IOSR Journal of Economics and Finance (IOSR-JEF)
e-ISSN: 2321-5933, p-ISSN: 2321-5925.Volume 7, Issue 5 Ver. IV (Sep. - Oct. 2016), PP 43-49
www.iosrjournals.org

Relations between Interest Rate, Inflation, Growth and Investment in Turkey, 2002-2015

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Abstract: *The debate on interest rates is not new for Turkey, but it expectedly intensifies during the economic slowdown periods. In order to determine the real reasons behind the decline in economic activity and the factors posing an obstacle to reaching the aims of economic policy, we need to reveal the relationships between interest rate, investment, inflation rate and growth rate in Turkey. This paper attempts to clarify if there is any causality and correlation between these indicators by analysing data belonging to 2002-2015 and obtained from the Electronic Data Delivery System (EDDS) of Central Bank of the Republic of Turkey (CBRT) and Turkish Statistical Institute (TurkStat). We applied Augmented Dickey-Fuller test, Granger causality tests and Pearson and Kendall Tau's correlation tests. Consequently, interest rates in Turkey do not play any direct role in determining investments and growth (and the relationship between interest rate and growth is even weaker, there is nearly no relation at all between them). In that case, economic authorities should focus on other factors in order to accelerate growth rates.*

Keywords: *Gross Fixed Capital Formation,Growth, Inflation, Interest Rate,Turkish Economy*
JEL classification indices: *E22, E40, E43*

I. Introduction

In 2000-2001, Turkish economy went through a big crisis, which was not maybe the gravest one but an incident leading important transformations in the recent economic history of Turkey. An IMF program, whose basic characteristics consisted of a hard budget discipline and tight monetary policy, steered Turkish economy in the following decade. Accordingly, a target of 6.5 percent primary surplus and prioritisation of price stability (culminating with the practice of inflation targeting) based on an independent central bank was conducted.

Within this framework, relatively high interest rates prevailed, which resulted in increasing capital inflows and decreasing inflation rates (even if the target could not be reached in general). With the help of abundant liquidity in the global economy, Turkish economy reached high levels of growth rate except 2008 and 2009.

From 2013 onwards, this equation began to deteriorate, and growth rates have declined despite increasing current account deficits. While looking for a way out of this impasse, the scapegoat was found: high interest rates. A great deal of people, especially government officials, began to argue that considerable interest rate cuts would boost investments and reduce inflation rate.

The purpose of this study is to analyse the interrelationships between interest rate, investment, inflation rate and growth rate in Turkey in the post-2001 crisis period (between 2002 and 2015). To this aim, we used Augmented Dickey-Fuller test, Granger causality tests and Pearson and Kendall Tau's correlation methods, after revealing main theoretical approaches and recent empirical literature.

II. Theory and Literature

Indicators such as interest rate, inflation and investment have aroused interest of many researchers from early political economists to current empirical scholars. In this section, after summarising the theories of principal economists, we compiled some recent empirical studies especially on developing countries.

2.1. Basic Theoretical Approaches

Adam Smith (2007: 58) correlated interest rates with profit rates of capital stock. Accordingly, he argued that the higher the usual market rate of interest, the higher the ordinary profits of stock (but usually interest rates are dependent on the profit rates). In classical economics, in general, money supply does not affect the market rate of interest; it is rather determined by the rate of profit, and the two rates are expected to be equal in case of equilibrium.

Henry Thornton who formulated classical interest rate theory distinguished between two types of interest rate: natural rate of interest and market rate of interest (bank rate). He developed a general equilibrium model, in which investment equals savings and natural rate of interest equals market rate of interest. Accordingly, an expansion of bank loans will reduce market rate of interest, and it will be below the natural rate

of interest, which is based on the "rate of mercantile profit". As a result, the rate of mercantile profit will potentially rise and the demand for investment goods and loans will boom. This will increase market rate of interest until it equals natural rate of interest again. The whole process will only increase the inflation rate: "It will simply cause the same goods to pass for a larger quantity of paper" (Thornton, 1962: 253-256; Tieben, 2012: 367).

John Stuart Mill explained the rate of interest in terms of abstinence, profits, and the demand and supply of loans. Interest is "all that a person is enabled to get by merely abstaining from the immediate consumption of his capital, and allowing it to be used for productive purposes by others". Interest rate is also a part of the profit rate, along with the insurance (remuneration for risk) and wages of superintendence (remuneration for trouble). After sparing some amount of money for risk, the remaining surplus "partly goes to repay the owner of the capital for his abstinence, and partly the employer of it for his time and trouble". How much goes to the owner of capital and how much to the entrepreneur is determined by the demand for and supply of loans (Mill, 1936: 406, 637).

Eugen von Böhm-Bawerk's theory of interest is based on his argument that "present goods have a higher subjective value, thus a higher exchange value and price than future goods of like kind and number". He then lists three factors accounting for the distinctions between present and future goods: "The difference in the circumstances of want and provision between present and future; the underestimate of future advantages and future goods; and the greater fruitfulness of lengthy methods of production." And this difference of value is the source of all interest on capital. Very simply, the lender gives to the borrower a sum of present goods, and the borrower gives the lender a sum of future goods. Since present goods are more valuable than the future ones, the borrower should pay a premium, which is the interest. Bawerk associates interest rate with profitability and productivity: When interest rate is lower, the premium paid for present goods is smaller and thus the profitability is higher. The rate of interest is determined by the "productiveness of the last extension of process economically permissible". If capital increases, or if the population decreases when capital remains the same, the rate of interest decreases; and the discovery of new and more productive methods of production, outlets, business opportunities, etc. raise the rate of interest (Bawerk, 1891: 247-248, 249, 273, 285-286, 393, 400-402).

According to Alfred Marshall, interest rate is the price paid for the use of capital and it tends towards an equilibrium level in which aggregate demand for capital is equal to aggregate capital stock. If the market is a small one, an increase in the demand for capital will be met by an increased supply from surrounding districts. But as for the whole world or the whole of a large country, aggregate capital supply will not increase quickly. Then it will be the rate of interest that will increase in the short run. The total stock of capital can only slowly and gradually increase (Marshall, 1920: 534). When the rate of interest falls, more capital will be used, and thus more investment will be made (Marshall, 1920: 520). Marshall also distinguished between "net interest" and "gross interest". Accordingly, the former is "the earnings for capital or the reward for waiting", and the latter includes other elements such as commercial security and the organisation of credit (Marshall, 1920: 588). Last but not least, Marshall established a connection between inflation, real interest rate and economic activity. When prices are likely to rise, people borrow more money and buy more goods, which help prices to rise further. Since real interest rate will be lower when inflation is high, borrowing people will pay back less real value and enrich themselves at the expense of the community. And in case of credit crunch and falling prices, everyone will want to sell the commodities and keep more money (namely, real interest rate will rise); this will decrease the prices and shrink the credits further (Marshall, 1920: 594-595).

Irving Fisher argued that the rate of interest is determined by three pairs of factors: the two "impatience principles", the two "opportunity principles" and the two "market principles". Market principles are related with supply and demand, and the other two pairs represent objective and subjective forces behind supply and demand. Subjective factor shows the impact of "human impatience" or "time preference": First, the rate of "time preference" depends on the attitudes of the individuals and on their prospective income; second, "human impatience" to spend income is crystallised into the market rate. Objective factor is investment opportunity rate or rate of return: First, each individual has the opportunity to change the nature of his prospective income; second, the increase in a future income at the expense of the immediate income is also crystallised into the market rate. In sum, interest rate is based on the impatience to spend income without delay and on the opportunity to increase income by delay (Fisher, 1930: 494-495). In addition, Fisher distinguished between nominal and real rate of interest by means of "expected inflation rate". He gave some evidence about when the expected price level tends to rise, the nominal interest rate will also rise. And he emphasised that when money supply (and thus the inflation rate) increases, the rate of interest tends to rise rather than falling (Fisher, 1930: 400-403, 438).

Knut Wicksell also made a distinction between natural (or normal) rate of interest and money (or bank) rate of interest. The money rate of interest depends on the supply of and demand for real capital, whereas the real rate of interest reflects the expected yield on the newly created capital. In case the natural rate is higher than the money rate, investments will increase, which thereupon increase the demand for credits until the two rates

become equal. And if natural rate is lower than the money rate, investments and thus demand for credits will decrease until the rates become equal again. In addition, when the money rate is lower the demand for goods, services and raw materials will rise, which will result in higher price level, and vice versa. There is one other mechanism keeping the interest rate stable: A raising of interest rates will cause money out of circulation into the banks, and the banks will have to pay high interest on money which they can barely lend. The only solution would be to lower the interest rate. A similar situation will occur in case of too low rates: As a result, money will be withdrawn from the banks and the banks will have to raise the interest rate in order to pull some of this amount (Wicksell, 1978: 190, 193-195, 201).

John Maynard Keynes, unlike classical economists arguing that interest rate is determined by the point where the amount of investment is equal to the amount of saving, put forward that interest rate is a monetary phenomenon. Interest is not the yield on saving but the price of or reward for parting with liquidity. Thus the rate of interest is determined by the demand for and supply of money. In addition to the rate of interest, "marginal efficiency of capital" (prospective yield of the investment in the future) determines the level of investment, and the latter's effect on investment is much bigger than the rate of interest (Keynes, 1936: 135-136, 145-146, 166-167, 175).

2.2 Empirical Literature

Baillie and McMahon (1981) analysed the relationships between investment on the one hand and nominal short-term interest rates, the real rate of interest, and nominal long-term interest rates on the other hand in West Germany between 1960 and 1978. Using Granger and Pierce/Haugh causality tests and analysis of residuals from Box-Jenkins models, they concluded that nominal short-term interest rates and the real rate of interest did not have a significant effect on investments; however nominal long-term interest rates influenced investments.

Mishkin (1981) analysed real interest rate movements in the United States between 1931-1979. While he found a negative correlation between the real rate and inflation, real rates were not significantly correlated with movements in real variables (real GNP growth, the GNP gap which is the percentage difference between potential GNP and real GNP, the unemployment rate and the investment to capital ratio).

Demirbaş (2000) analysed the effects of average banking rates of interest on investments in Turkey between 1980 and 1997. Using regression analysis, he found a negative relationship between interest rates and private investments, but concluded that the effect of interest rates on investments is insignificant.

Beccarini (2007) analysed the relationship between investment and interest rates in an uncertain context by using US data between 1952 and 1991 and Eurozone data between 1994 and 2005. Using Cox-Ingersoll-Ross model and Generalized Method of Moments, Beccarini revealed that, under uncertainty, when interest rate volatility is sufficiently high, there may be a positive relationship between investment and interest rates.

Munir, Awan and Hussain (2010) examined long-run and short-run relations between investment, savings, real interest rate on bank deposits and bank credit to the private sector in Pakistan between 1973 and 2007. Using ARDL bounds testing approach, and DF-GLS and Ng-Perron tests, they showed that private investment is positively affected by savings, real interest rate on bank deposits, bank credit to private sector in the log-run.

However, Muhammad et al. (2013) found an inverse relationship between investment and real interest rate in Pakistan, by using Johansen cointegration test with data from 1964 to 2012.

Osei-Assibey and Baah-Boateng (2012) investigated the effects of interest rate deregulation on investment in Ghana between 1970 and 2005. Using cointegration and error correction model techniques, they concluded that although there is a statistically significant and positive relationship between real deposit interest rate and financial savings, the relationship between real deposit rate and investment is negative.

Kelilume (2014) analysed the effects of changes in money supply and nominal interest rate on aggregate output and prices in Nigeria between 1996 and 2013. Kelilume, using cointegration and error correction modelling approach, found a significant long-run relationship between interest rate and output (a 10% increase in interest rate reduces output by 0.8%).

Osundina and Osundina (2014) investigated the link between interest rate and investment decision in Nigeria between 1981 and 2011. Using multiple linear regression model, they could not find any relationship between interest rate and investment spending. However their results show that there is a long-run relationship between interest rates and economic growth.

Ojo (2014) examined the relationship between interest rate and private domestic investment in Nigeria between 1980 and 2012. Ojo, using ordinary least square multiple regression technique and error correction model, found that an increase in interest rate encourages savings, which further increases investment (although the rise in interest rate causes private domestic investment to decrease, the effect of the rise in savings on investment is stronger than the former effect).

Sharpe and Suarez (2014) attempted to determine the insensitivity of investment to interest rates by using questions asked of CFOs of U.S. nonfinancial firms in the Duke CFO Magazine Global Business Outlook survey conducted in the third quarter of 2012. They found that most firms are insensitive to decreases in interest rates, and mildly more responsive to interest rate increases.

III. Methodology

In this study,we used secondary data obtained from the Electronic Data Delivery System (EDDS) of Central Bank of the Republic of Turkey(CBRT) and Turkish Statistical Institute (TurkStat). We obtained four macroeconomic variablesfor the period of 2002-2015: Growth Rate, Gross Fixed Capital Formation (Investment), Inflation Rate,Weighted Average Interest Rates For Banks' Commercial Loans(Interest Rate).We converted nominal interest rates to real interest rates by using this classical formula:

Real interest rate = (1 + nominal rate) / (1 + inflation rate) - 1

These macroeconomic variables were subjected toeconometric analysis to determine Granger causality.These macroeconomic variables were nonstationary, therefore unit root tests were performed on all variables. In order to determine the correlationlevel between the variables, we finally applied Pearson and Kendall's Tau correlation tests.

IV. Empirical Results

4.1 Unit Root Tests

Acording to Granger and Newbold the macroeconomic variables as a rule contained stochastic trends,that's why using these variables in econometric models may lead towards spurious regressions. Therefore, "testing data for stationarity is very important in research where the underlying variables based on time" (Mushtaq,2011:2). In other words, the variables in an econometric model must be stationary.In order to find out whether the variables are stationary, we can use the Augmented Dickey-Fuller test.Table1 shows the Augmented Dickey-Fuller test's results. The test reveals that some variables are non-stationary. But, they were made stationary after the first or second difference.

Table 1: Augmented Dickey-Fuller Test Statistic

Variable	**Level / 1.st difference**	**Augmented Dickey-Fuller test statistic**			
			Intercept	**Trend and Intercept**	**None**
INTEREST RATE	Level		-3.007319	-4.732059	-2.501265
	Test critical values	1%	-3.565430***	-4.148465*	-2.614029**
		5%	-2.919952*	-3.500495*	-1.947816*
		10%	-2.597905*	-3.179617*	-1.612492*
		Prob.	0.0409*	0.0019*	0.0134*
	1.st difference		-5.911386	-6.176007	-5.805561
	Test critical values	1%	-3.574446*	-4.161144*	-2.614029*
		5%	-2.923780*	-3.506374*	-1.947816*
		10%	-2.599925*	-3.183002*	-1.612492*
		Prob.	0.0000*	0.0000*	0.0000*
GROSS FIXED CAPITAL FORMATION	Level		-2.663591	-3.113935	-2.340675
	Test critical values	1%	-3.574446**	-4.161144**	-2.614029**
		5%	-2.923780**	-3.506374**	-1.947816*
		10%	-2.599925*	-3.183002**	-1.612492*
		Prob.	0.0878**	0.1148**	0.0201**
	1.st difference		-4.439533	-4.344714	-4.509134
	Test critical values	1%	-3.574446*	-4.161144*	-2.614029*
		5%	-2.923780*	-3.506374*	-1.947816*
		10%	-2.599925*	-3.183002*	-1.612492*
		Prob.	0.0008*	0.0061*	0.0000*
GROWTH	Level		-3.326686	-3.434944	-1.808901
	Test critical values	1%	-3.568308**	-4.152511**	-2.611094**
		5%	-2.921175*	-3.502373**	-1.947381**
		10%	-2.598551*	-3.180699*	-1.612725*
		Prob.	0.0188*	0.0582**	0.0673**
	1.st difference		-6.053657	-5.971567	-6.116399
	Test critical values	1%	-3.568308*	-4.152511*	-2.612033*
		5%	-2.921175*	-3.502373*	-1.947520*
		10%	-2.598551*	-3.180699*	-1.612650*
		Prob.	0.0000*	0.0000*	0.0000*
INFLATION RATE	Level		-3.969546	-3.434944	-3.852768
	Test critical values	1%	-3.571310**	-4.156734**	-2.614029*

		5%	-2.922449*	-3.504330**	-1.947816*
		10%	-2.599224*	-3.181826*	-1.612492*
		Prob.	0.0033*	0.0188*	0.0003*
	1.st difference		-5.555433	-6.044001	-5.448963
	Test critical values	1%	-3.574446*	-4.161144*	-3.568308*
		5%	-2.923780*	-3.506374*	-2.921175*
		10%	-2.599925*	-3.183002*	-2.598551*
		Prob.	0.0000*	0.0000*	0.0000*

* Stationary
** Non stationary

4.2GrangerCausality Tests

"If $\sigma^2 (X/U) < \sigma^2 (X/U - Y)$, we say that Y is causing X, denoted by $Y_t$toX_t. We say that Y_t, is causing X_t, if we are better able to predict X_t, using all available information than if the information apart from Y_t had been used"(Granger,1969:424-438).In this test, two variables are usually analysed together, while testing for their interaction. Thus, the below hypotheses are tested.

H_0:There is not Granger causality between the variables.

H_1:There is Granger causality between the variables.

Table 2: VAR Granger Causality/Block Exogeneity Wald Tests

VAR Granger Causality/Block Exogeneity Wald Tests Date: 07/04/15 Time: 20:09 Sample: 2002Q1 2015Q4 Included observations: 47					
Dependent variable: GROSS FIXED CAPITAL FORMATION (GFC)					
Excluded	Chi-sq	df	Prob.	Decision	Type for Causality
G	1.496749	4	0.8272	Accept H0	No causality
INF	2.067843	4	0.7233	Accept H0	No causality
IR	8.656280	4	0.0703	Accept H0	No causality
Dependent variable: GROWTH (G)					
Excluded	Chi-sq	df	Prob.	Decision	Type for Causality
GFC	2.267811	4	0.6866	Accept H0	No causality
INF	2.832738	4	0.5862	Accept H0	No causality
IR	7.592652	4	0.1077	Accept H0	No causality
Dependent variable: INFLATION RATE (INF)					
Excluded	Chi-sq	f	Prob.	Decision	Type for Causality
GFC	3.073875	4	0.5455	Accept H0	No causality
G	19.94321	4	0.0005	Reject H0	Uni-directional causality
IR	196.2017	4	0.0000	Reject H0	Uni-directional causality
Dependent variable: INTEREST RATE (IR)					
Excluded	Chi-sq	f	Prob.	Decision	Type for Causality
GFC	1.303141	4	0.8608	Accept H0	No causality
G	2.117496	4	0.7142	Accept H0	No causality
INF	6.412889	4	0.1704	Accept H0	No causality

Alpha (α) = 0.05

Decision rule: reject H0 if P-value < 0.05.

Table 2 shows that;

- Growth, inflation rate, and interest rate do not have any effect on gross fixed investments.
- Gross fixed ınvestments, inflation rate, and interest rate do not have any effect on growth.
- Growth, gross fixed ınvestments, and inflation rate do not have any effect oninterest rate.
- Gross fixed investments does not have any effect oninflation rate, but growthand interest rate have effect on inflation rate.

4.3Correlations Results

Correlation analysis is the statistical tool we can use to describe the degree to which one variable is linearly related to another (Levin and Rubin, 1998: 677).The most common measure of correlation in statistics is the Pearson Correlation. It shows the linear relationship between two sets of data. The results will be between -1 and 1. If the results are between 0.5 to 1.0 or -0.5 to -1.0, there is high correlation between the variables.If the results are between 0.3 to 0.5 or -0.3 to -0.5, there is medium correlation between the variables. If the results are between 0.1 to 0.3 or -0.1 to -0.3, there is low correlation between the variables (Evan,1996).

Table 3 shows Pearson correlation results between four variables.

Table 3: Pearson Correlation Results Between Intresest Rate, Inflation, Growth, and Investment

Correlations					
		GFC	G	INF	IR
GFC	Pearson Correlation	1	,211	-,174	-,387**
	Sig. (2-tailed)		,137	,222	,005
	N	51	51	51	51
G	Pearson Correlation	,211	1	-,186	-,063
	Sig. (2-tailed)	,137		,191	,659
	N	51	51	51	51
INF	Pearson Correlation	-,174	-,186	1	,445**
	Sig. (2-tailed)	,222	,191		,001
	N	51	51	51	51
IR	Pearson Correlation	-,387**	-,063	,445**	1
	Sig. (2-tailed)	,005	,659	,001	
	N	51	51	51	51

**. Correlation is significant at the 0.01 level (2-tailed).

According toPearson correlation:

- Pearson correlation coefficient between gross fixed investments and growth is 0.21. This means that there is low positive correlation between the variables.
- Pearson correlation coefficient between gross fixed investments and inflation rate is -0,174. This means that there is low negative correlation between the variables.
- Pearson correlation coefficient between gross fixed investments and interest rate is -0,387. This means that there is low negative correlation between the variables.
- Pearson correlation coefficient between growth and inflation rate is -0,186. This means that there is low negative correlation between the variables.
- Pearson correlation coefficient between growth and interest rate is -0,063. This means that there is low negative correlation between the variables.
- Pearson correlation coefficient between inflation rate and interest rate is 0,445. This means that there is medium positive correlation between the variables.

Table 4: Kendall's Tau Correlation Results Between Intresest Rate, Inflation, Growth, and Investment

Correlations						
			GFC	G	INF	IR
Kendall's tau_b	GFC	Correlation Coefficient	1,000	,145	-,075	-,227*
		Sig. (2-tailed)	.	,150	,457	,024
		N	51	51	51	51
	G	Correlation Coefficient	,145	1,000	-,020	-,048
		Sig. (2-tailed)	,150	.	,844	,645
		N	51	51	51	51
	INF	Correlation Coefficient	-,075	-,020	1,000	,422**
		Sig. (2-tailed)	,457	,844	.	,000
		N	51	51	51	51
	IR	Correlation Coefficient	-,227*	-,048	,422**	1,000
		Sig. (2-tailed)	,024	,645	,000	.
		N	51	51	51	51

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

According to Kendall's Tau correlation:

- Correlation coefficient between gross fixed investments and growth is 0.145. This means that there is low positive correlation between the variables.
- Correlation coefficient between gross fixed investments and inflation rate is -0,075. This means that there is low negative correlation between the variables.
- Correlation coefficient between gross fixed investments and interest rate is -0,227. This means that there is low negative correlation between the variables.
- Correlation coefficient between growth and inflation rate is -0,020. This means that there is low negative correlation between the variables.
- Correlation coefficient between growth and interest rate is -0,048. This means that there is low negative correlation between the variables.
- Correlation coefficient between inflation rate and interest rate is 0,422. This means that there is medium positive correlation between the variables.

V. Conclusion

As a result of the empirical research on the last decade of Turkish economy, it is hard to argue that macroeconomic indicators such as invesment, interest rate, inflation, and growth are only determined by the macroeconomic indicators themselves. Accordingly, there is not any causality between investment and growth; investment and inflation; investment and interest rate; growth and interest rate. And there is only uni-directional causality between growth and inflation, and inflation and interest rate.

Correlation results are not meaningful either. Pearson and Kendall's Tau correlation tests show that relationships between interest rate, investment and growth are weak. But there is a medium positive correlation betweeninflation and interest rate.The positive correlation between them may seem strange at first, but we can argue that, for the period in question, these two indicators are dependent variables: the same factors paved the way for decreasing them.

We should also note that in the statistical analyses, we took into account the interest rates for banks' commercial loans, which is the closest indicator to have an effect on the investment level. Since even this rate have little or no relationship to investments, it is highly predictable that the policy rate, which lies in the center of the interest rate debates, have nothing to do at all with investments and growth rate in Turkey.

To conclude, interest rates in Turkey do not rank among the main factors determining investments and growth rate; so it is clear that tranmission mechanism does not function in its classical sense in Turkey. While admitting that interest rates do effect some indicators suchasliquidity, capital movements etc., we can without hesitation argue that in order to boost investments and growth rate in Turkey other policies than interest rate changes should be considered.

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