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Relationship between inflation and economic growth in India

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Abstract
Inflation has always been considered to be unhealthy for the growth and development of a country. It has been a topic of debate whether inflation causes economic growth or adversely affects it. The existence literature hinted toward some countries exhibiting positive relationship between the two, however it cannot be concluded for all the countries. Hence, this study is focused on assessing whether a relationship between Inflation and Economic growth rate exists in India. The main objectives of the study are to find out a meaningful relationship between the two and to find the nature and direction of the relationship. For analyzing, four decadal data from year 1961 to 2020 is used, which is extracted from the World Bank's database. After using Linear Regression Model and Correlation, it is found out that a weak negative relationship exists between the two. Further, to check the nature and direction, Dickey-Fuller test, Engle-Granger Test and Granger Causality test are employed. The analysis of these tests showed that the variables are stationary and there exists a long-term relationship between Inflation and Growth rate. Moreover, the direction of the result is found to be bi-directional. Therefore, in the Indian context, there exists a negative long run bi-directional relationship between Inflation and Economic growth.

Keywords: Inflation, growth rate, World Bank, correlation, unit root, Granger causality test

Introduction

Inflation and economic growth are two of the most commonly discussed indicators when people try to understand how an economy is performing. Economists, policymakers and even ordinary citizens often look at these two numbers to judge whether things are improving or becoming more difficult. Inflation shows how fast prices are rising, while economic growth reflects the pace at which goods and services are being produced in an economy. Even though both indicators are widely used, the way they interact with each other is not always straightforward. Economic Growth shows the size of economy relative to earlier years. Whenever the growth is high, it typically shows up as more jobs and production. On the other hand, Inflation is very different, it shows how the cost of living is rising. A little increase in prices is normal, however, when prices rise too fast, it impacts the overall economy of the country. Very low inflation often showcases weak demand or a slowing economy. Due to this characteristic of Inflation, it is a thermometer of stability of an economy.

Because of this, inflation has become a prominent concern when peoples discussing the economy stability. In countries such as India, inflation can rise for a variety of causes. Sometimes farming yield is lower than anticipated. Sometimes global oil prices rise unexpectedly. Rising production costs might also lead to price increases. when inflation rises too quickly, central banks typically attempt to control it by hiking interest rates. This makes borrowing more expensive for both families and business. People then postpone significant purchase and firms reconsider their investment strategies. All of this together inhibits economic growth.

Inflation and growth do not always is same everywhere. It varies across countries and throughout time. For example, when a country has good harvests, rising productivity and stable supply conditions, it can grow rapidly while incurring little inflation, however, when there are supply shortages, natural disasters, wars, pandemics or unexpected worldwide price hikes, inflation can rise even while the economy is deteriorating. Between 1961 and 2020, India had a wide range of events, including rapid growth, server inflation, droughts important reforms and even worldwide catastrophes. Because of the wide range of experiences, it is crucial to examine how inflation and growth have interacted over a period of time.

Economic theories provide a variety of perspectives on how the two might be related, monetarists, particularly those who follow Milton Friedman's principle, argue that inflation is primarily caused by an excess of money in the economy and that it typically damages long-term performance by creating uncertainty. Neoclassical economist argues something similar, except they focus on how inflation affects decisions about saving, working and investment. On the other hand, Keynesian and structuralist economist believe that moderate inflation is not always a negative thing, they claim that when an economy grows, it is natural for prices to rise slightly as demand increases and wages adjust.

These theoretical contradictions explain why empirical research are not always consistent, in certain countries, inflation may help growth to some extent, while in others it may have a negative impact on growth very quickly. This is why scholars frequently discuss an inflation threshold, the concept is that these may be a level of inflation that the economy can sustain without affecting growth, but once inflation exceeds that level, the negative impacts take over. This topic has gotten a lot of attention, particularly in studies focused on emerging economi

In India's case, a long list of factors has influenced inflation. For instance, food supply shocks, global oil price movements, changes in monetary and fiscal policy,

industrial restructuring, various crises all played their role at different moments. The Indian economy has also changed a lot since the 1960s. The Green Revolution transformed agriculture, the 1991 reforms opened up the economy in a big way, and over the last two decades, the service sector has grown rapidly. All these shifts make it incumbent to study inflation and growth together across a longer period of time instead of focusing on small periods.

Keeping in mind the aforementioned discussions, the present study undertakes an attempt to comprehend the exact relation of inflation and GDP growth using annual time-series data for India from 1961 to 2020. The study does not work under the assumption of a fixed relationship between the two variables and instead seeks to understand how both these important economic variables have behaved across different decades. In other words, the clear objectives are to examine whether inflation and growth move together, the strength of their relationship, and whether one of them is helpful in predicting the other through simple econometric techniques.

This study examines the relationship between inflation and GDP growth rate of India by using times series data from 1961 to 2020. The analysis aims to:

1. to identify whether a meaningful relationship exists between the inflation rate and GDP growth,
2. to understand the nature of this relationship, and
3. to examine the direction of causality, if any, between the two variables.

Literature Review

Economies behave differently depending on the time period, level of development, structure of production, policy decisions and external events. Because of this, it is very hard to find a single pattern that fits all countries. Many studies have come up with different results, and sometimes even within the same country, findings vary depending on how the study was conducted. This section reviews some of the major studies from different countries while giving special attention to work done on India.

One of the earliest attempts to compare many countries at once was made by Paul, Kearney and Chowdhury (1997) [5]. Their study is often referred to because it questioned the traditional idea that inflation and growth usually move in one direction. Researchers at that time were mainly interested in whether inflation causes growth or whether growth causes inflation. Paul and his co-researchers did not start with the assumption that inflation and growth behave the same way everywhere. Instead, they examined a large sample of 70 countries across different regions and income levels. What they found was quite mixed, actually. In some places, inflation seemed to push growth; in others, growth seemed to push inflation, while in a rather surprisingly large number of countries, the two did not appear linked at all. The main message from their study was basically that you cannot treat every country the same. Each one has its own story, its own problems, and its own structure, so a pattern which perhaps shows up in one place does not show up anywhere else.

In the early 2000s, many economists got more curious about South Asia because inflation had started rising in several countries at the same time. Mallik and Chowdhury (2001) [4] picked up the question for Bangladesh, India, Pakistan, and Sri Lanka. Using annual data and long-run methods like cointegration, they concluded that inflation and growth moved together over long periods in all four countries. The relationship was not equally strong everywhere.

For India alone, researchers have long studied the inflation-growth relationship in india, but their results do not all line up. Singh and Kaliappa (2003) [6] found that higher inflation reduces growth and that india performs better when its inflation stays close to that of its trading partners. Veni and Choudhury (2007) [7] found no long run relationship at all and used cointegration and causality tests. They concluded that inflation and growth basically moved independently of each other.

Some helpful perspectives come from countries outside India. Chimobi (2010) [2] examined Nigeria from 1970 to 2005 and found no long-run relationship between inflation and growth rate. Kaur (2014) [3] observed that inflation generally had a negative impact of India's growth over time. Her work focused on identify broad trends instead of calculating exact statistical estimates. Behera and Mishra (2017) [1] found that inflation above roughly 4 percent may start to hurt growth in India and using spline regression or ARDL, they argued that this threshold is important for policy decisions.

Overall, the studies offer mixed results, some show inflation helping growth, others show it hurting and many find no clear link. These differences are expected because countries vary widely in their economic conditions and development levels.

In India, the evidence on the inflation-growth relationship is particularly mixed, some studies show a positive link, others a negative one, and some find no link at all. Given the major shifts in India's economy since the 1960s, from farm sector reforms to liberalisation and rapid growth in services, it makes sense that this relationship would not remain constant. Taken together, the research shows that the inflation–growth link depends heavily on how an economy is structured. This makes a fresh analysis for India, using updated data from 1961 to 2020, both timely and essential.

Data & Methodology

The methodology followed in this study is based on time-series analysis. Since the aim is to understand how inflation and GDP growth behave over a long period and whether they influence each other, the methods used here help in examining both the short-run and long-run behaviour of the variables. The data for both inflation and GDP growth has been taken from the World Bank database because it provides consistent and internationally comparable figures for different countries. Using a single source also avoids problems that arise when different datasets give different definitions of the same variable.

Inflation in this study is measured using the annual inflation rate that reflects the percentage change in consumer prices. GDP growth is measured using the real GDP growth rate at constant prices.

Table 1: Year wise data (1961-2020)

Year	Inflation Rate	Growth Rate	Year	Inflation Rate	Growth Rate	Year	Inflation Rate	Growth Rate
1961	1.70	3.72	1981	13.11	6.01	2001	3.78	4.82
1962	3.63	2.93	1982	7.89	3.48	2002	4.30	3.80
1963	2.95	5.99	1983	11.87	7.29	2003	3.81	7.86
1964	13.36	7.45	1984	8.32	3.82	2004	3.77	7.92
1965	9.47	-2.64	1985	5.56	5.25	2005	4.25	7.92
1966	10.80	-0.06	1986	8.73	4.78	2006	5.80	8.06
1967	13.06	7.83	1987	8.80	3.97	2007	6.37	7.66
1968	3.24	3.39	1988	9.38	9.63	2008	8.35	3.09
1969	-0.58	6.54	1989	7.07	5.95	2009	10.88	7.86
1970	5.09	5.16	1990	8.97	5.53	2010	11.99	8.50
1971	3.08	1.64	1991	13.87	1.06	2011	8.86	5.24
1972	6.44	-0.55	1992	11.79	5.48	2012	9.31	5.46
1973	16.94	3.30	1993	6.33	4.75	2013	11.06	6.39
1974	28.60	1.19	1994	10.25	6.66	2014	6.65	7.41
1975	5.75	9.15	1995	10.22	7.57	2015	4.91	8.00
1976	-7.63	1.66	1996	8.98	7.55	2016	4.95	8.26
1977	8.31	7.25	1997	7.16	4.05	2017	3.33	6.80
1978	2.52	5.71	1998	13.23	6.18	2018	3.95	6.53
1979	6.28	-5.24	1999	4.67	8.85	2019	3.72	4.04
1980	11.35	6.74	2000	4.01	3.84	2020	6.62	-7.25

Source: World Bank Database

Afterwards, a simple linear regression model is used. This model helps in checking whether inflation has any direct association with GDP growth.

The form of the regression equation is:

$GDP\ growth_t = C + \beta \times Inflation_t + \varepsilon$

If the inflation coefficient comes out negative, it more or less tells us that higher inflation often shows up in years when growth is lower. If the coefficient is positive, then it points in the other direction, meaning growth tends to be higher when inflation rises. The constant term is simply the growth rate the model predicts when inflation is assumed to be zero. It does not mean inflation is ever actually zero; it is just part of how the equation works.

Besides the regression, a basic correlation test is also helpful because it shows whether the two variables move in a similar pattern overall. Correlation can fall anywhere between –1 and +1. If it is close to +1, that means the variables usually move in the same direction. If it is closer to –1, they generally move in opposite directions. And if the value hangs around zero, the two variables do not have much of a linear relationship at all. In this study, checking the correlation is a simple way to see if the regression results fit with what the general movement of the data suggests.

Before applying more advanced tests like co-integration and causality, it is necessary to check if the data is stationary. Time-series methods behave very differently when the data is not stationary. A stationary series is one in which the mean, variance and overall pattern remain stable over time, even though the values may go up and down. If the series is not stationary, statistical tests may give misleading results. Therefore, the Augmented Dickey-Fuller (ADF) test is used. The ADF test checks for the presence of a unit root.

Once the stationarity of both inflation and GDP growth is confirmed, the next step is to check whether they move together in the long run. For this purpose, the Engle-Granger co-integration test is used. Co-integration is important because even if two series are individually stationary or even non-stationary, they may still follow a common long-run path. The Engle Granger test checks whether two variables tend to move together in the long run. It is not a perfect measure of anything, but it gives a reasonable hint about whether the two variables share a long-term path.

We use Granger Causality Test to figure out is whether one variable can actually help predict the other. It checks whether the past values of one variable forecasts the other. If the p value is below 0.05, we say that the first variable does help predict the second. If the p value is higher, then there is no sign of predictive power. Because the ADF test already showed that both inflation and GDP growth are stationary in their original form, we can run the Granger test directly.

Results

Descriptive Statistics of the data

The table gives a basic picture of how inflation and economic growth behaved over the years. Inflation was generally higher than growth, with an average of about 7.5 percent, while growth averaged around 4.8 percent. Both variables show quite a bit of variation. Inflation swung widely, going from negative values to almost 29 percent, which explains its large standard deviation and wide range. Growth also moved up and down, although its fluctuations were smaller compared to inflation. The negative minimum growth rate reflects the impact of major economic slowdowns such as the Covid year.

Table 2: Descriptive Statistics

Inflation rate		Growth rate	
Mean	7.505348	Mean	4.819263
Median	6.6495	Median	5.533455
Mode	6.623437	Mode	-7.25175
Standard Deviation	4.896956	Standard Deviation	3.639075
Sample Variance	23.98018	Sample Variance	13.24287
Range	36.23268	Range	16.87954
Minimum	-7.63395	Minimum	-7.25175
Maximum	28.59873	Maximum	9.627783
Count	61	Count	61

Figure 1 depicts that the scatter chart of inflation and GDP growth, gives a rough idea of the relationship between them. Although the scatter plot shows that there is some relationship between the variables, the points do not form a clear pattern. Some high-inflation points correspond to low

growth, but other high inflation points occur during moderate growth. Because the chart does not give a strong visual trend, it becomes necessary to use statistical tests to understand the relationship more precisely.

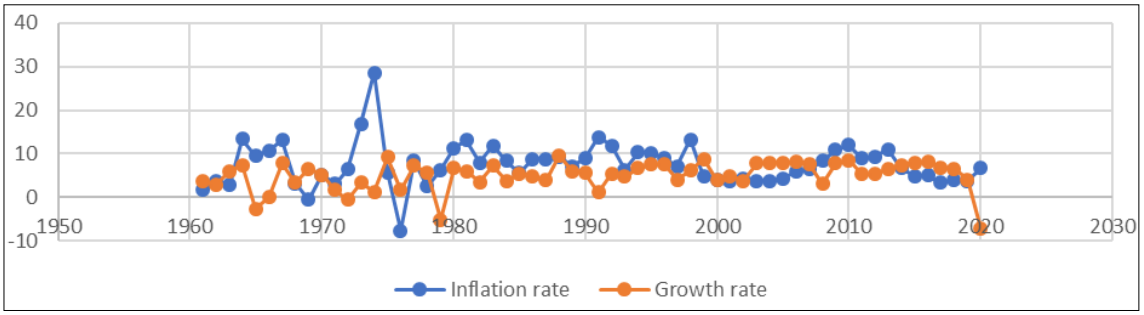

Fig 1: Scatter chart

The regression analysis is the next step. The estimated equation was

$GDP\ growth_t = 4.86496 - 0.0061 \times Inflation_t + \varepsilon$

The negative coefficient on inflation suggests that when inflation increases by one unit, GDP growth declines slightly. Although the effect is very small, the direction is negative, meaning that there tends to be an inverse relationship between the two variables. The constant term shows that if inflation were zero, GDP growth would be about 4.86 percent on average. It is important to note that this does not mean the economy actually needs zero inflation to grow; it simply reflects the average behaviour of the data. The main takeaway from the regression is that inflation has a mild negative effect on growth, consistent with many studies that found inflation to be harmful at least to some extent.

After the regression, correlation analysis was done. Table 3 showed that the correlation between inflation and growth is approximately -0.008. This value is quite close to zero, indicating that inflation and GDP growth do not follow a strong linear relationship.

The negative signs fit with the regression direction, but the tiny magnitude indicates that inflation and growth do not follow a consistent pattern. In simple words, sometimes inflation and growth move in opposite directions, but the relationship is so weak that it does not matter much in a linear sense.

Table 3: Correlation Analysis

	Inflation rate	***Growth rate***
Inflation rate	1	
Growth rate	-0.00819	1

The value of the correlation is close to zero: this means that inflation and GDP growth are not moving in a clear linear relationship. In other words, there may be years when inflation goes up and growth goes down, and there are also years where the opposite happens, but the pattern is so weak and inconsistent that it does not carry much meaning. So even though the sign is negative, the overall relationship is too small to matter in any practical sense.

Table 4: ADF Test

Variable	Test Statistic	P value	Conclusion
Inflation Rate	-4.9421	0.005	Stationary
Growth	-4.7448	0.01	Stationary

After stationarity checks were made, the next step was to perform the Engle Granger cointegration test to test whether inflation and GDP growth share any long-run relationship. The test statistic we obtained was around –4.581, which is more negative than all the critical values at the 10 percent level (–1.61), 5 percent level (–1.95), and even the 1 percent level (–2.60). Given that our statistic surpasses all these cutoffs, we fail to reject the hypothesis that the two variables cointegrate. In simple language, this result means that there appears to be some sort of long-run relation between inflation and growth, although the relationship between the two variables is not very strong over the short run. It seems that in the long run, both variables seem to follow a similar underlying pattern, even though in the short run, ups and downs often disrupt this linkage. This has to do with the fact that inflation and growth, while sometimes appearing as separate entities, are not unrelated when observed over a great length of time.

Table 4: Engle-Granger Co-integration Test

Metric	Test Statistic	10% critical value	5% critical value	1% critical value
Value	-4.581	-1.61	-1.95	-2.60

The next step in the analysis was the Granger causality test, used basically to see if the past values of one variable help in predicting the future values of the other. Two possibilities were checked. The first was whether inflation "Granger causes" GDP growth; the second was whether GDP growth "Granger causes" inflation. The p value for inflation predicting growth was around 0.057, and for growth predicting inflation it was about 0.075. Given that both numbers are above the usual 0.05 cut-off, we cannot say that either variable helps forecast the other. In simple terms, inflation provides no useful clues as to future growth, and growth doesn't have much to say about future inflation.

The result is interesting because it indicates that, although the cointegration test suggested the two variables share a long-term relation, this does not necessarily translate into predictive power in the short term. It's quite plausible that on account of deeper structural factors, inflation and growth move together over several decades, while in the short run their relationship gets messy. Supply shocks, policy changes, or unusual weather events, to say nothing of global happenings, can easily break whatever short-run pattern might exist.

Table 5: Granger Causality test

Direction	p-value
Inflation → Economic Growth	0.057
Economic Growth →Inflation	0.075

Conclusion

This paper aimed to look at the relationship between Inflation and Economic Growth in India. The aim was to see what patterns showed up in the data, using basic trends and a few standard tests.

The historical data shows that both variables have not been stable. Inflation shot up during the 1970s oil shock and even went negative in a few years. Growth also rose and fell at different times, with strong expansion in some periods and a sharp drop in 2020 during the COVID-19 crisis. When the two are viewed together, no clear short-run pattern appears. Their movements seem to depend on a mix of global events, domestic policies and unexpected shocks.

The regression results show a weak negative link between inflation and growth. Higher inflation is linked with slightly lower growth, but the effect is too small to explain much. The correlation test also showed almost no consistent short-term relationship. After checking stationarity with the ADF test, the Engle-Granger test suggested something more meaningful. Inflation and growth do seem to share a long-run relationship. The Granger causality results tell a different story for the short run. Neither inflation nor GDP growth helps in predicting the other from one year to the next. Knowing last year's inflation offers no meaningful clue about next year's growth, and vice versa. At first this seems inconsistent with the cointegration result, but it fits the nature of Indian macroeconomic data. Short-run outcomes in India are often shaped by sudden events such as droughts, changes in global markets, supply disruptions, unexpected policy shifts or political uncertainty. These shocks break any regular short-term pattern even if a long-term link exists. Taken together, the findings show that the relationship between inflation and growth in India is complicated. Inflation appears to have a mild negative effect on growth, but not strong or consistent enough to form a clear short-run rule. Over longer periods the two variables move together, but that does not make one a reliable predictor of the other. Policymakers therefore need to approach inflation and growth separately, without assuming that improving one will automatically improve the other. India's economic history since the 1960s adds important context. The Green Revolution, the 1991 liberalisation, the rise of the services sector, repeated oil price shocks, monsoon variations, global financial crises and political changes have all shaped inflation and growth at different times. These overlapping influences make it unrealistic to expect a single, simple relationship between the two variables. Future work could explore whether India has an inflation threshold; an upper level of inflation beyond which growth becomes noticeably weaker. Many countries show such tipping points. Including variables such as interest rates, unemployment, money supply, exchange rates or fiscal conditions could also offer a clearer understanding of what really drives the inflation–growth pattern in India.

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