Rate of Interest and its Impact on Investment to the Extent of Pakistan

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Abstract

The primary reason of this study is to test real interest rate and its impact on investment to the extent of Pakistan span from 1964 to 2012. To test the long-term nexus among level of income, interest rate and investment mainly Johansen Cointegration test is employed. The hypothesis of this study is that investment has an inverse association with real interest rate in Pakistan. If relationship exists then policy maker can make better policy for Pakistan. The outcomes confirm economic theory and a number of other studies that investment has significantly inverse association with real interest rate in Pakistan.

Keywords: Gross fixed capital formation, real GDP, real interest rate, investment, economic growth market returns.

1. Introduction

This study is conducted to observe the main determinants of investment empirically the interest rate and income in case of Pakistan. In economics, "an investment is the purchase of goods which are not used at present but are used in the future to generate wealth". For instance include railroad, machinery, factory construction etc. On the job training or costs

of schooling are called investment in human capital. The increase of goods inventories is inventory investment; it may be negative or positive, and it may be unintended or intended. Gross investment consists of residential investment (only new houses etc), Non-residential fixed investment (new machinery and new factories etc) and inventory investment. If depreciation is deducted from gross investment resultant "Net investment". The net raise in the value of capital stock annually is the Net fixed investment. So investment is change in capital stock in a certain time period. Investment theory as well explains that investment is a flow different from capital, which is a stock.

Interest rate is the cost of borrowing money. When interest rate increases the overall investment is reduces. Most of the businesses invest partially or wholly is credited. When increases in the interest rate companies have to put more resources to payoff this investment cost.
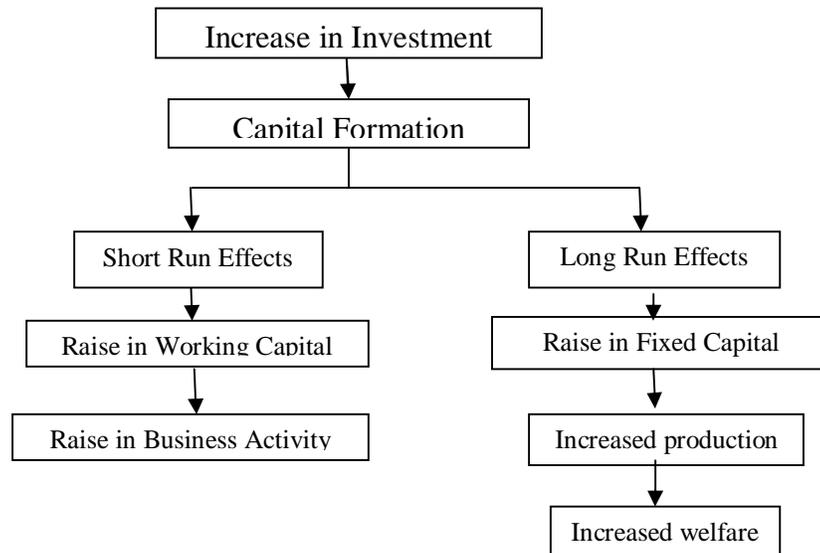
Income is the monetary worth of the entire goods and services produced generally within a year in an economy. This income is as well the earning of all factors of production of the economy.

Investment is frequently said as a function of interest rates and income, which are as follows:

$$I = f\left(\begin{array}{cc} R & Y \\ (-) & (+) \end{array}\right)$$

A high interest rate might lower investment because it turns out to be extra expensive to have a loan of money, while a raise in income promotes high investment. Still if a firm decides to employ its personal finance in an investment, the interest rate in this stands for an opportunity cost of investing those finances rather than providing out that quantity of money for interest rate.

The flow of increased in investment can be shown through the block diagram:

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          ┌─────────────────────────┐
          │  Increase in Investment │
          └────────────┬────────────┘
                       ↓
          ┌─────────────────────────┐
          │     Capital Formation   │
          └────────────┬────────────┘
              ┌─────────┴─────────┐
              ↓                   ↓
     ┌─────────────────┐  ┌─────────────────┐
     │ Short Run Effects│  │ Long Run Effects│
     └────────┬────────┘  └────────┬────────┘
              ↓                    ↓
  ┌────────────────────┐  ┌────────────────────┐
  │Raise in Working Capital│ │Raise in Fixed Capital│
  └────────┬───────────┘  └────────┬───────────┘
           ↓                       ↓
  ┌────────────────────┐  ┌────────────────────┐
  │Raise in Business Activity│ │ Increased production│
  └────────────────────┘  └────────┬───────────┘
                                   ↓
                          ┌────────────────────┐
                          │ Increased welfare  │
                          └────────────────────┘
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Source: Tabulated by Authors

Investment is the most important element of any economy. It is crucial factor for growth in every epoch. Investments in different sectors ultimately raise the capital (in other words cause capital formation), this capital can be divided into two broad categories the first is increase in working capital (in short run) which can be shown by increase in business activity and the other is increased in fixed capital (long run effect), which raise the output (production) which later cause increase in the welfare of the economy.

"Investment is the mean and welfare of the economy is the end".

Raise in the interest rate increase the cost of capital for the business sector that is invested in the working and business fixed capital. It also increases the cost of holding inventories.

Initially we check the stationary of the data, through unit root tests, after that we go for long-run and short-run association by the use of Johansen Cointegration Test (JCT) and Error Correction Model (ECM) respectively.

The Study consists of five sections Introduction, Review of Literature, Model / Analysis of data, Empirical analysis, and Conclusion & recommendation.

1.1 Objective of the Study

The objective of this study is to evaluate the cointegration among the chosen variables in Pakistan from 1964 to 2012.

1.2 Hypothesis

H_1 :   Investment has an inverse association with real interest rate

H_2 :   Investment has positive relationship with income

2. Literature Review

There is a possibility at this point; the level of investment can be inversely related to interest rate. Increase in real interest rate raise the real cost of borrowing and consequently decrease in the level of investment.

There are large numbers of studies conducted on this topic.

Joshua and Delano (1990) conducted a study on "determinants of private investment in Less Developing Countries (LDCs)" on 23 less developing countries for the span 1975 to 1985. They confirm the result that the real interest rate is inversely related to investment.

Hyder and Ahmed (2003) investigate that "why private investment in Pakistan has collapsed and how it can be restored". They explored that increase in real interest dampens the investment level.

James E. Larsen (2004) study "the impact of loan rates on direct real estate investment holding period return" in United State, they found that real estate investment has inversely related to interest rate.

Aysan et al. (2005), investigate "the determinants of unsatisfying private investment growth in the Middle East and North Africa (MENA)" during the 1980s and 1990s. The result shows that real interest rate inversely affect on a firm investment projects.

Wang and Yu (2007) observed "the role of interest rate in investment decisions for firms in Taiwan".

The results disclose that the interest rate is important factor to determine investment.

Bader and Malawi (2010) investigate "The Impact of Interest Rate on Investment in Jordan: A Cointegration Analysis". The results confirmed economic theory and various studies that real interest rate and investment is inversely associated; by contrast, the income and investment is positively associated.

All studies confirm the result that the investment is inversely responding to real interest rate.

3. Data and Model of the Study

Data is taken from the Handbook of Statistics on Pakistan Economy 2010 by SBP and Pakistan economic survey 2012.

The time span taken from 1964 to 2012 during this course of time monetary policy transmission from direct monetary policy to indirect monetary policy. In beginning of 70s Pakistan uses control monetary policy (direct monetary policy) in late 90s Pakistan use market oriented policy (indirect monetary policy).

According to the economic theory investment is the function of real interest rate and level of income.

$$I = f\left(\underset{(-)}{R}, \quad \underset{(+)}{Y}\right)$$

Empirical model:

$$GFCF_t = \beta_0 + \beta_1 R_t + \beta_2 GDP_t + \mu_t$$

In which;

GFCF is used as proxy for the investment level. GDP is used as proxy for the income level. Real interest rate(R) is defined by the actual interest rate (i) minus the current rate of inflation (π) which is Fischer Equation. $R = i - \pi$.μ is the error term and t is time.

In this study R is used because economic theory define that lenders, borrowers and savers care about real interest rate instead of nominal rate of interest rate.

4. Data Analysis, Methodology and Results

For checking Stationarity of variables unit root tests is applied. Unit root test of (ADF) 1979 is used in this study, which is given below:

4.1 ADF Unit Root Test

Dickey, D., Fuller, developed ADF test which applied if error term is non stationary. The equation of this model is as following:

$$\Delta Y_t = \beta_1 + \beta_2 T + \delta Y_{t-1} + \alpha_j \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_i$$

Where Δ is difference operator and ε is Error term,

$$\Delta Y = (Y_t - Y_{t-1}), \ \Delta Y_{t-1} = (Y_{t-1} - Y_{t-2}), \ \Delta Y_{t-2} = (Y_{t-2} - Y_{t-3}) \text{ etc.}$$

The central purpose at this point is to check whether δ is identical to zero or not. The critical t-values are created by Dickey and Fuller, to inspect unit root problem. Variable is said to be invariant, if the estimator of δ is less than tabulated t-values.

4.2 The Cointegration Test

Johansen (1991) developed Johansen cointegration test (JCT), is a process designed for testing Long run relationship of numerous time series variables. This test allows more than one Long run association, thus it is more usually appropriate than the Engle and Granger test (Engle and Granger 1987) which is based on the ADF test which considers one long run association.

The likelihood ratio (LR) is used for testing the quantity of long run associations. The LR intended for the trace test is:

$$LR = -T \sum_{i=r+1}^{q-r} ln\,(1-h_i)$$

Where hr+1, hq are the projected q-r eigenvalues. There is at most r long run vectors is the null hypothesis (H_0) of this investigation, at this point r is 0, 1, or 2. In this study, the H_0 is tested adjacent to the general alternative hypothesis (H_1) of r+1 long run vectors. So, the H_0 r=0 and H_1 r=1, r=1 beside the H_1 r=2 and consequently onwards

4.3 The Error Correction Modal (ECM)

Once long-run association among investment, real rate of interest and income is developed afterward it is crucial to discover short-run effect of real rate of interest and income on investment in case of Pakistan. For this purpose, we use ECM (Engle and Granger 1987). The empirical equation of ECM: Once long-run association among investment, real rate of interest and income is developed afterward it is crucial to discover short-run effect of real rate of interest and income on investment in case of Pakistan. For this purpose, we use ECM (Engle and Granger 1987). The empirical equation of ECM:

$$ECM = \Delta GFCF_t = \alpha_0 + \alpha_1 \Delta R_t + \alpha_2 \Delta GDP_t + \alpha_3 ECT_{t-1} + \varepsilon_t$$

Where, ECT_{t-1} is lagged error term α_3 is coefficient of lagged error term captures the speed of change from short-run to long-run.

4.4 Empirical Results

"Order of integration of the variables in the model defines correct method of estimation. If the order of integration of the variables is zero then we can use OLS. If order of integration of the variables is not the zero then the results of OLS could be spurious and misleading". (Gujarati, 1995)

To evaluate the order of integration of the variables ADF test is used.

Table: 1 Augmented Dickey-Fuller Test

Variable	Calculated Value	1% Critical Value	5% Critical Value	10% Critical Value	Probability
Log(GFCF)(1)	-3.648067	-4.165756	-3.508508	-3.18423	0.0363**
log(Δ(GFCF))(0)	-4.400998	-4.165756	-3.508508	-3.18423	0.0053*
Log(Δ(GFCF,2))(3)	-6.065621	-4.186481	-3.51809	-3.189732	0.0000*
Log(R)(7)	-3.316395	-4.273277	-3.557759	-3.212361	0.0817***
Log(Δ,R)(0)	-8.93624	-4.180911	-3.515523	-3.188259	0.0000*
Log(Δ(R,2))(5)	-5.329287	-4.273277	-3.557759	-3.212361	0.0007*
Log(GDP)(0)	-2.763744	-4.161144	-3.506374	-3.183002	0.2173
Log(Δ(GDP))(0)	-6.931308	-4.165756	-3.508508	-3.18423	0.0000*
Log(Δ(GDP, 2))(1)	-7.813897	-4.17564	-3.513075	-3.186854	0.0000*

Source: Summarized and Calculated by Authors
 Note: * = 1% significance level, ** = 5% significance level and *** = 10% significance level

Explanation of Table No 1: The result of the test shows that all selected variables are integrated at different order i.e. investment is integrated at order zero (that is investment is stationary at level), real interest rate is integrated at order one and real income is integrated at order one.

Because all the three variables are integrated at different order so we can't use OLS method for estimation. Here we use JCT to check long term association among the selected variables.

The result of Johansen Cointegration test is given in table 2.

Table 2: Johansen Cointegration test (Trace)

Hypothesized No. of CE(s)	Prob.**	Trace Statistic	0.05% Critical Value	Eigen value
None *	0.0048	43.68711	35.19275	0.934306
At most 1	0.5407	11.01419	20.26184	0.555870
At most 2	0.9117	1.274523	9.164546	0.100764

Source: Summarized and Calculated by Authors
 "Trace test indicates 1 cointegrating eqn(s) at the 0.05 level (*denotes rejection of the hypothesis at the 0.05

level)

 **MacKinnon-Haug-Michelis (1999) p-values"

Explanation of Table No 2: JCT: Trace Statistic value explains that all selected variables have long run association that is significant at the 5% level or one cointegration equation exists.

Table 3: Johansen Cointegration test (Maximum Eigen Value)

Hypothesized No. of CE(s)	Prob.**	Max-Eigen Statistic	0.05% Critical Value	Eigen value
None *	0.0013	32.67292	22.29962	0.934306
At most 1	0.3586	9.739667	15.89210	0.555870
At most 2	0.9117	1.274523	9.164546	0.100764

"Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level. *denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values"

Explanation of Table No 3: JCT: **Max-Eigen Statistic Value** explains that all selected variables have long run association that is significant at the 5% level or else one cointegration equation exists.

The resulting cointegration equation from the JCT is written as follows:

$$Log(GFCF_t) = -1.534429 - 0.442004 Log(R_t) + 1.028978 Log(RGDP_t)$$

Standard Error (SE)   **(0.30626)**   **(0.05980)**   **(0.02548)**

t-Statistics (t-s)   **(-5.0102)**   **(-7.3913)**   **(40.3837)**

Explanation of Johansen Cointegration Equation: SEs and t-statistics are in parentheses. Above define equation ("with assumption: No deterministic trend (restricted constant)") explains the equilibrium association between the investment real interest rate and real income. The sign of the coefficient is according to the economic theory. GFCF has strong and positive association with RGDP and GFCF has strong and inverse association with R, all coefficients are significant at five percent level.

Table 4: Cointegration Coefficients (Normalized First Cointegration Vector)

Variables	Coefficient	SE	t-values
LOG (R)	-0.429047	0.06362	-6.7439
LOG (RGDP)	1.029237	0.02711	37.9652

Explanation of Table No 4: This equation ("with assumption: Linear deterministic trend") shows that the GFCF is highly affected with R and RGDP. There is a positive association between GFCF and RGDP, these relations is significant, conversely GFCF respond inversely to R, this relationship is also significant at the 5% level.

The outcome of ECM is as follows:

Table 5: Error Correction Model

Variables		Coefficient		SE		Prob	t-s
D(R)		233.2912		1558.372		0.8817	0.149702
D(RGDP)		0.082257		0.021737		0.0005	3.784099
ECT_{t-1}		-0.194820		0.112419		0.0904	-1.732978
C		48113.55		35470.71		0.1822	1.356430
AR(1)		0.729231		0.153824		0.0000	4.740693
R^2	0.59	DW	1.57	Adj R^2	0.55	F-stat (Prob)	15 (0.00)

Source: Summarized and Tabulated by Authors

Explanation of Table No 5: Short-run dynamics clarify that the ECT_{t-1} is negative which explains as time passes it is adjusted from short-run toward long-run equilibrium "it should be negative to restore equilibrium" (Gujarati, 1995), and it is significant at one percent level. Value of ECT is -0.19 which shows that the disequilibrium is corrected nineteen percent in one year.

5. Conclusion and Recommendations

The first purpose of this study is to evaluate the interest rate and its impact on investment to the extent of Pakistan span from 1964 to 2012. Selected variables are GFCF; R and RGDP further Johansen Cointegration technique and Error Correction Model of analysis is used. The second purpose of this study is to confirm economic theory that investment and interest rate is inversely related and investment and income is positively associated.

On the basis of analysis perform above we accept hypothesis of this study and confirmed the economic theory empirically.

A continually declining trend in investment and economic growth rate are the key problems that adversely affect economy of Pakistan for the last decade. A profound analysis of the main determinants of investment that is Real interest rate and real income is reasonably helpful for Pakistan. To attract investment in Pakistan institution has to keep control the interest rate.

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