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Aakash¹,

¹M. A.(Financial Economics) Student,
University of Hyderabad

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Impact of Real Interest Rates on Investment and Economic Growth in India: An Empirical Analysis, 2000-2020

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Abstract

Interest rates are an important part of the transmission process of monetary policy. Interest rates influence the cost of loans, personal savings, corporate capital spending, the availability of credit, and the level of economic activity. This paper examines the relationship between real interest rates, capital accumulation and output growth in India using annual macroeconomic data over a period of two decades (2000-2020). The main explanatory variable is the effective interest rate, investment is proxied by gross fixed capital formation (GFCF) as a percentage of gross domestic product (GDP), and economic success is represented by the annual real GDP growth. The data are taken from the World Bank's World Development Indicators and several international financial databases. The empirical approach is based on descriptive statistics, Pearson correlation analysis and ordinary least square (OLS) regression. The results suggest a strong and statistically significant negative relationship between real interest rates and investment activity. The estimated correlation coefficient is approximately -0.618, and the bivariate regression shows that a one percentage point increase in the real interest rate is associated with a decrease of around 0.69 percentage points in GFCF as a share of GDP. Real interest rates have a small and statistically indistinguishable from zero direct linear effect on annual GDP growth. The investment coefficient is expected to be positive in a multivariate growth model. However, its statistical significance is limited by degrees of freedom and macroeconomic fluctuations. Our results suggest that the impact of monetary policy on the economy is mainly through capital accumulation and financial intermediation, rather than through a direct channel. The research suggests that policymakers need to consider the objective of maintaining inflation under control and the goal of providing attractive financing conditions for productive investment.

Keywords: Real Interest Rate, Capital Formation, Gross Fixed Capital Formation, Economic Growth, Monetary Transmission

1. Introduction

The interest rate has been widely studied as a price variable in macroeconomic theory and in the operations of central banks. Monetary policy rates impact aggregate demand via their effects on the cost of capital, household savings, business borrowing, asset prices and credit market conditions. So, when the central bank raises or lowers its key interest rate, the market interest rate for loans usually changes too, and this changes the financial situation for individuals and companies. Monetary authorities affect economic activity through a complex set of interlinked channels, primarily the interest rate, credit, balance sheet, currency rate and asset price channels (Ireland, 2006). As the Federal Reserve describes the monetary transmission mechanism, “Changes in the stance of policy affect the conditions and availability of credit, investment and spending decisions, and asset prices and the economy.

In traditional economic theory, investment will change in the opposite direction when interest rates change. It increases the cost of external financing. It also reduces the present value of the expected returns on capital expenditure. Reduced rates are the other way. They could then postpone or call off planned spending. Likewise, lower borrowing affects the profitability of investment and stimulates capital accumulation. This idea is based on the neoclassical investment model of Jorgenson (1963). It emphasizes the significance of the user cost of capital in determining the optimal level of capital stock. However, the empirical truth is not always so obvious. Higher real interest rates would improve incentives to save and the scope for financial intermediation. Some emerging countries could see modest positive real returns, which would support both capital distribution and financial savings. An early analysis of India suggested that the relatively high real interest rate could have promoted private capital formation and household savings through financial intermediation and self-financing channels (Athukorala, 1998). Therefore, the connection between growth and interest rates is mediated, through investment and other macroeconomic mechanisms. Interest rates are a large component of the monetary policies which determine the size and effectiveness of investments, and thus the long-term economic paths. This has been known to the International Monetary Fund (IMF) for some time.

India offers a very interesting framework to explore these dynamics. The country’s financial sector has been heavily deregulated in the past 20 years. There has been a change in monetary policy, and the growth of financial deepening has been slow. The rates have been very high and there’s been times when the actual returns have been just awful. According to data of World Bank, the ratio of investment in India has been extremely unpredictable during the period. GDP growth has been influenced by the economic cycle and shocks from outside. Interest rates are also too low because of the slowdown in investment that started in the early 2010s. Anand and Tulin (2014) showed the negative link between real interest rate and investment growth in India and underlined the significance of firm confidence, policy uncertainty, variables of global demand and structural restrictions. Their forecasts suggest that interest rates can account for only a fraction of the fall in capital formation that we have seen.

The present study has been carried out to investigate the relationship between changes in real interest rate and the growth of investment and output in India and further to analyze whether capital formation is a necessary link between financial environment and real economic activity. Monetary policy influences the economy by changing the financial environment. Loose policy reduces policy rates and thus cost of borrowing stimulates interest sensitive expenditure. Contractionary policy raises interest rates and reduces investment and aggregate demand. Fed officials say that is how the monetary policy ultimately feeds into employment, production and price stability.

Interest rate mechanism is quite important for the investment decision. Most organizations do an evaluation of the expected return of a project in terms of opportunity costs and capital costs. The high real interest rate causes a high barrier rate for the investment initiative. Lower capex renders marginal projects with low expected returns uneconomic. Then there is the credit channel. Bernanke and Gertler (1995) argue that tighter monetary conditions raise the external finance premium as

information asymmetries in financial markets increase. This friction has implications for bank lending and for the health of company balance sheets. This transmission mechanism is more important in India as commercial banks are the main source of credit for business. And so, the conditions of credit are transmitted through infrastructure investment, investment in manufacturing, housing development, entrepreneurial activity and working capital management.

2. Theoretical framework

Theory of interest Irving Fisher (1930) relates interest rates to intertemporal trade-offs between present and future consumption and to the productivity of investment possibilities. His paradigm provides the conceptual basis for separating nominal and real rates. The real interest rate is especially interesting for investment research because decision makers want the cost of capital adjusted for inflation and not the nominal rate.

Investment Theory of the Neoclassical School In the neoclassical paradigm, the desired capital stock of the firms depends, inter alia, on the user cost of capital. The higher this cost, the lower the optimal capital stock will tend to be. It reduces the demand for investment. The canonical model for the analysis of investment behavior in terms of optimal capital accumulation is due to Jorgenson (1963).

Transmission Mechanism of Interest Rates.

The basic causal chain can be summarized as follows:

Interest rate $\uparrow \rightarrow$ cost of borrowing $\uparrow \rightarrow$ incentive to invest $\downarrow \rightarrow$ capital formation $\downarrow \rightarrow$ productive capacity $\downarrow \rightarrow$ economic growth $\downarrow$

For rate decreases the reverse is true. But this chain is modulated by inflation dynamics, expectations, credit constraints, exchange-rate movements, fiscal policy, the health of the financial sector and investor sentiment.

The study's conceptual model is as follows: Causal ordering:

Real Interest Rate $\rightarrow$ Cost of Borrowing, Cost of Capital $\rightarrow$ Private and Corporate Investment $\rightarrow$ Gross Fixed Capital Formation $\rightarrow$ Productive Capacity $\rightarrow$ Economic Growth

Inflation, business confidence, credit availability, fiscal policy, exchange rates, global financial conditions, financial sector development and macroeconomic uncertainty moderate the relationship. This formulation can be placed in the broader literature on monetary transmission, which recognizes that interest rates affect output through many financial channels and not just through investment.

Related Literature Review

Interest Rates and Investment.

The standard investment paradigm suggests that the price of capital has a negative relation with the spectrum of profitable projects. The IMF has previously argued that interest rate policy affects both the level of investment and the effectiveness of investment and thus has implications for long-term economic growth.

Athukorala (1998) found that in some circumstances in India, higher financial intermediation can lead to higher savings and private investment because of high real interest rates. The result points out the significance of institutional and financial environment in the interest rate-investment nexus.

Similarly, Anand and Tulin (2014) in a study of investment slowdown in India also observe a negative relationship between real interest rates and investment growth. But they said the fall could not be explained by rates alone. Business trust mattered and so was policy ambiguity.

Recent research challenges this assumption of linearity. We further apply quantile methods from a 2024 paper to study the asymmetric response of investment to different interest rate regimes, highlighting some possible shortcomings of a univariate linear model.

Interest Rates and the Economy

Interest rates influence growth through investment, consumption, credit, asset prices and exchange rates. According to the IMF, the interest rate channel is one of the main channels through which monetary policy influences aggregate demand and output. Lower rates are good for investment and consumption in the short term, but accommodative conditions leave room for inflation or the misallocation of capital. But if policy is too tight it can choke off demand when there is a case for holding down inflation.

Channel Credit". Bernanke and Gertler (1995) show that monetary policy influences real activity through the availability of external finance as well as the price of funds. A restrictive stance could cut borrowers' net worth and curtail bank lending, a channel of particular importance for bank-dependent firms.

Evidence of India in India, the past work has been mixed. The IMF's research found that real rates, rather than nominal rates, better explained investment dynamics, and that higher real returns were estimated to be part of the reason for the slowdown of investment after the crisis, although they did not explain the whole contraction. Firm- and macroeconomic-level estimates suggest that a 100-basis point increase in the real interest rate could reduce investment by about 50 basis points and GDP growth by about 20 basis points, although magnitudes differ depending on methodology and sample period. The literature suggests interest rates do matter but warns against an obsession with them as the sole determinant of investment or growth.

Research Gap

The motivation for this analysis is three gaps. Second, the direct link between interest rates and investment has been widely studied in the literature, but the indirect channel from interest rates to growth via investment has been relatively less studied in basic empirical designs. Second, the Indian economy has undergone substantial structural change in monetary policy, financial liberalization and capital-market development and the findings from earlier studies may no longer be representative of the present environment. Third, interest rates and growth are mutually determined. Central banks usually tighten when activity is strong and inflation high, and ease in recessions. We cannot therefore assign any causal significance to a mere connection between rates and growth. In this paper we avoid the problem by disentangling the rate-investment relationship from the rate-growth relationship.

Methodology

The paper employs annual secondary macroeconomic data within a quantitative, explanatory design. The analysis is for the years 2000-2020, providing 21 observations per year. This period includes different macro-economic phases: the high growth period of the mid-2000s, the global financial crisis, the following period of slowdown in investments, periods of monetary tightening and easing, and the COVID-19 shock.

Data are drawn from the World Bank's World Development Indicators (WDI) and IMF's International Financial Statistics (IFS) accessed through the World Bank's real-interest-rate series. Real Interest Rate Definition: World Bank Lending rate adjusted for GDP deflator The series on GFCF and GDP growth are from the WDI national accounts.

Table 1 defines the variables employed.
Variable Definitions and Roles

Variable	Symbol	Measurement	Role
Real interest rate	RIR	Percentage	Independent variable
Gross fixed capital formation	GFCF	Percentage of GDP	Dependent/intermediate variable
GDP growth	GDPG	Annual percentage	Growth variable

Measurement. The real interest rate is the lending rate adjusted for inflation and preferred to the nominal rate because what matters for investment decisions is the real cost of borrowing. GFCF is a measure of investment as a percentage of GDP and is a measure of spending on machinery, equipment, structures, infrastructure and other fixed productive assets. Real GDP growth is the annual percentage change in real GDP.

Econometric Specification

Two models are estimated.

Model 1: Investment Equation.

$$\text{GFCF}_t = \beta_0 + \beta_1 \text{RIR}_t + \epsilon_t$$

Model 2 Growth Equation.

$$\text{GDPG}_t = \alpha_0 + \alpha_1 \text{RIR}_t + \alpha_2 \text{GFCF}_t + \epsilon_t$$

The two equations have been estimated by ordinary least square (OLS). Given the small sample size of 21 observations, the results should be considered exploratory rather than definitive causal estimates.

Data and Descriptive Statistics

Table 2; Annual Real Interest Rate, Investment, and GDP Growth in India, 2000-2020

Year	Real interest rate (%)	GFCF (% of GDP)	GDP growth (%)
2000	8.34	26.02	3.80
2001	8.59	29.93	4.80
2002	7.91	28.33	3.80
2003	7.31	28.33	7.90
2004	4.91	30.71	7.90
2005	4.86	32.76	7.90
2006	2.57	33.58	8.10
2007	5.68	35.81	7.70
2008	3.77	34.72	3.10
2009	4.81	33.95	7.90
2010	-1.98	33.23	8.50
2011	1.32	34.31	5.20
2012	2.47	33.44	5.50
2013	3.87	31.30	6.40
2014	6.70	30.08	7.40
2015	7.56	28.73	8.00
2016	6.23	28.19	8.30
2017	5.33	28.18	6.80
2018	5.51	29.19	6.50
2019	6.89	28.45	3.90
2020	4.14	27.32	-6.60

Note. Source: World Bank World Development Indicators; IMF International Financial Statistics (real-interest-rate series).

Table 3; Descriptive Statistics

Variable	N	M	Minimum	Maximum	SD
Real interest rate	21	4.93	-1.98	8.59	2.61
GFCF (% of GDP)	21	31.82	26.02	35.81	2.94
GDP growth	21	6.20	-6.60	8.50	3.04

The descriptive statistics indicate that real interest rates varied a lot in the sample. The minimum real rate, seen in 2010, indicates very accommodative inflation-adjusted borrowing conditions. Investment was at its highest around the mid-2000s and GDP growth was at its lowest in 2020 during the pandemic.

Correlation Analysis

Table 4; Pearson Correlation Matrix

Variable	Real interest rate	GFCF	GDP growth
Real interest rate	1.000	-.618**	-.069
GFCF		1.000	.335
GDP growth			1.000

Note. * $p < .01$.

The strongest evidence for the rate-investment link comes from the correlation matrix. The coefficient of -0.618 indicates a strong negative relationship which implies episodes of high real borrowing costs were associated with depressed investment ratios. By contrast, the correlation between real interest rates and GDP growth is essentially zero (-.069), which points to an extremely weak direct linear relationship. The correlation between GFCF and GDP growth is positive (.335), implying that higher investment ratios tend to be linked to stronger growth, but this link is much weaker than the rate-investment link.

Regression Results

Table 5; OLS Regression: Real Interest Rate and Investment

Predictor	B	SE	t	p
Constant	34.286	1.136	30.183	<.001
Real interest rate	-0.687	0.200	-3.428	.003

Note. $R^2 = .382$; Adjusted $R^2 = .349$; $N = 21$.

The regression confirms the significant negative relationship. In this simple specification, the coefficient on the slope of -0.687 suggests that a one-percentage-point increase in the real interest rate is associated with a fall in GFCF as a share of GDP of an estimated 0.687 percentage points. The model accounts for about 38.2% of the variation in investment. Thus, the null hypotheses of no relationship and no effect between real interest rates and investment (H_{01} and H_{02}) are rejected.

Table 6; OLS Regression: Economic Growth on Real Interest Rate and Investment

Predictor	B	SE	t	p
Constant	-11.874	10.784	-1.101	.285
Real interest rate	0.279	0.346	0.805	.431
GFCF	0.531	0.311	1.705	.105

Note. $R^2 = .143$; Adjusted $R^2 = .048$; $F = 1.504$; $p = .249$; $N = 21$.

In the multivariate growth specification, the coefficient on GFCF is positive, which is in line with theoretical priors that investment spurs expansion. It does not, however, reach typical levels of significance. The coefficient in the real interest rate is also statistically insignificant. The patterns point to an important methodological lesson: it is far more difficult to identify the direct effect of interest rates on annual GDP growth than to identify their effect on investment.

Interpretation of Findings

The first major finding is the strong inverse relationship between capital formation and real interest rates. The correlation of -0.618 and regression coefficient of -0.687 together imply that investment ratios fell significantly when real financing costs were high. The result is consistent with neoclassical investment theory and earlier Indian evidence. Similarly, Anand and Tulin (2014) documented a negative association between rate and investment.

The second major finding is that the direct relationship between rate and growth is weak. This does not mean that interest rates have no role in growth, rather it is an acknowledgment that the expansion of output is the result of a convergence of forces consumption, exports, public spending, productivity, employment, technology, inflation, global conditions, exchange rates and unforeseen shocks. Thus, a simple bivariate rate-growth specification would not capture the entire transmission mechanism.

Third, investment is positively related to the growth. The correlation coefficient of 0.335 indicates that the faster growing economies are those with higher ratios of capital formation. The results of the multivariate regression are imprecise because of the limitations of the sample. The lack of statistical significance in the growth equation should not be taken as evidence that investment does not matter. With only 21 annual observations and major structural disturbances, including the 2020 COVID-19 contraction, the statistical power is necessarily limited.

Discussion

The results are consistent with the theoretical proposition that real costs of finance matter for the development of capital. An increase in the real cost of capital will increase the required rates of return on companies, delay marginal projects, and reduce total capital investment. These results are consistent with a large literature on monetary transmission, which identifies an interest rate channel (via financing conditions) and a credit channel (via availability and conditions of external funding). The research also provides clues as to why monetary policy cannot be simply judged by the direct relationship between interest rates and GDP. When demand is strong and inflation is high, central banks raise interest rates; when the economy is weak, they cut them. Elementary correlations are thus polluted by reverse causation: stronger growth can indeed lead to tighter policy. In a recession, a central bank would cut interest rates, but the shock may cause a fall in output. Thus, simple correlations are likely to underestimate the true stimulative effect of more accommodative monetary conditions.

The 2020 observation is a good case in point,” Even with interest rates at historic lows, India witnessed a sharp contraction in GDP, but that was not an indication that low rates were hampering growth, but the unprecedented disruption caused by the virus. Indian scholarship supports this interpretation. Anand and Tulin (2014) argued that real interest rates were only a partial explanation of the slowdown in investment, and that company confidence and policy uncertainty were other contributing factors.

Major Findings

The study found that real interest rates in India were highly volatile during the period 2000-2020, while investment increased substantially during the high-growth phase of the mid-2000s and then declined. The study also showed that there was a significant negative relationship between real interest rates and gross fixed capital formation (GFCF) and real interest rate explained around 38.2% of the variation in investment. The estimated effect of a 1 percentage point increase of the real interest rate was a decline in GFCF as a share of GDP of roughly 0.687 percentage points.

The correlation between annual GDP growth and real interest rates was found to be very weak and statistically insignificant. In contrast, investment had a positive relationship with economic growth indicating that investment is important in expanding productive capacity and supporting economic performance. Overall, the results indicate that interest rates influence economic growth primarily through investment and financial conditions. Therefore, interest-rate policies must be considered in

the light of inflation, availability of credit, investor confidence, fiscal policy and external economic conditions to promote sustained investment and growth.

Policy Implications

Maintain an Appropriate Real Interest Rate If inflationary pressures are contained, monetary authorities should avoid unnecessarily high real rates, as high financing costs can suppress productive investment.

Balance inflation control, support growth. Lower rates cannot be pursued without consideration of inflation. Continued price instability erodes purchasing power, introduces more uncertainty and eventually requires corrective tightening. Hence, policymakers should seek a balance between price stability and financing conditions conducive to capital formation.

Structural Measures as an Adjunct to Rate Policy. Moreover, interest rate policy will be most effective when combined with reforms that improve the investment environment: infrastructure development, regulatory stability, easier project approvals, greater access to credit, deeper financial markets, and less policy uncertainty.

Enhance Credit Transmission. The effect of changes in policy rates depends on the degree of pass-through to lending rates. The effectiveness of monetary policy can be enhanced through improving the efficiency of the financial sector, optimizing transmission mechanisms and increasing competition in banks.

Watch out for cheap credit. Low interest rates encourage investment, but if they persist for too long, it can lead to inefficient projects, overborrowing, market distortions and misallocation of capital. The IMF literature indicates that, given the right institutional framework, financial deregulation and sufficiently positive real interest rates may improve the distribution of savings and investments.

Conclusion

The present study investigates the effect of real interest rate on investment and economic growth in India for the period 2000-2020. An OLS analysis of annual secondary data indicated a statistically significant negative relationship between real interest rates and capital formation. This result is in line with the theoretical prediction that higher real costs of borrowing decrease the appeal of investment projects. The analysis also found weak linkages between real interest rates and GDP growth. The result indicates that economic growth is affected by the broader set of macroeconomic and structural factors. Interest rates do not appear to have a direct and immediate effect on output but rather operate through investment and a range of financial channels to influence growth. These findings are in line with earlier Indian studies which have found that real interest rates do impact on investment but are not enough to explain the variations in capital accumulation or growth. The transmission of monetary policy depends on inflation trends and expectations, credit conditions, financial development, business confidence, fiscal stability and external shocks.

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