

Time Series Analysis of the Relationship Between Interest Rate and Private Investment in Turkey

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Abstract

The two major determinants of private fixed investment are per capita real gross domestic product and real interest rate. Income channel works through capital adjustment mechanism and the effects of changes in income on fixed investment depends on capital output ratio. Real interest rate, on the other hand, represents the alternative cost of investment. For almost a decade, private investment has been sluggish, and as a result, there has been a heated debate in both political and academic circles regarding the level of interest rate and whether low interest rate is a major stimulus for the private investment in Turkey. In this paper we model the interaction between real interest rate and private investment in Turkey over the period between 1973 and 2014. Our findings indicate that there is unidirectional causality from real interest rate to private investment in the short and long run. However, there are breaks in terms of the size of the relationship, trend and regime during the second oil crisis (1978), Asian and Russian economic crises (1887, 1999), and global financial crisis (2008/2008). Therefore, we conclude that there is room for the monetary policy to stimulate private investment by lowering real interest rate in Turkey.

Keywords: *Private Investment, Interest Rate, Cointegration Test with Structural Breaks, Turkey*

JEL Classification: *C22, E22, E32,E43, E50*

Türkiye’de Faiz Oranı ve Özel Yatırım Arasındaki İlişkinin Zaman Serileri Analizi

Özet

Özel sektör sabit sermaye yatırımlarının iki temel belirleyicisi kişi başına reel gayri safi yurt içi hâsıla ve reel faiz oranıdır. Gelir kanalı sermaye uyumlanma mekanizması yoluyla çalışmakta ve bu süreçte gelirdeki değişmelerin sabit sermaye yatırımları üzerindeki etkisinin büyüklüğünü sermaye hâsıla oranının büyüklüğü belirlemektedir. Diğer yandan, reel faiz oranı, yatırımın alternatif maliyetini temsil etmektedir. Yaklaşık on yıldır Türkiye’de özel sektör yatırımları belirgin bir biçimde durgun olduğu için hem politik hem de akademik çevrelerde, hem reel faiz oranının düzeyi hem de düşük faiz oranının özel sektör yatırımları için bir teşvik unsuru olup olmadığı konusunda ateşli bir tartışma söz konusudur. Biz bu çalışmada Türkiye’de 1973-2014 dönemi için reel faiz oranı ve özel yatırımlar arasındaki ilişkiyi modelliyoruz. Bulgularımız hem kısa hem de uzun dönemde reel faiz oranından özel yatırımlara doğru tek yönlü bir nedenselliğin varlığına işaret etmektedir ancak, hem ilişkinin büyüklüğü hem de eğilim ve formu anlamda ikinci petrol krizi (1978), Asya ve Rusya ekonomik krizleri (1997, 1998) ve küresel finansal kriz (2008/2009) dönemlerinde kırılma gözlemlenmektedir. Böylece, çalışmanın buğularından yola çıkarak, Türkiye’de para politikasının reel faiz oranını düşürerek özel sektör yatırımlarını özendirmesinin olanaklı olduğunu ileri sürebiliriz.

Anahtar Kelimeler: *Özel Yatırım, Faiz Oranı, Yapısal Kırılmalı Eşbüttünleşme Testi, Türkiye*

JEL Sınıflandırması: *C22, E22, E32,E43, E50*

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1. Introduction and a Short Literature Review

Capital stock, together with labor force and the level of technology, determines the productive capacity in an economy in the long run. Investment is addition to the capital stock, and, through its income effect it determines the short run economic growth performance of the economy. Investment also determines the size of employment in a country's economy and it becomes crucial when the country is experiencing high levels of unemployment. On the other hand, private investment is the most volatile component of aggregate demand. Therefore, most of the studies conducted to examine the determinants of investment expenditure seek to understand major source of fluctuations in aggregate demand.

Private investment expenditures cover three major categories; fixed nonresidential investment, fixed residential investment, and inventories. The two major determinants of private fixed investment are per capita income (per capita real gross domestic product-GDP) and real interest rate.

From a theoretical perspective, income channel works through capital adjustment mechanism and the effects of changes in income on fixed investment depends on capital output ratio. Real interest rate, on the other hand, represents the alternative cost of investment. For almost a decade, private investment has been sluggish, and as a result, there has been a heated debate in both political and academic circles regarding the level of interest rate and whether low interest rate is a major stimulus for the private investment in Turkey. In this paper we model the interaction between real interest rate and private investment in Turkey for the period 1973-2014.

Akkina and Celebi (2002) analyze the determinants of private fixed investment spending in Turkey over the period 1970-96 and find that volume of funds is as important as the cost of funds used in financing private fixed investment. On the other hand, they conclude that although the effect of the medium-term real lending rate on private fixed investment is negative, it is statistically insignificant. This finding is consistent with Çolak and Öztürkler (2012)'s conclusions that the

average savings rate in Turkey is very low (which leads to a sizable national savings deficit) and low level of per capita income raises the responsiveness of savings to income. As a result, the availability of the funds becomes as important as the cost of the funds. In addition, the positive link between the volume of the funds and investment leads to categorical shifts in the response of investment to interest rate. That is, elasticity of investment to the cost of funds is time and state-varying. For instance, Esiyok (2001) empirically show how different periods of macroeconomic deviations in terms of the state of the economy and economic policies and strategies alter the investment trends in Turkey over the period 1971-2000.

Karagoz (2010) investigates the long run determinants of private investments in Turkey over the period 1970-2005. The estimated long run coefficients in the indicate that real GDP, real exchange rate, the ratio of private sector credit to GDP, private external debt, inflation, and trade openness have a significant impact on private investments. These findings also imply that in the long run availability of funds is more important than the cost of the funds and inflation uncertainty is a major impediment to private investment. On the basis of these results, as Lindner (2014) points out, one can argue that in a developed country with no constraints in terms of funds, there is neither a deficit of private investment in equipment nor financing costs are hindering businesses from expanding their production capacity by increasing investment. In such a case, what is required is only additional demand – whether domestic or foreign. On the other hand, as emphasized by Kehinde et al. (2012), in a less developed country such as Nigeria, neither investment nor

availability of credit has a stimulating effect on private investment, and furthermore, credited provided to businesses for fixed investment is misused. However, when developing countries are concerned it is possible to find conflicting results. For instance, Muhammad et al. (2012) conclude that that investment has significantly inverse association with real interest rate in Pakistan over the period 1964-2012.

In the empirical part of this study below we focus on the real interest rate, which is an essential component of the investment decision process and investigate its effect on the private fixed investment in Turkey for the period between 1973 and 2014. From a theoretical perspective when the interest rate is low there will be higher allocation of funds to investment for both lower alternative cost effect and increased risk taking tendency among investors. Therefore, we expect a negative relationship between real interest rate and private investment in Turkey and the magnitude and form of the relationship to change in sub-periods.

2. Model and Data

We start with an empirical model specification of the following form:

$$PINV_t = \beta_1 + \beta_2 REAL_INT_t + \varepsilon_t, \\ t = 1, 2, 3, \dots, T$$

where $PINV_t$ is the dependent variable and represents the share of real private investment in real GDP (henceforth we shall call private real investment) while $REAL_INT_t$ is the independent variable and represents annual real interest rate for the year t . We obtained yearly data for the period between 1973-2014 from

World Development Indicators published by World Bank and Penn World Table¹. Descriptive Statistics for these the variables are provided in Table 1.

Table 1: Descriptive Statistics

Variable	PINV	REAL_INT
Mean	0.225895	37.50735
Median	0.226566	36.06231
Maximum	0.400018	87.06685
Minimum	0.114257	3.856423
Std. Dev.	0.061732	25.98453
Skewness	1.093632	0.359918
Kurtosis	4.842692	1.838070
Jarque-Bera	14.31437	3.269430
Probability	0.000779	0.195008
Sum	9.487572	1575.309
Sum Sq. Dev.	0.156245	27683.02

1. These data were obtained from Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2015), "The Next Generation of the Penn World Table" *American Economic Review*, 105(10), 3150-3182, available for download at www.ggd.net/pwtss.

Table 2: Unit Root Test Results

Series	Intercept	Prob_v	Intercept+Trend	Prob_v
PINV	-1.939448	0.3116	-2.982693	0.1492
REAL_INT	-1.601523	0.4728	-1.260509	0.8837

Both the Trace and Max-Eigenvalue test statistics illustrated in Table 3 indicate existence of one cointegration relationship between real private investment and real interest rate. Maki (2012) the proposed tests perform as well as the tests of Gregory and Hansen (1996a's cointegration test results also confirm existence of cointegration

3. Empirical Results

We employ unit root test developed by Phillips & Perron (1988) to check the presence of stationarity in the variables in the model. Table 2 provides the results of this unit root test. All the results in Table 2 show that null hypothesis of unit root for both variables is not rejected for both model specifications; i) with intercept and ii) with intercept and trend. However, the first differences of the series seem to be stationary. So we can conclude that both variables are integrated of order one. To check whether or not the two variables are cointegrated we employ VAR approach of Johansen (1988) and Johansen and Juselius (1990) and Maki (2012)'s cointegration test with structural breaks which is based on single equation approach.

relationship as illustrated in Table 4a. However Maki(2012)the proposed tests perform as well as the tests of Gregory and Hansen (1996a's cointegration parameters are obtained on the basis of OLS estimate and although the cointegration parameter $\hat{\beta}_2$ is super-consistent it suffers from second order bias due to correlation

between u_t and v_t^2 . To overcome this bias we use Dynamic OLS (DOLS) developed by

2 Suppose we have $Y_t = \beta_1 + \beta_2 X_t + u_t$ with u_t is $I(0)$. When X_t is a random walk $\Delta X_t = v$ and v_t is $I(0)$, if $Cov(u_t, v_t) = \sigma_{12}$ for $t \neq s$ OLS estimate is biased and this bias is well known as second order bias. Then DOLS developed by Stock & Watson (1993).

Stock & Watson(1993)³. The date of breaks obtained by Maki (2012)the proposed tests perform as well as the tests of Gregory and Hansen (1996a's test and the cointegration relationship based on DOLS is illustrated in Table 4a and 4b.

3 Fully Modified OLS developed by Phillips & Hansen(1990) could also be used as alternative to DOLS.

Table 3: Cointegration Test Results

Null	Trace	0.05		Max-eigenvalue	0.05	
		Critical Value	Prob		Critical Value	Prob
None *	16.55448	15.49471	0.0345	15.36017	14.26460	0.0334
At most 1	1.194309	3.841466	0.2745	1.194309	3.841466	3.841466

Table 4a: Maki(2012)'s Cointegration Test Results

Test statistics	Dates of breaks	%1	%5	%10
		critical values	critical values	critical values
Level shift	1999	-5.563	-5.083	-4.784
	2007			
	2009			
Level shift with trend	1978	-5.833	-5.373	-5.106
	1999			
	2005			
Regime shift	1997	-6.251	-5.703	-5.402
	1999			
	2008			

Critical values for %1 %5 %10 level were obtained from the study of Maki(2012).

* Statistically significant at %1 level.

Table 4b: DOLS Estimation Results

Variable	Coefficient	Prob.
REAL_INT	-0.001110	0.0111
C	0.263373	0.0000

Maki(2012)the proposed tests perform as well as the tests of Gregory and Hansen (1996)as test results show that the size of the relationship between real interest rate and real private investment in Turkey changed during the 1999 Russian economic crisis and 2008/2009 global financial crisis. The test results also indicate size and trend changes during the second oil crisis (1978) and 1999 Russian crisis. The Turkish economy experienced an industrial production growth of around 8 percent between the second half of 2002 and first half 2005. However, average growth rate of the industrial production declined

significantly following 2005. Maki's test results point to a break in the relationship between real interest rate and real private investment in terms of level and trend in 2005. Furthermore, the test results correctly capture the regime shifts during the 1997 Asian and 1999 Russian economic crises and 2008/2009 global financial crisis.

Once we have obtained the cointegration relationship by DOLS we then proceed to VECM and Granger causality tests. Table 5 shows optimal lags according to several criteria. In this paper we adopt Schwartz criterion and set the optimal lag to one.

Table 5: Lag Order Selection Results

Lag	LR	FPE	AIC	SC	HQ
0	NA	0.948383	5.622733	5.708922	5.653398
1	84.41327*	0.105016	3.421451	3.680018*	3.513447*
2	8.306651	0.101021*	3.380261*	3.811205	3.533588
3	1.779779	0.118378	3.533375	4.136696	3.748032
4	3.684660	0.129954	3.616844	4.392543	3.892832

Table 6 depicts the VECM and causality test results between real private investment and real interest rate. These results show that there is unidirectional causality from real interest rate to private investment in

the short and long run. However, there is no evidence that indicates unidirectional causality from private investment to real interest rate in the short and long run.

Table 6: VECM Test Results

Dependent Variable	D(PINV)	D(REAL_INT)	ECM	Result
D(PINV)	-	2.5***	-0.311143*	both short and long run causality from real_int to pinv
D(REAL_INT)	0.192750		74.48206	no short and long run causality from pinv to real_int

* Statistically significant at %1 level.

** Statistically significant at %5 level.

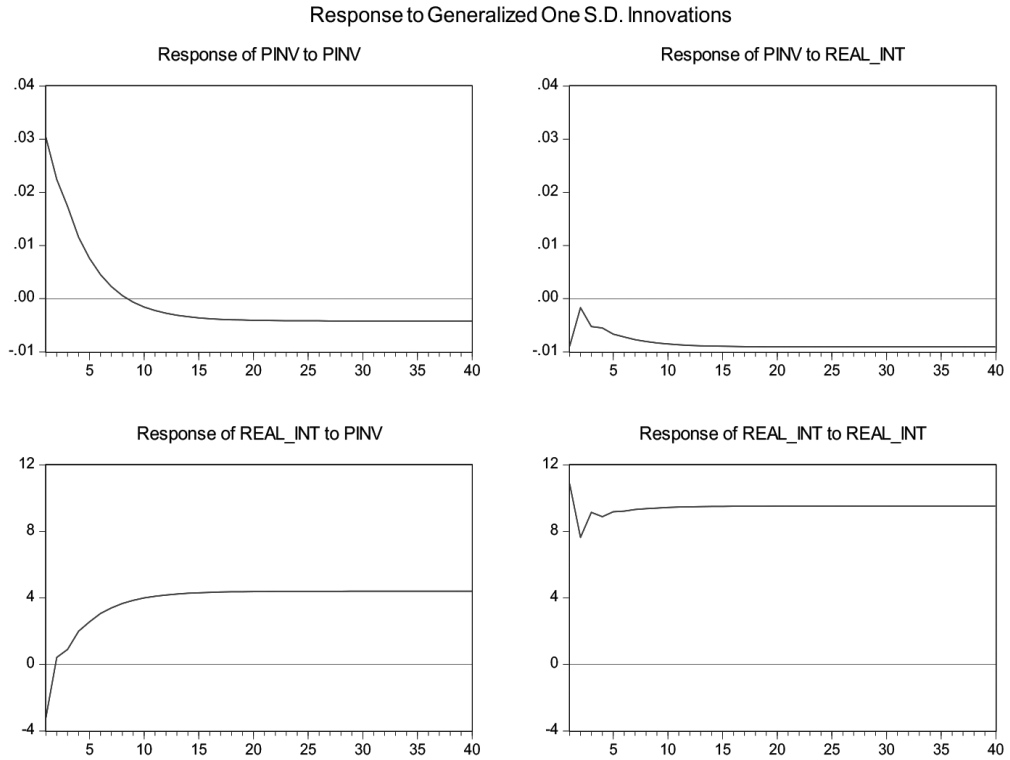
*** Statistically significant at %10 level.

Existence of causality and significance of error correction term justify existence cointegration.

Finally to trace out the effects of one standard deviation shock on each variable we

obtain the generalized impulses responses proposed by Pesaran & Shin (1998)[Koop et al. (1996). As illustrated in Figure below the effect of an interest shock to private investment is negative in all periods.

Figure



4. Conclusion

In this study we model the interaction between interest rate and investment in Turkey for the period 1973-2014. Previous empirical studies of the subject mostly conclude that there is no statistically significant relationship between interest rate and of private fixed investment spending in Turkey. In contrast, our findings indicate that that there is unidirectional causality from real interest rate to private investment

in the short and long run. Furthermore, the effect of an interest shock to private investment is negative in all periods. On the other hand, there are breaks in terms of the size of the relationship, trend and regime during the second oil crisis (1978), Asian and Russian economic crises (1887, 1999), and global financial crisis (2008/2008). Therefore, we conclude that there is room for the monetary policy to stimulate private investment by lowering real interest rate in Turkey.

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