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Determining Factors of Private Investments: An Empirical Analysis for Turkey

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Özel Yatırımları Belirleyen Faktörler: Türkiye İçin Ampirik Bir Analiz

Abstract

Private investment plays a pivotal role in the free market economy. In the contemporary economic thinking private sector has a weighty and important place in the investment and production based growth. Considering the multifaceted nature of private investments, determining the factors which have effects on private investments gain importance. This paper aims to determine the factors which affect private investments in long-run in Turkey. To this end, the long-run private investment equation is estimated via bounds test (ARDL) approach to co-integration. Estimated coefficients of the variables show that in the long-run real GDP, real exchange rate, ratio of private sector credit to GDP, private external debt, inflation, and trade openness have a significant impact on private investments.

Key Words : Private Investment, Turkey, ARDL Test, Co-integration.

JEL Classification Codes : E22, C22, O16, O40.

Özet

Özel sektör yatırımları serbest piyasa ekonomisinin ekseni mesabesindedir. Çağdaş ekonomik anlayışta özel sektör yatırımları yatırım ve üretime dayalı büyümede ağırlıklı ve önemli bir yere sahiptir. Özel sektör yatırımlarının çok yönlü etkileri dikkate alındığında özel yatırımları etkileyen faktörlerin belirlenmesi önem kazanmaktadır. Bu çalışmada Türkiye'de uzun dönemde özel yatırımları etkileyen faktörlerin belirlenmesi amaçlanmaktadır. Bu amaçla, eşbütünleşmeye sınır testi (ARDL) yaklaşımı ile uzun dönem yatırım denklemi tahmin edilmiştir. Tahmin edilen katsayılar uzun dönemde GSYH, reel döviz kuru, özel sektör kredilerinin GSYH'ye oranı, özel dış borçlar, enflasyon ve ticarî açıklığın özel sektör yatırımları üzerinde olumlu etkide bulunduğunu göstermektedir.

Anahtar Sözcükler : Özel Yatırımlar, Türkiye, ARDL Testi, Eş-bütünleşme.

1. Introduction

In the theory and literature of economics, it is accepted that one of the most important props of the healthy and sustainable growth is capital accumulation and the main source of capital accumulation is capital assets investments. In the contemporary economic thinking, private sector has a weighty and important place in the investment and production based growth. In the late 1980s when socialist regimes have collapsed one after another, private sector has been in ascendant in developing countries while economic activities of public sector receded and a general conviction has been occurred about the fact that private sector could act a considerable part on the way of economic development. In these countries, in order to develop the private sector as a base for sustainable economic growth, structural adjustment programs and sectoral reforms have been adopted. But the varying weight of private sector in economy across developing countries indicates that private investments are affected by different factors and country-specific structures direct the private sector.

Considering the effects of private investments on production, rise in employment and income, stability of prices and balance of payments, technology transfer and capital accumulation, together with the general economic growth, determining the factors which have effects on private investments gains importance. In this way, by following more rational policies it will be possible that unbarring the private investments and maximizing the benefits that expected from private sector.

Like many other developing countries, especially in last few decades, private sector-led economic growth has been adopted also in Turkey. In this context, it is tried to enhance the private investments by various investment inciting means and on the other side the weight of public sector in the production activities has been reduced. If the evolution of the private fixed capital investments over time is examined, despite the contractions ever and anon, it is seen an upward trend. If macro and microeconomic importance of private investments are considered, the subject of determining the factors which affects the investment decisions gains importance. It will be beneficial to determine these factors for both preserving the existing investments and determining the policies to be followed for providing convenient environment for new investments.

This paper aims to determine the factors which affect private investments in long-run in Turkey. To this end, the long-run private investment equation is estimated via bound test (ARDL) approach to co-integration. The plan of the paper is as follows: In the next section, a brief overview of general structure of Turkish economy and evolution of private investments are given. In Section 3 theoretically effecting factors of private

investments are considered. Some other studies those conducted for other countries are reviewed in section 4. In section 5 the employed econometric methodology, empirical results and their interpretation are presented. Finally concluding remarks are given in Section 6.

2. Turkish Economy and Private Sector

There is a common belief that any increase in goods and services in consequence of fixed capital investments that realized by public sector or private sector will rise the national income and may cause to development of the country. If the development of the public sector fixed capital investments over time is examined, it is seen that until the late 1970s government has established state-owned enterprises aiming at to provide the economic development, to lead the economy, to finance the government expenditures. If the conditions of the time when the Republic has been established considered, the idea of state-led development (statism) may be found reasonable. In order to provide the economic growth and development the government has took place with state-owned enterprises in producing investment-intensive processes such as transportation, energy, mining, iron & steel, and petro-chemical etc. These state-owned enterprises also activated in the fields which private sector couldn't get in and succeed (Yilmaz and Tezcan, 2007: 5).

In line with the public-led import substitution-based development idea, which has lasted until late 70s, a little achievement has gained in the production of consumption goods, but about investment goods and intermediate products dependence to external markets has continued. Since, in import substitution-based development model in essence production aims to satisfy the domestic demand, exchange shortage and import difficulty crop up over time due to deterioration in trade balance. This situation handicaps the sustainability of the system. Turkey has tried to overrun this bottleneck by export-led development policy in the post-80s transformation period and this has accelerated the investments in export-oriented manufacturing sectors.

Especially from the mid 80s onwards, together with the liberalization wave, by the impact of privatization on one side and resurrection in private sector itself on the other side, a considerable expansion has been provided in private investments. If the sources of the stable growth trend, that is saw in Turkish economy in recent years, are examined it can be seen that private investments became the engine of the economic growth. At the beginning of the recession in late 70s, while the share of the private fixed capital investment in GDP was 20%, then it has sharply decreased to 9% in 1984. In 2005, private investments increased in real at a rate of 23.6% and contributed to growth at 4.6 point (SPO, 2006).

3. Effecting Factors of Private Sector Investments

3.1. Economic Factors

Theoretically, it can be said that in developing countries private investments are affected by level of domestic production, real interest rate, public sector investments, amount of available credit, and volume of external debt, exchange rate, and overall macroeconomic stability. The neoclassical theory of investment treats the value of the capital stock desired by a competitive enterprise as a positive function of its output level. Accelerator theory also suggests that as demand or income increases in an economy, so does the investment made by firms. Furthermore, when demand levels result in an excess in demand, firms increase investment to match demand (Khan and Khan, 2007: 7).

The real interest rate is also considered an important variable in determining the level of investment by neoclassical theory. A negative relationship is expected theoretically because of increases in the interest payable being disincentive to investment. However, R.I. McKinnon and E. S. Shaw suggest that there could positive relationship between investment and real rate of interest rate, because higher real rate of interest would increase savings, volume of domestic credit will increase as a result, and equilibrium investment be higher. This hypothesis, known as McKinnon – Shaw hypothesis, is based on assumption that quantity of financial resources is main constraint on investment rather than cost of financial resources (Khan and Khan, 2007: 7). In the developing countries, the public sector generally plays a large part in economic activity through public sector investment. The public sector investment may have "crowding out" or "crowding in" effects on private sector investment.

According to Keynesian approach, crowding out effect of public sector on private investments is very small and unimportant. Demand decrease which is caused by underemployment may result in a reduction in production and an increase in unemployment. Therefore, the government will try to enhance the demand by reducing the tax rates and raising the public expenditures. In consequence of this enhanced demand the productivity of private investments will rise and investments will be accelerated. In this case, even though interest rates rise crowding out effect will not arise. But, as much as the economy converged to full employment crowding out effect will make feel itself.

Monetarist opinion asserts that in the case of financing the budget deficits by taxes or borrowing via flotation, due to the increase in demand for loanable funds, interest rates will rise too. This increases the cost of investment and hence private investments will reduce. In this case, private sector expenditures decrease as much as the increase in public expenditures (Taban and Kara, 2006: 13).

Another important factor which affects private investments is development level of financial intermediation system. Empirical findings point out that financial development and private investments affects each other positively (Huang, 2006). Financial development will present more opportunities and incentives to investors. In a developed financial system mobilization and distribution of resources will be more effective for investors. Credit constraint that sourced from less developed capital markets and inadequate financial intermediation will affect the investment decisions of the firms negatively (Shrestha and Chowdhury, 2005: 2). Because of the absence of long-term financing and the future market, bank loans and external borrowing may be the only sources of credit available for private sector investment financing (Khan and Khan, 2007: 7).

Exchange rate also plays a crucial role in investment decisions by entrepreneur; especially in this globalised world it becomes more important. A change in currency value changes the real costs of purchasing imported capital goods, the profitability of the private sector is affected and possibly causing investment to change. Furthermore, this may result into change in real income of the economy as a whole, thus altering the production capacity. The change in exchange rate also affects the investment through sectors producing internationally traded goods, due to its impacts on competitiveness and export volumes.

The other thing that is important in investment decision making is irreversible nature of investment in capital goods. As many capital goods are company specific and cannot be sold at the same prices they were purchased. It means an irrecoverable cost is attached with sale of such goods. This irreversibility may result into uncertainties which in turn have a large influence on investment decision. That is why investors are reluctant to carry out major investments, even in the prosperous environment. When the investment contains more irreversible features, excess volatility and related uncertainty may lead the investors to seek profit opportunities in short-term portfolio investments rather than investing in long-term productive projects (Aysan et al., 2005: 3). The adjustment cost attached depends on degree of economic stability and the credibility of public policies. This is very reason that recent studies on private-sector investment in developing countries have included the variables representing uncertainties in the investment decision-making process. However it is hard to define political instability. Although many approaches have been used in this regard, two of them are worth mention here. In the first approach, political instability is defined as executive instability i.e. propensity to observe government changes which is associated with policy uncertainty for example threat to property rights. Second approach is based on socio-political unrest that is measured by some index of variables related to such unrest. Both the measures, however, are difficult to construct (Khan and Khan, 2007: 8).

3.2. Non-Economic Factors

In addition to economic factors stated above, there are some other factors that are important for the rapid private sector investment growth. These include the good governance, quality of institutions and entrepreneurial skills for the private sector to make big investment decisions based on a rational assessment of risks and potential pay-offs. These factors play complementary role with the traditional economic factors. It has been suggested that the types of entrepreneurship that can be identified and the enterprise strategies adopted, are heavily influenced by the external environment in general, and the institutional context in particular.

Government-sourced factors become effective on private investments generally in the form of political risk. Political risk can be decomposed to three components roughly, as political stability, from of regime change and capacity of performing the policies (Le, 2004). Again, a developed physical infrastructure provided by the state also has the potential of affecting the feasibility of private investments.

4. Literature Review

The theoretical literature on private investment is quite rich and diverse. The accumulation of real fixed capital stock and capital formation by the private sector has been afforded extensive detail in formal models based on the experience of developed countries. The major strands of investment behavior could be classified as the simple accelerator theory, Tobin's Q theory, and neoclassical theory. The neoclassical flexible accelerator theory has been the most popular among the models of investment behavior (Oshikoya, 1994: 583).

Empirical literature as to effective factors of private investment can be classified into two broad groups: macroeconometric studies which depend on analyze the time series that belong to one or more countries, and microeconometric studies which depend on firm-scale data. Sakr (1993), Oshikoya (1994), Jenkins (1998), Ghura and Goodwin (2000), Ribeiro and Teixeira (2001), Seruvatu and Jayaraman (2001), Valadkhani (2004), Ouattara (2004), Acosta and Loza (2005), Aysan et al. (2005), Khan and Khan (2007) can be cited as examples of the first group studies.

Serven (1998) assess the impact of macroeconomic uncertainty on private investment using a large panel data set on developing countries. He draws a distinction between sample variability and uncertainty constructs alternative measures of the volatility of innovations to five key macroeconomic variables – inflation, growth, the terms of trade,

the real exchange rate and the price of capital goods – and examines their association with aggregate private investment in a regression framework, controlling for other standard investment determinants. The estimates show significant output and cost-of capital effects, with the latter captured by the relative price of capital, the real interest rate and/or the availability of credit to the private sector. The results also show that private investment displays significant persistence over time.

Acosta and Loza (2005) provide an empirical analysis of the macroeconomic factors that can potentially affect decisions in Argentina in a short, medium and long run perspective. The results they have obtained suggest that investment decisions seem to be determined, in the short run, by shocks in returns (exchange rate, trade liberalization) and in aggregate demand. Besides, there is evidence of a "crowding-out" effect of public investment. In the long run, the capital accumulation path seems to be closely dependent on both well-developed financial and credit markets and on perspectives of fiscal sustainability.

In general, economic theory predicts a feedback relationship between investment and financial development. Especially in financing the SMEs and large scale investment project, existence of a developed financial intermediation mechanism plays a crucial role. So, an advance in financial intermediation may reduce the financial cost of investment while increasing investments cause to a rise in financing need. Huang (2006) aimed to investigate the causality between aggregate private investment and financial development in a globalized world. Using a panel data set with 43 developing countries over 1970-1998, the analysis is conducted in two steps. In first step, system GMM estimation on data for 5-year averages indicates positive casual effects go on in both directions and a high degree of persistence in the averaged data of private investment and financial development. In the second step, a common factor approach on annual data allowing for global interdependence and heterogeneity across countries has been adopted. The analysis demonstrates that the series of both private investment and financial development are integrated, and two-way positive casual effects exist in the cointegrated system.

Mallick (2002) found that, in a Keynesian framework, in India the long run determinants of private investment were public investments, volume of domestic credit used by private sector, real interest rate, and human capital. In another study which made for Senegal, Ouattara (2004) investigates the determinants of private investment over the period of 1970-2000. The long-run private investment equation is derived using the Johansen cointegration techniques and bounds test approach. In both cases, the results indicate that public investment, real income and foreign aid flows affect positively private investment, whilst the impact of credit to private sector and terms of trade is negative. The study of Ribeiro and Teixeira (2001) reveals that, in Brazilian economy, level output,

public investment and amount of financial credits affect private investment positively, whilst exchange rate affects negatively.

Khan and Khan (2007) attempted to analyze the determinants of private investment in Pakistan over the period 1972-2005. The ARDL cointegration approach is employed to check the existence of a long-run relationship as well as short-run dynamics of investment. The result of their analysis shows that most traditional factors have little or no impact on private investment. They have found partial support for the accelerator principal and the crowding-out hypothesis in the case of Pakistan. However, the hypothesis that the volume of the funds is as important as the cost of the funds used in financing private investment and the McKinnon-Shaw hypothesis are not verified in the case of Pakistan. On the other hand, the findings of Sakr (1993) show that government investment, GDP growth and credit extended to private sector was positively correlated to private investment. However, when government investment is disaggregated into its infrastructural and noninfrastructural components, the latter is found to be negatively correlated with private investment.

It is accepted that some non-economic factors and political risk facts may have impact on private investment, and there is sufficient empirical evidence at this direction. Aysan et al. (2005) analyzed the determinants of unsatisfying private investment growth in the Middle East and North Africa (MENA) throughout the 1980s and 1990. Their paper shows empirically for a panel of 40 developing economies, that in addition to the traditional determinants of investment, government policies explain MENA's low investment rate. Additionally, insufficient structural reforms represented as poor financial development and deficient trade openness has been a crucial factor for the deficit in private capital formation. Economic uncertainties of the region that mainly caused by external debt burden and economic volatility have constituted major deterrent for firms to invest. Le (2004), as distinct from other studies, links the private investment to rate of return differential, risk aversion, and several types of political risk. Estimating private investment equation for a panel of 25 developing countries over 21 years he yielded the following results: i) socio-political instability characterized by nonviolent protests promotes private investment while violent uprisings hinder private investment; ii) regime change instability characterized by constitutional government change promotes private investment; and iii) policy uncertainty characterized by variability of contract enforcement rights promotes private investment while variability of government political capacity hinders private investment.

To the best of author's knowledge there is no empirical analysis as to determinants of private investment in Turkey in a comprehensive framework. In some studies, however, effects of various factors on private investment have been investigated.

Chhibber and van Wijngergen (1998) analyzed the impacts of public policy on private investment. Their empirical results reveal that output level, real effective cost of borrowing and ratio of public sector credits to GDP has a significant effect on private investment. Other two variables, namely capacity utilization rate and the share of infrastructural investment in gross public investment, seem to have no meaningful effect. Chhibber and van Wijngergen (1998) put forward that the effect of public policies on private investment was complex, and the subject should be evaluated in the light of the institutional factors such as exchange and export promotion program.

Taban and Kara (2006) found in their empirical analysis that government's domestic borrowing and public investment has "crowding-out" effect on private investment in Turkey.

5. The Model and Method

In order to determine the effective factors on private investment in Turkey, following Ribeiro and Teixeira (2001) we used the model as given below:

$$PINV_t = \beta_0 + \beta_1 GDP_t + \beta_2 RER_t + \beta_3 PUI_t + \beta_4 IR_t + \beta_5 PCR_t + \beta_6 PED_t + \beta_7 INF_t + \beta_8 TO_t + e_t \qquad (1)$$

Where GDP_t is gross domestic product, RER_t is real exchange rate, PUI_t is stock of public sector investment, IR_t is the interest rate, PCR_t is ratio of private sector credit to GDP, PED_t is private sector external debt, INF_t is inflation rate (WPI), and TO_t is trade openness (i.e. export plus import). A priori expectations about the parameters are such that $\beta_1 > 0$, $\beta_2 < 0$, $\beta_3 < 0$ or > 0, $\beta_4 < 0$ or > 0, $\beta_5 > 0$, $\beta_6 > 0$, $\beta_7 < 0$, $\beta_8 < 0$. All annual time series data from 1970 to 2005 are collected from the CBRT's (Central Bank of Republic of Turkey) database (EDDS) and Turkish Statistics Institution. All variables are used in their logarithmic form.

It is known that economic time series are non-stationary in general. When dealing with time series data, it is necessary to asses whether the series are stationary or not. The reason being that regression of a non-stationary series on another non-stationary series lead to what is known as spurious regression. Furthermore, statistical tests of the parameters resulting from such regression may be biased and inconsistent. The standard approach to investigate the stationarity of a time series is through unit root tests. Several tests are available but the most commonly used is the augmented Dickey-Fuller (ADF) test. If two series are non-stationary but their linear combination is, the two series are said to be cointegrated. Series that are cointegrated move together in the long run at the same rate; in other words, they follow an equilibrium relationship in the long run. Traditional tests of co-integration necessitate that all variables must be homogeneous at same order.

But, so called auto-regressive distributed lags (ARDL) approach does not have any such pre-requisite (Pesaran and Shin, 1999; Pesaran, et al., 2001). Other important advantages of ARDL approach are that it can take care of endogeneity of the explanatory variables and has good performance in small samples whilst the Johansen co-integration techniques require larger samples for the results to be valid (Pahlavani, 2005: 9).

The short-run dynamic can be incorporated into the equation, as econometrics literature suggests. The above equation can be specified in an error-correction modeling format as:

$$\Delta PINV_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta PINV_{t-i} + \sum_{i=1}^{p} \delta_i \Delta z_{t-j} + \gamma_0 PINV_{t-1} + \gamma_i z_{t-1} + e_t \qquad (2)$$

Here, z is vector of explanatory variables, δ and γ are vectors of coefficients, β_0 is drift component. The ARDL model testing procedure starts with conducting the bound test for the hypothesis of no cointegrating relationship. Using conventional F-tests, the null of H_0: $\forall\ \gamma_i = 0$, is tested against the alternative of H_1: $\exists\ \gamma_i \neq 0$, (where, i = 0, 1, 2, …, p). The null hypothesis means the non-existence of the long run relationship between private investment and explanatory variables. The calculated F-statistic is compared with the critical values. The F-test has a non-standard distribution which depends upon (i) whether variables included in the ARDL model are I(0) or I(1), (ii) the number of regressors, and (iii) whether the ARDL model contains an intercept and/or a trend term (Narayan and Narayan, 2004). Pesaran et al. (2001) tabulated two sets of critical values, one for the case when all variables are I(1), i.e. upper bound critical values and the other one when all variables are I(0), i.e. lower bound critical values. If the test statistic is higher than the upper bound critical value, the null of no co-integration (non-existence of the long-run relationship) is rejected in favor of the presence of co-integration. On the other hand, if the F-statistic falls below the lower bound critical value this implies the absence of co-integration. In the event that the calculated F-statistic lies between the two critical values, there is no clear indication of the absence of a co-integration relationship (Babatskii and Egert, 2005; 12).

The ARDL method estimates $(p + 1)^k$ number of regressions in order to obtain optimal length for each variable, where p is the maximum number of lag to be used and k is the number of variables in the equation. The model can be selected using the model selection criteria like Schwartz Bayesian Criteria (SBC) or Akaike's Information Criteria (AIC). SBC gives more parsimonious model, selecting the smallest possible lag length, whereas AIC selects the maximum relevant lag length (Shrestha, 2005). The model choose is demonstrated as ARDL(*,*,*, …) where * denotes the selected lag length of the related variable based on model selection criteria.

In the second step, the long run relationship is estimated using the selected ARDL model. Once the long run relationship i.e. the co-integration among the variables is confirmed, the following Error Correction Model (ECM) can be estimated at the third step:

$$\Delta PINV_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta PINV_{t-i} + \sum_{i=1}^{p} \delta_i \Delta z_{t-i} + \lambda ECM_{t-1} + \varepsilon_t \quad (3)$$

Where λ represents the speed of adjustment parameter and *ECM* is residual obtained at the first step.

6. Empirical Findings

Although it is not a precondition for ARDL co-integration approach, integration orders of the variables are investigated by using ADF unit-root test to confirm the necessity and adequacy of ARDL test. Because the ARDL test is based on the assumption that the variables should be I(0) or I(1), in the presence of I(2) variables the computed F-statistics could not comparable with the values tabulated by Pesaran et al. (2001). Therefore, the implementation of unit root tests in ARDL procedure might still be necessary in order to ensure that node of the variables is integrated of order I(2) or beyond (Wahid and Shahbaz, 2009). Test results of the unit root tests are given in Table 1 (see Appendix). So, the variables *PUI*, *RER*, *PCR* and *TO* are stationary at their levels, while the variables *PINV*, *GDP*, *IR*, *PED* and *INF* become stationary at their first differences. Therefore the most appropriate estimation technique is ARDL approach.

Since the sample covers eight explanatory variables and only 36 observations per variable, the lag length has been fixed as two for each variable in order to avoid further loss in degree of freedom. Thus, the total number of regressions estimated following the ARDL model in Equation-2 is $(2 + 1)^8 = 6561$. The selected ARDL model based on AIC is (0,0,2,2,2,2,2,2,1). The calculated F-statistic is equal to 7.433. This value exceeds by far better the upper bound critical value reported in Pesaran *et al.* (2001) at the 0.05 percent level, which suggests the rejection of the null hypothesis of no cointegration (the tabulated lower and upper bound F values are 2.272 and 3.447 respectively).

As second step, estimated long-run coefficients of the variables are given in Table 2. The results show that in the long-run real GDP, real exchange rate, ratio of private sector credit to GDP, external debt and trade openness have a significant impact on private investments. The impacts of first and last variables are negative while others' are positive. Rest of the variables seems have no statistically meaningful effect.

After estimating the long-run coefficients, the error correction representation of the ARDL model has been obtained. The estimated coefficients of the error-correction model are given in Table 4. The results show that error correction term has a negative sign and significant which confirms the existence of long run relationship at the first step.

The error correction term indicates the speed of the equilibrium restoring adjustment in the dynamic model. The ECM coefficient shows how quickly/slowly variables returns to equilibrium and it should have a statistically significant coefficient with a negative sign. Bannerjee et al. (1998) holds that a highly significant error correction term is further evidence of the existence of a stable long-run relationship. As it is seen in Table 4, the expected negative sign of the ECM is highly significant. The estimated coefficient of the ECM (-1) is equal to -1.4678, suggesting that deviation from the long-run *PINV* path is corrected by 1.47 percent over the following year. This means that the adjustment takes place relatively quickly.

7. Conclusion

As for most of the developing countries, private investment is also crucial for Turkish economy in the way of (sustainable) economic growth and a robust market economy. Especially after 80s, together with the liberalization, privatization, and open-market reforms, private sector has become a dominant actor in Turkish economy. Nevertheless, it can be said that private sector is still weak and vulnerable across economic bottlenecks in Turkey. Therefore, it is of great importance to know which factors are effective on private sector investment decisions, in Turkey.

In this paper, the long-run determinants of private sector investment in Turkey have been investigated, over the period of 1970-2005. To this end, integration level of variables has been examined in first step. ADF test result shows that public investment, real exchange rate, ratio of private sector credit to GDP, and trade openness variables are stationary at their levels whilst the others are stationary in their first differences. The difference in integration levels confirms and also necessitates of using the ARDL co-integration approach. Therefore, the long run estimate of the private investment function for Turkey was derived using the ARDL bounds test approach. Result of the ARDL test points out a statistically meaningful long run co-movement among the variables.

In the second step, most parsimonious estimation results have been obtained. Estimated long-run coefficients of the variables show that in the long-run real GDP, real exchange rate, ratio of private sector credit to GDP, private external debt, inflation, and trade openness have a significant impact on private investments. The impacts of first and

last variables are negative while others' are positive. Rest of the variables seems have no statistically meaningful effect. This situation may be an indicator of that in Turkey private sector is export-oriented. On the other hand, meaningfulness of the ratio of private sector credit to GDP and private external debt variables can be seen as apparent deficit in equity capital of Turkish firms. The negative and significant coefficient of the inflation variable confirms the detractive impact of economic instability on private investment decisions.

The error correction representation of the ARDL model shows that error correction term has a negative sign and significant. The estimated coefficient of the ECM (-1) is equal to -1.4678, suggesting that deviation from the long-run *PINV* path is corrected by 1.47 percent over the following year. This means that the adjustment takes place relatively quickly.

The results do not support the existence of any relationship between public and private sectors investment in long-run. But ECM estimates point to one-year lagged crowding out effect of public investment in short-run.

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APPENDIX

Table: 1
ADF Unit Root Test Results

		Level		1. Difference	
Variable	***Lag***	***Intercept***	***Int.+Trend***	***Intercept***	***Int.+Trend***
PINV	0	-1.350	-1.549	-4.332***	-4.328***
	1	-1.740	-2.678	-2.811**	-2.678
	2	-1.416	-2.844	-2.683*	-2.532
GDP	0	-2.023	-2.018	-5.808***	-6.006***
	1	-2.355	-2.257	-3.304**	-3.516*
	2	-2.606	-2.948	-2.822*	-2.994
IR	0	-1.465	-0.677	-5.834***	-6.164***
	1	-1.456	-0.469	-5.141***	-5.865***
	2	-1.244	0.669	-2.418	-3.124
PUI	0	-2.395	-1.966	-4.634***	-4.850***
	1	-3.002**	-2.771	-4.051***	-4.371***
	2	-3.031**	-2.593	-4.143***	-4.771***
RER	0	-1.853	-4.686***	-7.569***	-7.446***
	1	-1.284	-4.612***	-6.008***	-5.921***
	2	-0.781	-4.593***	-5.731***	-5.606***
PCR	0	-0.979	-2.639	-4.065***	-3.988**
	1	-1.506	-4.441***	-4.553***	-4.414***
	2	-1.151	-3.414**	-3.686***	-3.326*
PED	0	-1.694	-1.072	-4.493***	-4.690***
	1	-1.550	-1.439	-3.658***	-4.050**
	2	-1.902	-1.464	-2.882*	-3.332*
INF	0	-1.485	-0.921	-5.443***	-5.840***
	1	-1.811	-1.001	-3.924***	-4.446***
	2	-1.785	-0.763	-3.694***	-4.498***
TO	0	-1.767	-3.057	-4.435***	-4.472***
	1	-1.587	-3.998**	-4.080***	-4.110**
	2	-1.520	-4.087**	-3.479**	-3.331*

Note: (***), (**), (*) indicates significance at 1, 5, 10 percent, respectively.

Test statistics	LM Tests	p-value
A: Autocorrelation	$\chi^2(1) = 12.3188$	0.000
B: Functional form	$\chi^2(1) = 3.2992$	0.069
C: Normality	$\chi^2(2) = 5.1895$	0.075
D: Heteroscedasticity	$\chi^2(1) = 2.8378$	0.092

A: Lagrange multiplier test of residual serial correlation

B: Ramsey's RESET test using the square of the fitted values

C: Based on a test of skewness and kurtosis of residuals

D: Based on the regression of squared residuals on squared fitted values

Table: 2
Long-run coefficients of ARDL(0,0,2,2,2,2,2,2,1) Model Selected Based on AIC Criterion

Dependent variable: $\boldsymbol{PINV_t}$

Explanatory variable	Coefficient	Std. Error	t-stat	[p-value]
GDP	1.1112	0.2456	4.5252	[0.001]***
RER	-0.3508	0.0629	-5.5754	[0.000]***
PUI	0.0117	0.1453	0.0805	[0.937]
IR	0.0439	0.0769	0.5715	[0.578]
PCR	0.2846	0.1271	2.2394	[0.045]**
PED	0.0678	0.0166	4.0779	[0.002]***
INF	-0.0700	0.0180	3.8894	[0.002]***
TO	-0.0320	0.0057	-5.5928	[0.000]***
Constant	4858019	1165894	4.1668	[0.001]***

Note: (***), (**), (*) indicates significance at 1, 5, 10 percent, respectively.

Table: 3
Error Correction Representation of ARDL(0,0,2,2,2,2,2,2,1) Model Selected Based on AIC Criterion

Dependent variable: $PINV_t$

Explanatory Variable	Coefficient	Std. Error	t-stat	(p-value)
ΔGDP	1.1112	0.28875	3.0741	[0.008] *
ΔRER	-0.1316	0.70718	-1.7617	[0.098] ***
ΔRER1	0.0908	0.72455	-3.8447	[0.002] *
ΔPUI	-0.0560	0.27768	-0.2652	[0.794]
ΔPUI1	-0.2967	0.22844	4.5951	[0.000] *
ΔIR	0.0236	0.20612	0.4932	[0.629]
ΔIR1	-0.1302	0.19775	1.1113	[0.284]
ΔPCR	0.3533	0.11337	-0.8186	[0.426]
ΔPCR1	0.2478	0.17536	-2.6219	[0.019] **
ΔPED	-0.3045	0.16013	-0.3963	[0.697]
ΔPED1	-0.1541	0.23528	1.7215	[0.106]
ΔINF	0.0080	0.01405	0.3394	[0.739]
ΔINF1	-0.0206	0.02817	2.2042	[0.044] **
ΔTO	-0.0091	0.02699	1.5982	[0.131]
Constant	4858019	7.03840	1.5211	[0.149]
ECM(-1)	-1.4678	0.28052	-5.2324	[0.000] *

Note: (***), (**), (*) indicates significance at 1, 5, 10 percent, respectively.

$$ECM = PINV - 2.7403\ GDP + 0.2511\ RER + 0.0585\ PUI - 0.3110\ IR + 0.1971\ PCR + 0.0111\ PED - 0.0857\ INF + 0.4085\ TO - 7.2942\ C - 0.0331\ T$$

R^2	0.9708	Adjusted R^2	0.8623	
S.E. of Regression	0.0518	F-stat. F(18.15)	12.9284	[.000]
Akaike Info. Criterion	52.2592	Schwarz Bayesian Criterion	31.6534	
DW-statistic	2.0706			