and interest although income factor raises investments Türkiye economy. Further unexpected result, Idorenyin (2012) obtained that interest rate had no significant effect on investment albeit it had negative coefficient for Nigeria economy between 1981-2010 years. In those studies, no explanations were found justifying why results were obtained contrary to the general view of empirical literature.

As far as known, the most recent study so far, Hüsnüoğlu and Durkaya (2023) found results matching precisely with previous studies in empirical and theoretical background. They represented their evidence that income level and interest rate boosted and diminished investments respectively in the Türkiye economy, the period of 1987-2020. Indeed, empirical studies are not limited to those explained in literature review. Researchers involving empirical analysis in their studies such as Hydar and Ahmad (2003), Aysan et al. (2005) and Wang and Yu (2007) represented the similar results in their evidence. However the general review covers all possible and different conclusions found by researchers. It is a fact that most studies confirm the negative effect of interest rate on investment decisions and positive effect of income level on investments. These results are clearly coherent with theoretical assumptions. Nevertheless, empirical literature has not fulfilled some requirements to explain the current period for investment. The latest dataset in the empirical literature contains years until 2020 in Hüsnüoğlu and Durkaya (2023)'s study. Therefore with this study, presenting results of years until 2022 was aimed. Furthermore, to current knowledge, no study including any analysis how investments were influenced by the latest outbreak. Therefore Covid-19 outbreak effect which appeared in 2019 was investigated by using Covid-19 variable in this study's empirical model.

3. Empirical Analysis for the Investment Function: Model, Methodology and Findings

In order to present empirical evidence, in this section, the investment function for the Türkiye economy was tested by using a reference model, tests and period. In the context of the study, model and methodology were firstly defined. Subsequently empirical results were given in the sub-title, findings.

3.1. Model

In order to find empirical determinants of investment decision, reference model encountered in the literature such as Keynes (1936)[2], Bader and Malavi (2010), Li Suyuan and Khurshid (2015), Alexiou (2016), Ysmailov (2021) and Hüsnüoğlu and Durkaya (2023) was used. In addition to the model of these studies, Covid-19 variable called a dummy variable was included. Thus, an empirical model was built as following:

$$Investment = f(Interest\ rate, Covid - 19_{dummy})$$ (Eq. 2)

The reference model was constructed for the Türkiye economy and the reference period was chosen from 1990 to 2022. All variables in the reference model were transformed to natural logarithmic form in order to make them homogeneous. LINV, and LINT(here and after) show logarithmic forms of investment and interest rate respectively. In Table 1 and Table 2, definitions, data availability and descriptive statistics were shown.

Table 1. Definitions and Data Availability of Variable in the Model

Variable	Definition	Source
LINV	*"Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories."* ($)	World Bank (2024)
LINT	*"Deposit interest rate is the rate paid by commercial or similar banks for demand, time, or savings deposits."* (%)	World Bank (2024)
Covid-19 dummy	Dataset, consisted of the value 0 from 1990 until 2018 and the value 1 from 2019 through 2022. The validity of Covid-19 outbreak in international size was considered, although the first Covid-19 case was detected in 2020, Türkiye. Because the Türkiye economy is an open economy and its interest rate has been affected by interest rate arrangements in the world.	Author's compilation.

Table 2. Descriptive Statistics for Variables in the Model

Variable	Observ.	Mean	Median	Maximum	Minimum	Std. Dev.	Jarque-Bera Prob.
INV	33	1.48E+11	1.48E+11	3.18E+11	2.79E+10	9.70E+10	0.167893
IR	33	35.3597	24.25917	87.79083	13.35667	26.14694	0.11338
Covid-19$_{dummy}$	Dummy variable's values differed among 0 and 1.						

According to the descriptive statistics, INV variable representing the Gross Capital Formation has a maximum value higher than 300 billion $ and the lowest value for investment is about 27 billion $. Interestingly, the highest value for investment is one from the Covid-19 period. _Intuitively_, it can be assumed that the outbreak had no restrictive effect on the investments in Türkiye. On the other hand, interest rate value seems in the range of percent 87 and 13. In terms of the expected results, there are two conflicting views. Firstly, the higher interest rate level means the more cost of using capital and dampens private investments. On the other hand, private investment may be associated with interest rate positively in developing countries. Because domestic investments in the economy is the positive function of individual savings which have been affected positively by interest rate (Greene and Villanueva, 1990: 40).

3.2. Methodology

In this study, as the research method, unit root test, diagnostic tests and cointegration test were used. For unit root analysis, variables were tested by Augmented Dickey-Fuller (ADF) (1981) and Phillips-Perron (PP) (1988) methods. These are the most popular unit root tests in the scientific literature. The main purpose of using unit root tests is to determine the stationary information about series. If variables are not stationary, namely contain unit root, in order to

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[2] In theoretical explanations, the investment function by Keynes (1936) consisted of the interest rate and MEC. Although it is known, this study's model did not include the MEC. Because interest rate and the MEC are highly correlated causes multicollinearity problem (negatively). Also dataset for the MEC is not external and there is dataset collecting problem. Because of all these problems, the MEC was excluded from the model.

eliminate the regression fallacy the first difference of variables must be used. In unit root test, those equations are expressed (Akcan et al. 2022: 128):

$$\Delta Y_t = \lambda Y_{t-1} + u_t .$$ (Eq. 3)

$$\Delta Y_t = a_0 + \lambda Y_{t-1} + u_t .$$ (Eq. 4)

$$\Delta Y_t = a_0 + a_1 t + \lambda Y_{t-1} + u_t .$$ (Eq. 5)

$$T_{\ddot{o}} = t\delta \left(\frac{y_0}{f_0}\right)^{1/2} - \frac{T(f_0 - y_0)[se(\hat{s})]}{2\sqrt{fs}}$$ (Eq. 6)

Equation 4, 5 and 6 is used in case of no constant and trend effect (none), constant and both constant and trend respectively. Equation 6 shows the unit root test by Phillips-Peron (1988) which is sensitive to correlation and heteroscedasticity in error terms.

As follows to unit root tests, to see whether variables are cointegrated in the long run or not, Autoregressive Distributed Lag (ARDL) test which was recommended by Pesaran et al. (2001) was applied. ARDL Bound test provides many advantages as compared to cointegration tests such as R. F. Engle and C. W. Granger and S. Johansen. As the most advantageous ARDL method, it allows to investigate cointegration relationships regardless of stationary of the variables. In the ARDL method, if f-statistic value exceeds upper bound value, it can be concluded as the existence of cointegration. Otherwise, in the situation that F-statistics is between lower and upper bound or less than lower bound; cointegration relationship between variables is not acceptable.

When the reference empirical model of this study is redefined with methodologic form of ARDL Bound test (for long and short run equation), it can be expressed as the formula following (Hüsnüoğlu and Durkaya, 2023: 21):

$$\Delta LINV_t = \beta_0 + \sum_{i=1}^{m} \beta_{1i} \Delta LINV_{t-1} + \sum_{i=0}^{n} \beta_{2i} \Delta LIR_{t-i} + \sum_{i=0}^{p} \beta_{3i} \Delta Covid19_{t-i} + u_t.$$ (Eq. 7)

$$\Delta LINV_t = \beta_0 + \sum_{i=1}^{m} \beta_{1i} \Delta LINV_{t-1} + \sum_{i=0}^{n} \beta_{2i} \Delta LIR_{t-i} + \sum_{i=0}^{p} \beta_{3i} \Delta Covid19_{t-i} + \lambda ecm_{t-1} u_t.$$ (Eq. 8)

The content which is shown in the empirical model as ecm$_{t-1}$ shows the error correction term (ECM). It shows how much of a shock that appears in the short term is going to disappear in the long run by evaluating its coefficient. The expected result for this coefficient is both significant and negative statistically. In the next section of the study, empirical findings obtained as a result of examining the methodologic assumptions are presented.

3.3. Findings

Findings of the empirical analyisis were presented in this section. Firstly evidence from unit root tests was shown and afterward the diganostic test to work with perfect model, short and long term cointegration test results were given. In this context, unit root test results were included in Table 3.

Table 3. *ADF and PP Results*

Variable	ADF	PP
LINV (Level)	-0.91/-2.32/1.47	-0.80/-2.34/1.71
LIR (Level)	-1.16/-1.78/-0.59	-1.16/-1.74/-0.62
ΔLINV	-7.01***/-6.91***/-6.48***	-6.99***/-6.89***/-6.43***
ΔLIR	-6.38***/-6.31***/-6.40***	-6.45***/-6.45***/-6.42***

Note: *** shows that the series are significant at the %1 critical level. Values symbolize three different econometric equations respectively.

ADF and PP tests apparently confirmed similar findings. Accordingly, whole variables include unit root and they are not stationary at level with any equations such as with none, constant and constant and trend. On the other hand, in all the first difference equations, the hypothesis that series include unit root was rejected. As a result of this empirical evidence

that all variables in the model are stationary, analysis can proceed to test the existence of cointegration among variables in the long and short run. However before this, using diagnostic tests are necessary to see features of models and create appropriate models. In Table 4, results are shown.

Table 4. Diagnostic Test Results

Test	Assumption	Statistic	Result
Breusch-Godfrey LM	The model does not contain autocorrelation problem.	0.5543	Unrejectable.
Jarque-Bera	The model has normal distribution.	0.3262	Unrejectable
White	The model does not contain heteroskedasticity problem.	0.3224	Unrejectable

Note: Due to the model does not include two or more exogenous variables, the multi-correlation problem was not tested.

Diagnostic test results informed that, the reference empirical model of this study does not include any problem which may avoid to find consistent findings or cause erroneous results. In this manner, cointegration test can be applied for the model. In the Table 5 and 6, ARDL test results and ECM findings were presented.

Table 5. ARDL Cointegration Test Results for Long Term

Variable	Coefficient	Std. Error	t-Statistics	Prob. Value
LIR	-1.135985	0.120582	-9.420861	0.0000***
Covid-19$_{dummy}$	0.350199	0.237644	1.473629	0.1517
k=2, F-statistics= 6.32 – Lower Limit %1= 4.13 – Upper Limit %1= 5.00 – R^2= 0.94				

Note: *** shows that variable is significant at the %1 critical level.

Table 6. ECM Results

Variable	Coefficient	Std. Error	t-Statistics	Prob. Value
ECM (-1)	-0.460379	0.086987	-5.292523	0.0000***
R^2= 0.43				

Note: *** shows that the variable is significant at the %1 critical level.

Evidence obtained by using ARDL cointegration test significantly represented that series in the reference model were cointegrated both in long and short terms. Statistically, the value of F-statistics was calculated as 6.32. As compared to lower and upper limit values, F-statistics value is higher than both of them and exceeding limits indicates the validity of cointegration assumption. Moreover CUSUM and CUSUM of squares test results were indicated in Figure 1. They were informed that the confidence interval covered cointegration relationships. CUSUM and CUSUMSQ test values (blue lines) were within the critical limits (red lines) at the 5% significance level and showed that the estimated model was stable in the reference period and there was no structural break in the empirical model.
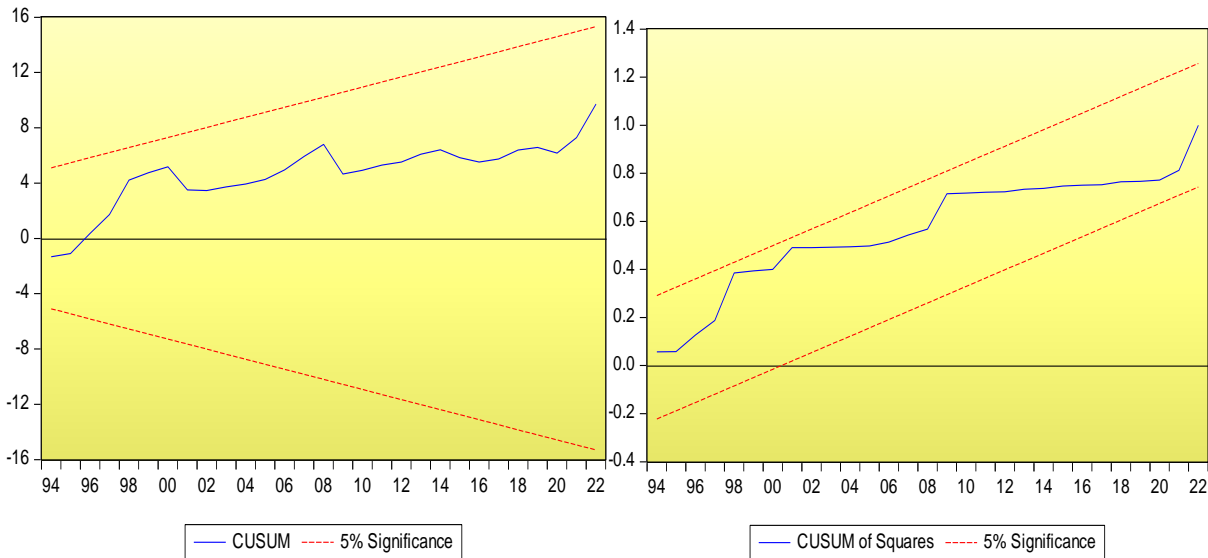
Figure 1: *CUSUM and CUSUM of Squares Test Results*

Coefficient information was determined as 1.13 and this points out that increasing the interest rate as %1, decreases investments %1.13 in the Türkiye economy. In addition to this high sensitivity, R^2 value was found 0.94. In this way, the explanatory power of the interest rate and Covid-19 outbreak on the change in investments was found to be 94%. With regard to short run, the coefficient of ECM was obtained as minus and 0.46. These statistics showed that any shock appeared on the investments turned to equilibrium and was eliminated after the second period, in the third period (1/0.46=2.17). However, no statistically significant relationship was detected among investments and Covid-19 outbreak. This evidence can be justified with the interest rate policy of the Turkish government. Even though CBRT's monetary policy, especially about interest rate, was criticized by most of the economists due to low interest rate, seemingly, low interest rate policy promoted to protect investments level in the economy. Not only directly but also indirectly, low interest rate policy supported the investments by providing a certain consumption level in the economy and this recovering effect may have been eliminated by the shocks caused by Covid-19 outbreak. Because the interest rate was decreased sharply by the Central Bank of the Republic of Turkey (CBRT) until February-2023 period and it had been %8.5 in this date (CBRT, 2024).

Summarily, this study unveiled the information that the interest rate has a negative effect over investments in the Türkiye economy. This finding has been supported by almost all of the studies in related literature. Furthermore, the Covid-19 outbreak empirically was found as a variable which had no significant effect on the investments in the reference period, 1990-2022. All these proofs were derived from an empirical model which did not contain any inconsistency or deviation.

Conclusion

From past to today, it is undoubtedly accepted that investment is quitely important indicator to evaluate the performance of an economy. Similarly, variables which affect the investment decision is another significant issue for economics. Mentioned discussion is thus replaced in the center of investment theories. Accordingly, almost of the scientific literature and theoretical approaches acknowledged the negative effect of interest rate over investment decision of actors in the economy.

In this study, as addition to drawing theoretical and empirical review, it was intended to provide new evidence to the scientific literature with some aspects. One of which was testing the period from 1990 through 2022 empirically in terms of the effects of interest rate and Covid-19 outbreak over the investments. Because as far as known, no study including this reference period and effect of last outbreak. Findings presented the expected results: (i) The reference model was valid to seek the effect of interest rate and outbreak and series were cointegrated in short and long terms. (ii) Interest rate had minus coefficient and investment in Türkiye was negative function of interest rate. Yet, (iii) result that Covid-19 outbreak had no significant influence over investment was obtained. Evidence of this study implies a coherent with empirical literature albeit a few of them found different results. Besides, results support the most popular investments theories such as Keynesian and it can be stated that Türkiye economy contains a Keynesian investment function under the assumption that all other variables were excluded.

In the line with empirical results, suggestions can be explained with three aspects. Firstly, high interest rate sensitivity of investment in Türkiye economy makes interest rate policy very critual issue. In order to promote the sustainability for investment, interest rate policy should follow the real economic conditions. Otherwise huge loss in investment decision may be observed. Secondly, evidence about Covid-19 outbreak showed that no significant effect over investments. This evidence can be matched with low interet rate policy. Accordingly, low interest rate policy supported investment by decreasing of using of the capital. Moreover low interest rate policy may be encourage households to consume more. Eventually the more consumption can be resulted as accelerated investments. It is possible to think that the insignificant effect of the outbreak is linked with easy access to credits and money. In other words, recovery mechanism was working during this period. Indeed, this policy was not valid only in Türkiye but also in international size. For example, according to statistics of Federal Reserve Economic Data (FRED), interest rate was approximately 2 percent in United States of America before Covid-19 outbreak. After detection of negative effect of shock, interest rate was reduced until approximately 0 percent. As for recommendations, CBRT should follow new economic conditions. Although excessive low interest rate policy makes the economy accelerated, in developing countries which has no enough capital accumulation, decreases individual savings and increases consumption. This situation creates consumption-oriented societies that do not have sufficient production maturity. Consequently occurring demand shock may trigger inflation rate. Hence, by following the effects of outbreak, interest rate policy should be revised and moderate policies should be implemented. For instance, ECM result showed that any shock disappeared in third year. Considering Covid-19 outbreak started in 2019, monetary policy required revision after 2022. Therefore taking empirical findings and indicators notice by policy-makers is strongly suggested.

Finally, this empirical study also contains limitations in its construction just as all other studies. In this research, a model which was established many years ago was tested. Therefore, in further studies, extending this model with variables such as propensity to saving of households/firms and income level may help to find more specific and stronger results about investment function and contribute to scientific literature.

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