EUROASIA JOURNAL OF SOCIAL SCIENCES & HUMANITIES
Internetional Indexed & Refereed
ISSN: 2651-5261

DETERMINANTS OF PRIVATE INVESTMENT IN TURKEY: AN ARDL BOUNDS TESTING APPROACH

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ABSTRACT
The primary purpose of this research is to identify and evaluate the key drivers of private investment (PI) in Turkey. The corporate tax, private sector credit, GDP per capita, exchange rate, inflation and interest rate were chosen as predictors. These variables were analyzed using time series analysis methods and annual data for the period of 1975-2018. The cointegration relationship between the variables was investigated through the use of an Autoregressive Distributed Lag (ARDL) bound test because of the flexibility it offers with regards to the number of variables and the degree of integration between the variables. In the long run, an inverse impact of corporate taxes and inflation was observed on PI. The impact of private sector credit, GDP per capita, and exchange rate was positive on PI. However, no significant relationship was observed with interest rates. These findings offer policymakers important insights regarding decisions to promote investments in Turkey.

Keywords: Private Investment, ARDL Bounds Testing, Cointegration, Error Correction Model (ECM), Unit Root Test with Two Structural Breaks.

1. Introduction

Gross fixed capital formation, defined as investment, represents one of the fundamental elements of economic growth thanks to its potential for productivity growth, employment creation, and technological progress. Although investments can be made both by the private or the public sector, private investments (PI) which are the subject of this study are crucial for the efficient functioning of free market conditions. Especially in the post-1990 period, when the neoliberal economic approach accelerated and multinational companies became dominant in world trade, private sector investments started to be seen as the locomotive of economies. During this process, reducing the share of government in the economy and directing the public investments mainly to infrastructure investments, which are difficult to be undertaken by the private sector, have been the tendency in the countries that have adopted the market economy. In the context of the need for governments to play only a supervisory and regulatory role in the markets rather than direct production activities, governments have sought to create a favorable business environment through broad reform packages, including privatizations, to encourage the PI.

Parallel with the developments in the world and other developing countries, similar trends have also seen in Turkey. Especially after 1980, with the neoliberal policies brought into life, PI in Turkey has been supported through a wide range of reforms covering the banking system and promotion of regional and sectoral investments. With the new investment incentive system introduced in 2012, the companies that will make investments are provided with tax exemptions and land allocation. Moreover, during this process, the government provided investment loans to Small and Medium-Sized Enterprises (SMEs) through the SMEs Agency (KOSGEB) to overcome the bottlenecks in access to finance. Between 2003 and 2017, more than 50.000 SMEs benefited from KOSGEB investment loans amounting to 20 billionTL. Another important incentive provided to enterprises to increase their investments was the treasury-backed credit guarantee fund. When it was first established in 2013 the fund supported only small and medium-sized enterprises, with a loan volume corresponding to 0.5% of Gross Domestic Product (GDP). In 2017, the fund was extended to serve all sizes of enterprises and its limit was raised from 20 billion TL to 250 billion TL (8% of GDP) making it the highest loan guarantee fund among the OECD countries.

Efforts to encourage private sector investments have helped to increase the investments in Turkey rapidly, however, especially since the 2008 Global Financial Crisis private sector investments have been volatile. Considering that investment is a key pillar of sustainable development, investigating the factors which affect the PI in Turkey is of great importance in terms of shedding light on the determination of the policies that will be implemented to encourage investments.

While in the literature there is a consensus on the positive impact of PI on GDP, the factors that affect PI vary from country to country. Due to the different indicators and methods used, even the studies conducted for the same country reveal contradictory results. For example, while in the study conducted by Karagöz (2010) for Turkey, no statistically significant relationship was observed between the PI and the real interest rate (RIR), in their recent research Güloğlu et al. (2018) found a one-way causal relationship from RIR to PI in Turkey. Ambiguous results of the existing studies and paucity of research investigating the determining factors of PI in Turkey constitute the main motivation of this research. The primary objective of this research is to determine the determinants of PI in Turkey. Findings from this study are expected to provide important insights into investment incentive schemes in Turkey.

This research is structured as follows. In the first section, theories that describe the determinants of investments are reviewed. The findings of studies on the determinants of PI conducted both in Turkey and in other countries are then discussed in the second section. The third section describes the econometric analysis. Finally, there is a discussion of the results and implications presented in a conclusion section.

1. Theoretical Framework

Investment expenditures are critically important macroeconomic factor because it takes into account most of the movements in the business cycle (Dornbush&Fisher, 1994). Investments generally consist of two major components: domestic investment and foreign investment. Domestic investments can be made either by the private or public sector and represent accumulation to net stock levels. On the other hand, foreign investment is called FDI when it is in the form of a tangible asset investment by non-residents; the purchase of equities, bonds, and securities is called portfolio investment.

The Keynesian Investment Model

There are different theories in the literature that take into account the determinants of investments. The first investment theory was postulated by Keynes (1936). It is of fundamental importance in Keynes' critique of classical economics that a movement in savings will inevitably lead to a movement in investments. Keynes stated that savings and investments are made by different economic agents so investments and savings need not be equal. According to Keynes, the main factor determining the level of investment are interest rates and the expected profitability of those investments. He postulated an inverse relationship between the level of investment and interest rates.

Keynesian investment theory states that the investment will rise as a result of the presence of firms that balance the marginal productivity of new capital, or in other words, the marginal efficiency of capital (MEC) with the expected return on investment. Therefore, investment decisions are made by comparing the expected return on expected investment or the MEC, with the RIR that constitutes the cost of capital. In this model, capital projects with lower interest rates appear to be financially feasible, while those with higher interest rates will result in postponement or cancellation due to the rising cost of borrowing. Additionally, Keynes stated that the investments are variable because the investments depend on the expectations of the firms about the return on investment (Keynes, 1936).

The Accelerator Theory

In the accelerator investment theory, investment corresponds to the increase in production due to the changes in demand in the future period. In other words, the theory implies that changes in the output level or aggregate demand determine the change in the investment or capital stock (Reinert et al., 2008). In this case, firms attempt to reduce the difference between the desired level of capital stock (K*) and the level of actual capital stock (K). This model thus defines the GDP, interest rate (external borrowing cost) and capital as the main determinants of PI.

Tobin's Q Theory

The investment theory introduced by James Tobin (1969) is based on financial markets. In Tobin's Q investment theory, the ratio of the current capital stock to the replacement cost (Q ratio) is the most critical factor of investments. That is, if the market value of the new investment of an incremental unit is larger than the replacement cost, the enterprises will invest. Tobin's Q investment theory suggests that if the physical capital of a firm exceeds the replacement cost of capital, its capital will have more value inside than outside of the firm. Therefore, according to Tobin, companies will accumulate more capital when Q is greater than 1 and will lower their capital stocks when Q is less than 1. In the case of when Q equals 1 (the market value is equal to the replacement cost), no change is foreseen in the level of capital stock. Therefore, this theory postulates that investment or desired capital stock is affected by market prices and the cost of capital renewal. In other words, investments are a function of interest rates and profitability. Lower capital costs increase profitability and hence the applicability of the investment. In this model, the risk is another factor that is taken into consideration to make the Q ratio greater than 1.

Neoclassical Model

This theory suggests that as demand or income increases, investments made by companies will also increase as a linear function (Jorgenson, 1963). This model suggests that PI correlates positively with income. Because as country wealth increases, more wealth will be directed to finance domestic investment (Greene&Villanueva, 1991). The theory proposes that the real output growth rate is positively related to investment because investors will want to meet the changes in total production demand and that RIR is correlated to the level of investment. Based on the theory, an adverse relationship is expected because interest rates negatively affect the return on investment. Capital goods, interest rates, and the corporate tax can be included as determinants of PI in this model.

Nonetheless, McKinnon (1973) and Shaw (1973) argue that PI and RIR are directly associated. They believe that higher RIR will stimulate savings, which will then increase domestic credit volume and the equilibrium investment level. This hypothesis assumes that the primary constraint on investment is the level of financial resources rather than the cost of financial resources.

Theory of Internal Funds

In the theory of internal funds proposed by Tinbergen (1939), investments are determined according to demand and the rate of profit. Profit in this model is the expected level of profit in the future and the expected profit in the future is generally affected by the level of RIR and the expected risk level in the future. In studies, inflation and exchange rate variables are often used as indicators of the risk level.

In addition to the aforementioned theories, Rodrik (1991) recently cited "policy uncertainty" as a determinant of PI. According to Rodrik, when a policy reform is carried out, the private sector is unlikely to see it as a hundred percent sustainable. The possibility that the reforms implemented will have unexpected consequences may result in the suspension of investments as rational behavior.

2. Previous Research

Karagöz (2010) used an ARDL testing approach and data for the 1975 to 2005 period from Turkey to assess the determinants of PI. The results showed that the real GDP and openness had a negative effect on PI, whereas real exchange rate (RER), private sector credit, private sector external debt and inflation had a positive impact in the long-term. The RIR and the public sector investments were not found to be statistically significant. Investigating the determinants of PI in Turkey for 1970-2009 period, Uçan and Öztürk (2011) used the Johansens' cointegration test, VAR decomposition analysis, and the Granger causality test. As a result of their analysis, a positive relationship was found between financial development indicators and the PI. Additionally, they found a negative correlation between inflation, the RIR, the real GDP growth, and PI. Güloğlu et al. (2018) conducted a research for Turkey to investigate the impact of interest on PI taking into account the 1973-2014 period using the DOLS estimator, VECM, and the Granger test. In this study, which found a one-way causal relationship from the RIR to PI in both the short and long term, the impact of interest rate shock on PI was negative during all periods.

Asante (2000) investigated the determining factors of PI in Ghana with the time series analysis. The study revealed that PI and public investment are complementary and therefore the government needs to maintain infrastructure to increase private sector investments. It has also been demonstrated that the real credit expansion extended to the private sector was an important determinant of PI. In the study, macroeconomic stability indicators were not found to be statistically significant. In a study conducted for Ghana by Frimpong and Marbuah (2010) using an ARDL approach for 1970 to 2002, examined public investment, openness, inflation, the RER, the RIR, and the type of constitutional governance. They found these factors in the short run to be the primary determinants of the level of PI, while in the long run the PI was affected by openness, inflation, the RER, the RIR, real output, and external debt. Eshun et al. (2014) tested the effect of financial variables on PI in Ghana between 1970-2010 with the ARDL model. Their empirical findings support the position that PI will decrease in both the short and long term when the level of RIR is high and when loans to the private sector are limited. Sakyi et al. (2016) analyzed the impact of financial development on PI in Ghana by applying ARDL bounds testing approach and cointegration with data from 1970 to 2014. As a result of their analysis, it was concluded that financial development was not a determinant of PI in the long term, however, the magnitude of financial development varied according to the selected financial development indicator in the short term. Similarly, in a study conducted for Ghana with the Johansen cointegration method using the 1986 to 2011 data, Senzu and Ndebugri (2018) found that corporate tax adversely affects PI in both the long and short term. Their study also revealed a positive impact of real GDP, public expenditures, and money supply on PI. They also reported a negative relationship exists between interest rates, the RER, inflation with the level of PI.

Ouattara (2004) examined the drivers of PI for 1970 to 2000 for Senegal, using cointegration and ARDL methods. His findings showed that the level of public investment, real income and foreign aid are positively related to the level of PI, but are negatively related to private sector loans and the terms of trade. Bayai and Nyangara (2013) investigated PI in Zimbabwe for the period 2009-2011 and found that the key variables of PI were political risk, interest rate, GDP, debt service and foreign trade were the key determinants. Elbanna (2016) analyzed the drivers of PI in Egypt from 1983 to 2014 using a multiple regression model. That study revealed that money supply, exchange rate, and GDP were the key determinants of the level of PI. In that study, no statistically significant relationship was found between public investments, commercial loans, interest rates, Foreign Direct Investment (FDI) and PI. In their research using the ARDL method for Pakistan with the data between 1984-2014, Babar et al. (2017) showed that corporate tax reduces PI by reducing company profitability. Ngoma et al. (2019), investigated the macroeconomic determinants of the PI in 35 Sub-Saharan African countries for 2000-2017. In the study which used pooled regression, fixed and random effects, and the panel corrected standard error techniques, the impact of GDP was positive on the level of PI, whereas the RIR, public investment and inflation negatively affected the PI.

3. Econometric Analysis

3.1. Data and Model Specification

This research design covers the period 1975 to 2018 and uses data collected from Turkey. The dependent variable is the level of PI. A set of predictor variables were identified from the extant literature after reviewing the leading investment theories and empirical studies found in the literature review and incorporated into the research design. These are Corporate Tax, Private Sector Credit, GDP per capita, Exchange Rate, Inflation Rate, and Interest Rates. The dependent and predictor variables are described below in Table 1.

Table 1. Description of the Data

Variable Name / Code	Description	Source
Private Investment / PI	Private sector's share of gross fixed capital formation (%GDP)	Strategy and Budget Directorate of Turkey (www.sbb.gov.tr)
Corporate Tax / TAX	Corporate tax	Turkish Revenue Administration (www.gib.gov.tr)
Private Sector Credit / CREDIT	Domestic credit to private sector (% of GDP)	World Bank, World Development Indicators
GDP per capita / GDP	GDP per capita, current prices (US dollars)	International Monetary Fund, World Economic Outlook
Exchange Rate / FX	Nominal exchange rate, yearly average USD/TL	Penn World Table (www.ggdc.net/pwt)
Inflation / INF	Average consumer prices	International Monetary Fund, World Economic Outlook
Interest Rate / INT	Lending rate	International Monetary Fund, Internation Financial Statistics (IFS)

The following model is used to explore the factors responsible for influencing PI in Turkey. A similar model was used by Eshun et al. (2014) in the case of Ghana. The closed form of the regression model containing sev
en macroeconomic variables is simply as follows:

$$PI = f\,(TAX, CREDIT, GDP, FX, INF, INT)$$

The econometric model used can be expressed in log-log form as;

$$lnPI_t = \alpha_0 + \beta_1 lnTAX_t + \beta_2 lnCREDIT_t + \beta_3 lnGDP_t + \beta_4 lnFX_t + \beta_5 lnINF + \beta_6 lnINT_t + \varepsilon_t \quad (1)$$

Equation (1) illustrates a long-run equilibrium relationship where β represents the coefficients for the predictor variables, ε_t, t, and *ln* represent the error term, time and the natural logarithms respectively.

3.2. Unit Root Test Procedures

Testing the presence of the unit root is the first and the most strategic phase of the time series analysis since the presence of a unit root means that the series is not stationary. If a non-stationary time series is regressed according to one or more non-stationary time series, a false regression is likely to be encountered. The reason for this is that standard linear regression procedures assume that the time series included in the analysis are stationary. If the analysis is performed with non-stationary time series, a false regression will be estimated, and there can be no reliance on basic statistics such as F and t-tests (Gujarati, 2015: 341).

Stability is especially a problem if the macroeconomic time series is exposed to many long-term shocks. If these shocks have a lasting effect on the time series, it will disrupt the stability of the series. Therefore, when working with time series, it is critical to determine the degree of stationarity of the series. To evaluate the stability of these data an Augmented Dickey-Fuller (ADF) unit root test and Lee and Strazicich (LS) (2003) double break unit root test, which are frequently used in unit root testing were employed. A description of these tests is described below.

ADF Unit Root Test

This test, which is mostly preferred to investigate the presence of unit root testing in time series, can be considered to be a version of the Dickey-Fuller (DF) unit root test that utilizes the AR(1) process. However, if there is a higher-order correlation in the time series, εt (error term sequence) it will lose its clean sequence property. The ADF test uses the AR(p) process rather than the AR(1) process to incorporate the delayed difference terms "p" into the equation to overcome this problem (Dickey&Fuller, 1979: 427). Thus, without intercept and non-trend (2), with intercept (3) and with intercept and trend (4) ADF equations are given below:

$$\Delta y_t = \delta y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \varepsilon_i \quad (2)$$

$$\Delta y_t = \mu + \delta y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \varepsilon_i \quad (3)$$

$$\Delta y_t = \mu + \beta t + \delta y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \varepsilon_i \quad (4)$$

In the equations μ represents the intercept, p represents the number of lags and ε_t refers to error term series. For all three ADF equations, the null hypotheses expressing the presence of unit root in the series are the same (Gujarati, 2015: 328).

Lee Strazicich (2003) Unit Root Test with Two Structural Breaks

The use of conventional unit root tests in series with structural breaks may show the series as not stationary, while in fact, it is. Lee ve Strazicich (LS) (2003) stated that the disruption of the stationarity is caused by structural break/s. The break times are determined endogenously in the LS test which acts considering the breaks. When there is a data generation process such as below:

$$y_t = \delta Z_t + e_t \quad and \quad e_t = \beta e_{t-1} + \varepsilon_t \quad (5)$$

In equation (5), Z_t represents the external variables vector and ε_t represents the error term sequence. The model based on the LM principle is:

$$\Delta y_t = \delta \Delta Z_t + \emptyset \hat{S}_{t-1} + \varepsilon_t \quad (6)$$

Here, $\hat{S}_t = y_t - \tilde{\varphi}_x - Z_t \hat{\delta}$ and t=2,…,T. In this equation, $\tilde{\varphi}_x$ is expressed by $y_1 - Z_1 \hat{\delta}$. The variables y_1 and Z_1 indicate the initial values of the matrices and $\hat{\delta}$ the matrix of coefficients. Known as the LS (2003) exogenous variables vector "Z_t" has been created considering the two-break and two models, Model A and Model C have been proposed. Model A considers the break at level, where Model C takes into account the breaks both at level and trend.

For the break at level Model A is defined as $Z_t = [1, t, D_{1t}, DT_{1t}]$ and $D_{jt} = 1$ when j = 1,2 in case of $t \geq T_{Bj} + 1$ and is equal to 0 in other cases. In this equation, T_{Bj} shows the time of the break in the period examined.

Model C is defined as $Z_t = [1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}]$ for breaks at level and trend, where it takes the value $DT_{jt} = t - T_{Bj}$ in case $t \geq T_B + 1$ and 0 in other cases. To test the presence of unit roots in these variables, the hypotheses below were established:

H_0: Ø=0: There is a unit root
H_1: Ø<0: There is no unit root

The test statistic to test the null and the alternative hypotheses is calculated as:

$$\tau = t - stat(\widehat{\emptyset}) = \frac{\widehat{\emptyset}}{sh(\widehat{\emptyset})}$$

where $\widehat{\emptyset}$ indicates the parameter obtained from the Least Square estimation of the equation (6), *sh* represents the standard error for that parameter.

3.3. Autoregressive Distributed Lag (ARDL) Model

In their study, Pesaran, Shin and Smith (PSS) (2001) proposed an Autoregressive Distributed Lagged (ARDL) model, which gives reliable results even in the case that the integration order of times series is either I(0) or I(1). Below an ARDL $(p, q_1, \ldots, q_k)$ model where y_t is a dependent variable and $x_{j,t} j = 1, \ldots, k$ are independent variables specified as:

$$y_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^{p} \varphi_i y_{t-i} + \sum_{j=1}^{k} \sum_{l_j=0}^{q_j} \beta_{j,l_j} x_{j,t-l_j} + \varepsilon_t \qquad (7)$$

Here, α_0 represents the intercept, α_1 linear trend coefficient, φ_i coefficients of the lagged value of the dependent variable, whereas β_{j,l_j} is the coefficients of the lagged value of "k" number of independent variables and ε_t is the error term series. Based on equation (7), Pesaran et al. (2001) proposed five different conditional error correction models (ECMs) and then tested the cointegration relationships for these models using the bounds testing approach. Out of the five models proposed, Model 3 was selected for this study. Model 3 with an intercept and non-trend form is shown below:

$$\Delta y_t = \alpha_0 + b_0 y_{t-1} + \sum_{j=1}^{k} b_j x_{j,t-1} + \sum_{i=1}^{p-1} c_{0,i} \Delta y_{t-i} + \sum_{j=1}^{k} \sum_{l_j=1}^{q_j-1} c_{j,l_j} \Delta x_{j,t-l_j} + \sum_{j=1}^{k} d_j \Delta x_{j,t} + \varepsilon_t \qquad (8)$$

ECM obtained from equation (8) is as follows:

$$EC = y_t - \sum_{j=1}^{k} \frac{b_j}{b_o} x_{j,t} \qquad (9)$$

If no cointegration relationship exists between the variables, the following null hypothesis cannot be rejected:

$H_0: b_0 = b_j = 0, \forall_j$ (no cointegration among the variables)

Pesaran et al. (2001) calculated a restricted F-test statistic to test the null hypothesis from these five proposed models. However, all variables included in the model are assumed to be stationary at their levels since the calculated F-statistic do not conform to the standard F distribution and the critical values (bound values), considered as a lower limit, are derived for different error margins as the number of observations goes to infinity asymptotically. Thus, according to this approach, the H_0 cannot be rejected if the calculated F-statistic < I(0), which is the lower limit critical value, it will be rejected in case there is no cointegration between the variables and if the calculated F-statistic > I(1). If the calculated F-statistic takes a value between the lower bound I(0) and the upper bound I(1), it will not be possible to determine whether there is a cointegration relationship between the variables.

Narayan (2005), on the other hand, re-derived the upper and lower critical limits for smaller samples which were calculated by Pesaran et al. (2001) for large samples. Thus, in analyses whit small observations, using the critical values derived by Narayan (2005) reveals better results. However, the important point regarding the bounds test is in fact what the alternative hypothesis will be in case of rejecting the H_0 constructed as "there is no cointegration". Thus, a rejected H_0 will not indicate the presence of cointegration relationship. The second important point here is that three of the five models proposed by Pesaran et al. (2001) are called unrestricted models and the alternative hypothesis in these models (Model 3 is also one the unrestricted models) is formed in three different ways. In the unrestricted models, if the null hypothesis is rejected as a result of the F-test, the cointegration relationship can be tested with the t-bound test (Mert&Çağlar, 2019: 282).

For equation (9), in case the calculated F-statistic is greater than the critical value, this hypothesis will be rejected. Although the alternative hypothesis emerges in three different ways, only the case where the cointegration relationship exists is shown here:

$$H_A: b_0 \neq b_j \neq 0, \forall_j$$

Here, the coefficients of the one lagged dependent variable (y_{t-1}) and one lagged independent variables ($x_{j,t-1}, j = 1, \dots, k$) will be different than zero, hence the cointegration relationship will be valid. However, these results do not guarantee the presence of a cointegration relationship. In order to examine this relationship, Pesaran et al. (2001) constructed the t-bound test.

$$H_0: b_0 = 0$$

If in case of $|t| > |I(1)|$, if the independent variables $x_{j,t}$ follows the I(0) or I(1) procedure, the null hypothesis will be rejected and a cointegration relationship can be concluded.

3.4. Findings and Discussion

Table 2 exhibits the outcomes of the unit root test. As the results suggest, using a 0.05 alpha level, the null hypothesis cannot be rejected. Thus, it can be concluded that the variables have a unit root. Therefore, none of the variables examined according to the ADF unit root test are stationary. To assess the stationarity of the variables, the ADF unit root test was employed to the first differences of the series.

Table 2. ADF Unit Root Test Results

	Intercept			Intercept & Trend		
Variables	**Statistics**	**p-value**	**Result**	**Statistics**	**p-value**	**Result**
LPI	-1.090766	0.7110	X	-2.689385	0.2459	X
LTAX	-2.225255	0.2006	X	-2.829841	0.1950	X
LCREDIT	0.394669	0.9805	X	-1.311205	0.8718	X
LGDP	-1.395718	0.5756	X	-2.115530	0.5228	X
LFX	-2.072202	0.2565	X	-1.786850	0.6924	X
LINF	-1.308301	0.6172	X	-2.309772	0.4199	X
LINT	-1.601447	0.4732	X	-2.068566	0.5481	X

Note: *,**,*** denote significance levels of alpha at 0.01, 0.05, and 0.10 respectively.

Table 3 shows the ADF unit root test results of the variables whose first differences were taken. According to the results, the null hypothesis, which expresses the unit root presence for all variables examined, is rejected at a 5% significance level. So it can be concluded that these variables are stationary. Thus, the difference taking process made all the series stationary and the degree of integration of these variables according to the ADF unit root test is “1”. However, traditional unit root tests like DF, Phillips-Perron (PP) and Kwiatkowski KPSS tests do not always take into account the breaks in the series, so they are not always very reliable. For this reason, in the second stage of unit root analysis, the stationary degrees of these variables were investigated by the double-break unit root test introduced by Lee and Strazicich (2003) based on LM statistics.

Table 3. ADF Unit Root Test Results at First Difference

	Intercept			Intercept and Trend		
Variables	**Statistics**	**p-value**	**Result**	**Statistics**	**p-value**	**Result**
ΔLPI	-6.274518	0.0000*	**I(1)**	-6.282658	0.0000*	**I(1)**
ΔLTAX	-6.083720	0.0000*	I(1)	-6.068498	0.0000*	I(1)
ΔLCREDIT	-4.772014	0.0004*	I(1)	-5.025156	0.0010*	I(1)
ΔLGDP	-6.057340	0.0000*	I(1)	-6.065742	0.0000*	I(1)
ΔLFX	-3.280311	0.0222**	**I(1)**	-3.895123	0.0210**	**I(1)**
ΔLINF	-7.690203	0.0000*	**I(1)**	-7.728786	0.0000*	**I(1)**
ΔLINT	-4.742410	0.0004*	**I(1)**	-4.962123	0.0012*	**I(1)**

Note: *,**,*** denote significance levels of alpha at 0.01, 0.05, and 0.10 respectively.

The findings of the two-break unit root test are shown in Table 4. The results indicate, at a 5% significance level, both PI and TAX series have breaks and at a 10% significance level the GDP series has breaks. When these breaks are taken into consideration, it can be concluded that these variables are stationary. Examining the other series that follow: the I(0) process breaks observed for PI in the years 1986 and 2001; TAX variable in the years 1991 and 2012, and GDP in the years 2006 and 2014. It can be concluded that these other variables follow a unit root process even when the structural breaks are considered, in other words, they are non-stationary variables. Thus, PI, TAX, and GDP followed the I(0) process while the variables of CREDIT, FX, INF, and INT variables follow the I(1) process.

Table 4. Lee-Strazicich (2003) Two-Break Unit Root Test Results at Level

Variables	Statistics	Break Dates	Result
LPI	**-4.305462**	**1986-2001**	**I(0)**
LTAX	**-3.645990**	**1991-2012**	**I(0)**
LCREDIT	-2.176164	2004-2007	I(1)
LGDP	**-3.313049**	**2006-2014**	**I(0)**
LFX	-2.790973	1981-2005	I(1)
LINF	-2.067157	1981-1983	I(1)
LINT	-1.437351	2006-2008	I(1)

Note: Critical values for the F intercept options were derived by Lee ve Strazicich as -4.0730, -3.5630, -3.2960 for significance levels of 0.01, 0.05, and 0.10 respectively.

Table 5 shows the estimation results of an ARDL model whose dependent variable is PI. According to the results obtained from Table 5, the appropriate lag length is "2" for the dependent variable PI, "0" for TAX (i.e. level values),"1" for CREDIT, "1" for GDP, "0" for FX, "1" for INF and "1" for INT. Thus, ARDL (2, 0, 1, 1, 0, 1, 1) model was estimated. The corrected R^2 value for this model was calculated as 0.91 and it was found that the model was statistically significant. When the coefficients of the model are analyzed, it is seen that only one period lagged value of the CREDIT variable is not statistically significant at the 5% and 10% levels and all other coefficients are statistically significant. Before testing whether this model is a cointegration model, it is necessary to pass the model through a series of diagnostic tests and correct the deviations, if there is any. In this context, first, the Breusch-Godfrey test for testing the possible autocorrelation in the model, the Breusch-Pagan-Godfrey test for varying variance, the Jarque-Bera normality test for determining the appropriateness of the model's residues to a normal distribution and the Ramsey-Reset for the suitability of the model specification were applied.
The standard model in estimating these conditions as represented in Eq. (8) is the basis of our analysis, which can be rewritten as Eq. (10):

$$PI_t = a_0 + \sum_{i=1}^{p} \varphi_i PI_{t-i} + \sum_{j=0}^{q_1} \beta_{1j} TAX_{t-j} + \sum_{j=0}^{q_2} \beta_{2j} CREDIT_{t-j} + \sum_{j=0}^{q_3} \beta_{3j} GDP_{t-j} + \sum_{j=0}^{q_4} \beta_{4j} FX_{t-j} + \sum_{j=0}^{q_5} \beta_{5j} INF_{t-j} + \sum_{j=0}^{q_6} \beta_{6j} INT_{t-j} + \epsilon_t \quad (10)$$

In the equation α_0 represents the intercept, $\in_t$ is the residual series, p, q_1,.....q_6 show the lag length that belongs to dependent and independent variables and is determined as 2,0,1,1,0,1,1 respectively. Lag lengths were calculated using AIC, SIC, and HQ model selection criteria and adjusted R^2 statistics.

Tablo 5. ARDL Model Estimation

Dependent Variable	**PI**			
Independent Variables	**TAX, CREDIT, GDP, FX, INF, INT**			
Selected Model	**ARDL(2, 0, 1, 1, 0, 1, 1)**			
ARDL Model Estimation	**Variables**	**Coefficient**	**Std. Error**	**p-value**
ARDL(2, 0, 1, 1, 0, 1, 1)	PI(-1)	0.753698	0.126470	0.0000*
	PI(-2)	-0.419537	0.141161	0.0059*
	TAX	-0.123830	0.068904	0.0827***
	CREDIT	0.270731	0.122372	0.0350**
	CREDIT(1)	-0.169453	0.108021	**0.1276**
	GDP	0.455650	0.106485	0.0002*
	GDP(-1)	-0.427119	0.102315	0.0002*
	FX	0.030902	0.011508	0.0119**
	INF	-0.075690	0.043041	0.0892***
	INF(-1)	-0.076700	0.038352	0.0550**
	INT	0.004637	0.002391	0.0623***
	INT(-1)	-0.004743	0.002306	0.0488**
	Constant	1.478075	0.625049	0.0250**
Adj. R2= 0.914576				
F-statistic= 37.58000 / F-Prob.= 0.000000*				

Note: *,**,*** denote significance levels at 0.01, 0.05, and 0.10 respectively.

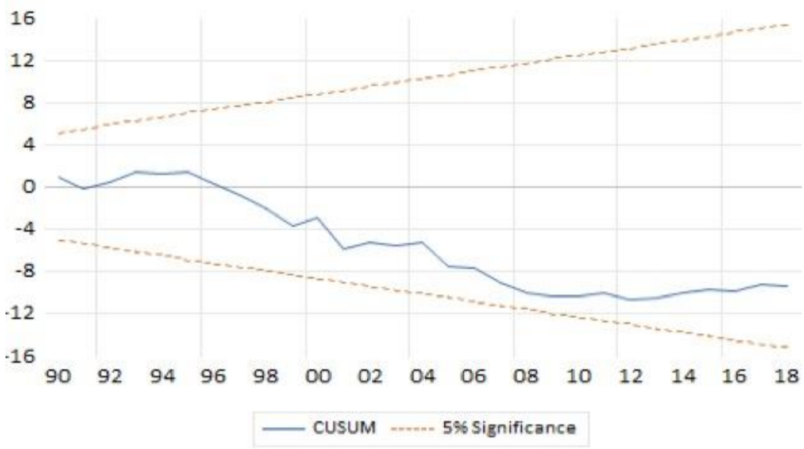
Table 6 shows the results of the diagnostic tests performed on the predicted ARDL model. Results are as follows:

- In the Breusch-Godfrey serial correlation test, at a 5% significance level, the null hypothesis which assumes no serial correlation in the model cannot be rejected as the prob>0.05 (0.3969>0.05).
- In the Breusch-Pagan-Godfrey test, at a 5% significance level, the null hypothesis which indicates that there is no heteroskedasticity in the model cannot be rejected as the prob>0.05 (0.0951>0.05).
- In the Ramsey-Reset test, using a 5% significance level, the null hypothesis assuming no specification (identification) error in the model cannot be rejected (p-value>0.16), so it can be concluded that the model does not yield any specification error.
- In the Jarque-Bera test, at a 5% significance level, the null hypothesis which indicates the residual distribution is normal cannot be rejected as prob>0.05 (0.9743>0.05). Thus, it was concluded the residues of ARDL(2,0,1,1,0,1,1) model are distributed normally.
- In order to test whether the predicted parameters are stable in the model, CUSUM and CUSUMQ graphs are plotted. The straight lines in these graphs represent the parameter estimates and the dashed lines represent 95% confidence limits (Graph 1, Graph 2).

Tablo 6. Diagnostic Tests

Diagnostic Tests	**Statistic**	**p-value**
Breusch-Godfrey Test	0.956520 (F- stat.)	0.3969
Breusch-Pagan-Godfrey Test	1.946003 (F-stat.)	0.0951
Ramsey RESET Test	2.017281 (F- stat.)	0.1666
Normality Test (Jarque-Bera)	0.051919 (JB- stat.)	0.9743

Graph 1. CUSUM



Graph 2. CUSUMQ

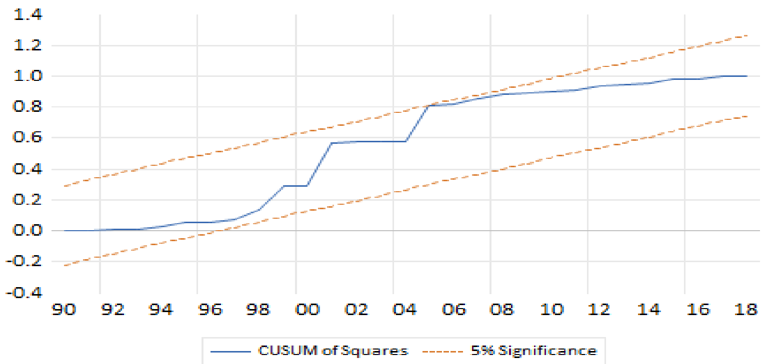


Table 7 shows the conditional error correction (CEC) model/regression. The significance of the **PI (-1)** variable is tested by looking at the prob values. Since this coefficient does not fit the standard "t" distribution, it must be tested through the t-bound test. Therefore, the prob value of the variable was not included.

A t-statistic -5.22448 was calculated for the dependent variable with a lag of one period (PI (-1)) which shows it is reliable.

Table 7. CEC Regression

Dependent Variable	**ΔPI**			
	Variables	**Coefficient**	**Std. Error**	**t- statistic**
	Constant	1.478075	0.625049	2.364735
	PI(-1)	**-0.665839**	**0.127446**	**-5.22448**
	TAX	-0.12383	0.068904	-1.797138
	CREDIT(-1)	0.101279	0.056713	1.785825
	GDP(-1)	0.028531	0.078703	0.362519
	FX	0.030902	0.011508	2.685258
	INF(-1)	-0.00101	0.038879	-0.025984
	INT(-1)	-0.000106	0.001658	-0.064011
	Δ(PI(-1))	0.419537	0.141161	2.972038
	Δ(CREDIT)	0.270731	0.122372	2.212367
	Δ(GDP)	0.45565	0.106485	4.278998
	Δ(INF)	0.07569	0.043041	1.758569
	Δ(INT)	0.004637	0.002391	1.939215

Table 8 shows the F and t-bound tests performed for the ARDL model. It is decided at this stage whether there is a cointegration relationship and if there is a cointegration relationship, long/short term coefficient estimations should be started, otherwise, a false regression problem will arise. Table 7 shows the F-bound test in the first part and the t-bound test in the second part. While "k" denotes the number of independent variables in the model, it is seen that the F-statistic is calculated as **5.920**. Columns I(0) and I(1) show the lower and upper critical values respectively. These values were initially produced by Pesaran et al. (2001) for n = 1000, and then Narayan (2005) produced lower and upper critical values for small samples, and in this study, lower and upper critical values recommended for n_2=40**, which is the nearest sample size to n_1=42*, are taken. Thus, since the calculated F-value 5.920 is greater than all the upper critical values (F> I (1)) at alpha 0.01, the null hypothesis of "there is no cointegration" can be rejected. Therefore, it is concluded that these series are cointegrated. However, it is necessary to test whether this cointegration is valid. For this reason, the t-bound test, whose results are presented in Table 7, was performed. For the t-bound test, t value calculated as -5.22448. This t value is the t-statistic of the 1 lagged value of the dependent variable in the CEC model. At this stage, it can be concluded that the cointegration relationship between the series is valid since the calculated t-statistic is greater than the absolute value**(|t=-5.22448|> |-4.04|; |-4.38|; |-4.66|; |-4.99|**) at all significance levels.

Table 8. ARDL Bounds Test

H_0: No cointegration between the variables			
F-bound Test	**α**	**I(0)**	**I(1)**
F= 5.920, k=6	10%	2.353	3.599
n_1=42*	5%	2.797	4.211
n_2=40**	1%	3.8	5.643
	α	**I(0)**	**I(1)**
t-bound Test	10%	-2.57	-4.04
t=-5.22448	5%	-2.86	-4.38
	2.5%	-3.13	-4.66
	1%	-3.43	-4.99

The long-term synchronized relationship between the cointegrated variables can be derived from Table 9. As the test results indicate, in the long-run all variables except INT are statistically significant. The negative sign of the TAX variable indicates that a 1% rise in corporate tax decreases the PI by 0.186%. This result is in line with the neoclassical investment theory and also with the finding of a recent study of Barbar et al. (2017) which revealed a negative effect of corporate tax on investment. The positive sign of the CREDIT variable indicates that an improvement of loans to private sector by 1% raises the level of PI by 0.152%. This finding confirms McKinnon and Shaw's hypothesis, that the availability of financial resources is an important determinant of the level of investments. This result also confirms the finding of Karagöz (2010) who found the private sector credit as an important driver of PI in Turkey and Asante (2002) who concluded that the real credit expansion was a key driver of investment in Ghana. The positive sign of the GDP variable shows that as GDP per capita increases by 1%, PI rises by 0.043%. This finding is line with the Accelerator Model of investment and with the finding of Uçan and Öztürk (2011) who concluded that PI is positively affected by real per capita GDP. The FX variable's positive sign indicates that a 1% rise in the exchange rate would increase the PI by 0.046%. This finding confirms that the depreciation of Turkish lira has been able to stimulate export-driven and import-substituting industries, consonant with the results of Karagöz (2010) and Frimpong and Marbuah (2010). The negative sign of the INF variable indicates that a 1% increase in inflation decreases the PI by 0.002%. This finding confirms the theory of internal funds which considers inflation as a macroeconomic risk factor. However, in the literature, the impact of inflation is ambiguous. In the studies conducted for Turkey (Karagöz, 2010; Uçan&Öztürk, 2010), the impact of inflation was found to be negative, However, in Ghana, this macroeconomic indicator was found to be a stimulant for investment (Frimpong&Marbuah, 2010). The interest rate was not found to be statistically significant in the model. This result contradicts the Keynesian investment theory and Tobin's Q theory which consider the cost of capital, in other words, the interest rate as the fundamental determinant of investment. However, this result confirms the finding of Karagöz (2010) who could not reveal a significant relationship between the RIR and PI in Turkey and the study of Elbanna (2016) who found similar results in Egypt.

Table 9. The Long-Run Estimation of ARDL Model

Dependent Variable	PI			
Long Run	**Variables**	**Coefficient**	**Std. Error**	**p-value**
	TAX	-0.185975	0.099807	0.0726***
	CREDIT	0.152107	0.085365	0.0852***
	GDP	0.042850	0.015118	0.0172**
	FX	0.046411	0.017194	0.0115**
	INF	-0.001517	0.000697	0.0396**
	INT	-0.000159	0.002480	**0.9492**

Note: *,**,*** denote significance levels at 1%, 5%, and10% respectively.
Note: All variables are in logarithmic form.

The estimated cointegration equation is shown as:

$$PI = -0.1860*TAX + 0.1521*CREDIT + 0.0428*GDP + 0.0464*FX - 0.0015*INF - 0.0002*INT \quad (11)$$

Table 10, shows the ECM as well as the short-term model/ coefficients. The most important point here is to test whether the error correction (EC) mechanism works. The main condition for this mechanism to work is that the EC parameter **"**CointEq (-1)" takes a negative value and is statistically significant.

Table 10. Error Correction Model

Dependent Variable	ΔPI			
Error Correction Model/Short-Run	**Variables**	**Coefficient**	**Std. Error**	**t-statistic**
	Constant	1.478075	0.231005	6.398448
	Δ(PI(-1))	0.419537	0.109626	3.826998
	Δ(CREDIT)	0.270731	0.084284	3.212147
	Δ(GDP)	0.455650	0.080579	5.654717
	Δ(INF)	0.075690	0.030196	2.506609
	Δ(INT)	0.004637	0.001703	2.723116
	CointEq(-1)*	**-0.665839**	**0.102998**	**-6.464574**

In this model, the determination of the significance of the error correction parameter is evaluated by using the t-bound test results (Table 11). It is concluded that the error correction coefficient (ECC) is statistically significant since the calculated t-statistic is greater than the absolute value **(| t = -6.464574 |> | -4.04 |; | -4.38 |; | -4.66 |; | -4.99 |)** at all significance levels and this means that the ECM is operating.

Table 11. t-bounds Test (ECM Model)

t-bounds Test	α	I(0)	I(1)
t= -6.464574	10%	-2.57	-4.04
	5%	-2.86	-4.38
	2.5%	-3.13	-4.66
	1%	-3.43	-4.99

To interpret the ECC, it is necessary to calculate the rate of re-equilibrium of the system by dividing the ECC by "1" (1/0.665839 = 1.501). This value indicates that it will take approximately **1.5 years** for the system to be rebalanced.

Conclusion

This study investigated financial and macroeconomic determinants of PI in Turkey using an ARDL model which examined both short term and long term effects with data from 1975 to 2018 from Turkey. This study provides empirical evidence that like other developing countries that PI in Turkey is affected by financial and macroeconomic variables. These findings incorporate crucial policy implications for Turkey regarding the support of the level of PI.

Corporate tax was not significantly related with PI in the short run, however, an increase in corporate tax reduces PI in the long run. Therefore, reducing corporate tax can encourage PI. Private sector credit was identified as a significant driver of PI in both studied periods. In this context, facilitating access to loans and take measures to reduce credit risks of companies may stimulate the PI. The fact that interest rates, which are considered as an important element of PI in investment theories, do not emerge as a significant variable in the long run, reveals the importance of credit volume and access to credit rather than the cost of borrowing for investors. A rise in interest rates increased PI in the short term as suggested by McKinnon (1973) and Shaw (1973). Since the GDP per capita has a positive effect on PI, the government must develop policies to support inclusive growth.

In the study, it was observed that the depreciation of the exchange rate had a positive effect on PI in the long run. In this context, the study emphasizes once again the importance of exchange rate management. Depreciation of the exchange rate increases the investment in export-oriented and import-substituting industries. Considering that excessive depreciation of the exchange rate causes macroeconomic instabilities such as inflation, it becomes vital to determine an optimal exchange rate level that will not increase inflation, but at the same time encourage investments.

Although it was seen that inflation, which is the most important indicator of macroeconomic instability, affects PI positively in the short run, it decreases the level of investment in the long run. Although it is rational behavior for producers to respond to rising prices favorably, the macroeconomic instability created by long-run inflation discourages PI. Therefore, it is important to implement economic policies that are in line with an optimal inflation level in terms of encouraging investment.

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