Double Blind Peer Reviewed Journal

ANWESHAN

Journal of the Department of Commerce,

UNIVERSITY OF NORTH BENGAL

ISSN: 2321-0370, Vol. 6, No. 1, 2019, pp. 1-24

Available online at www.nbu.ac.in

ECONOMIC GROWTH-INFLATION DYNAMIC TRADE-OFFS IN INDIA: STABILITY ISSUES AND POLICY IMPLICATIONS

KALYAN DAS[1]

Abstract

Endogenous and exogenous shocks disrupt macroeconomic stability. Growth, inflation and external balance are used to evaluate macro performance of an economy. Examining the relationship between inflation and gross domestic product (GDP) has long been an important field in macroeconomic research. This paper examines the nature of dynamic trade-offs between inflation and output and their direction of causation in the Indian economy utilizing time series dataset over the period from 1950-51 to 2015-16 employing together with unit root tests, co-integration regression and causality tests. There is strong evidence of their bidirectional causality. The empirical findings help to translate certain important theoretical issues on structural adjustment problems into various policy relevant solutions and interrelationships examining the role and conduct of macroeconomic stabilisation policies with particular emphasis placed on the specific episodes on macroeconomic dips, the existence of recessionary episodes, the counter-cyclical nature of inflation and the sustainability of macroeconomic policies.

Keywords: Growth, Inflation, Causality Test

JEL Classifications: 040; E31; C22

INTRODUCTION

Macroeconomic malice arises when disequilibria persist between aggregate domestic demand and supply. It needs adjustment comprising stabilisation and structural reform policies to reduce absorption and to improve the balance of payments (BOP). So long as foreign resources are available, such a situation can sustain despite at severe economic costs like

[1] Kalyan Das, Associate Professor in Economics, A.C. College of Commerce, Jalpaiguri, West Bengal, India, e-mail: das_kalyan1@rediffmail.com

rising external debt, high inflation and stagnant growth. This situation yields a wide variety of economic disorders in the list of macroeconomic aggregates, including production, consumption, savings and capital formation via changes in real interest rate and exchange rate, price level, terms of trade, inter-sectoral linkages, and the others and thereby the problem of effective demand in the process of economic growth. Policy induced endogenous and exogenous shocks disrupt macroeconomic growth process. The economic policy of a nation is essential to evaluate its macroeconomic performances. This holds true for a country like India where a highly interventionist government is seen to have followed a complex set of economic policies in a wide variety of areas and sectors since independence. Examining the relationship between inflation and growth has long been an important field of interest to theoreticians and empirics across countries and times. Sustaining high economic growth with price stability is one of the most fundamental objectives of macroeconomic policies. There are several reasons for this subject is of current interest: first, the issue of adjustment has become a global phenomenon throughout the developing world since the outbreak of the debt crisis in 1982; second, Post-independence India witnesses the dynamics of macroeconomic policy shifts to inform policy reliance; and third, Indian macroeconomic time-series database is considered relatively good by developing country standards as data being available on a comparable basis and has advantage for systemic econometric investigation.

It has long been one of the debated and controversial issues whether there is any relation or causation between inflation and growth rate. However, if any consensus exists, it suggests that macroeconomic stability specifically defined in terms of low inflation is positively correlated with economic growth. The neo-classical view postulates a negative relationship between inflation and economic growth while the Keynesians, post-Keynesians and endogenous growth theoreticians have established a positive link between the two in the short-run. According to structuralists, inflation is necessary for economic growth while the monetarists see inflation as harmful for economic progress. The mainstream theoretical works developed centering the trade-off between inflation and output in the short-run versus the long-run in rational expectations and sticky prices studies to stochastic optimal control techniques to business cycle approaches. The IMF accepted the view that moderate rate of a 2 per cent inflation has a positive effect on growth. Many developing countries' economists and central bankers have been endorsing a 4 to 6 per cent range of inflation rates as the socially desirable for developing countries. However, empiricists' views are divergent regarding the sign of the

relationship. One strand of research argues a positive relationship (Cukierman and Gerlach, 2003) while the other strand of research supports a negative relationship (Conrady and Karanasos, 2010) and some empirical studies support neutral link (Hayat & Kalirajan, 2009).

However, country-specific systematic studies of this nature have been few and far between. The existing studies in the Indian context are partial in period, policy and sectoral coverage. More importantly, a great deal of earlier studies carried out prior to 1990s tends to be spurious as were based on traditional regression methodology even dealing non-stationary dataset and could mislead their findings. This paper aims to fill this gap. This paper examines the nature of dynamic trade-offs between inflation and output and their direction of causation both in the short-run and in the long-run in the Indian context utilizing macroeconomic time series dataset over the period from 1950-51 to 2015-16. The rest of the paper is organized into the following sub-sections. Section I provides a discussion on the data sources and methodology adopted. Section II provides a graphical analysis of the inflation-growth nexus in the Indian economy. Section III provides results and illustration of econometric investigation. Section IV provides a discussion on the stages of India's macroeconomic dips, and section V concludes the paper with policy analysis.

SECTION I. DATA SOURCES & METHODOLOGY

Data used in this paper are annual covering economy's economy-wide, sector - wise and economic activity – wise details at current and constant prices both over the period from 1950-51 to 2015-16 obtained or compiled directly from the following official sources such as national accounts statistics of the Central Statistical Organisation (CSO); balance of payments accounts of the Reserve Bank of India (RBI) and monetary accounts of the Currency and Finance (CF) of the RBI; fiscal accounts pertaining to budget financing operations of the Ministry of Finance (MoE), Government of India (GoI). The dataset covers macroeconomic statistics related with the components of GDP, financing current account deficits, public sector investment, gross fiscal deficit, exchange rates, exports and imports of goods and services, interest rates, inflation, growth, etc. These individual time-series help to depict the growth of both the real and financial sectors and also its structural changes, if there be, over the entire sample period, in general, and between the pre- and post-liberalisation phases, in particular. It is important to note that the data-series till 2009-10 and the rest used in this paper are based on 1993-94 and 2004-05 base-year series (prices) respectively. Though conceptual and methodological

revisions, which were made in the base period changes are minor, the dataset are comparable to preserve the overall robustness. The paper computationally demands the methodology to integrate short-run disequilibrium dynamics with long-run equilibria to examine how the changes in endogenous and exogenous factors affected the growth and inflationary process. A battery of time series econometric techniques including different unit root tests, cointegration test, VEC model, and Granger causality tests are performed. However, this paper has not discussed all the methodologies adopted in detail to conserve its space.

SECTION II. GROWTH-INFLATION TRADE-OFFS: A SYNOPTIC SURVEY

This section summarizes the Indian growth-inflation trade-offs experiences over the period from 1950-51 to 2015-16.

Fig. 1: Annual Growth rate of Real GDP and Inflation Rate at Factor Cost

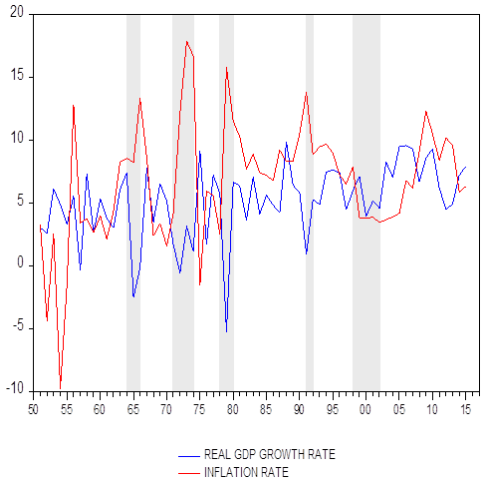
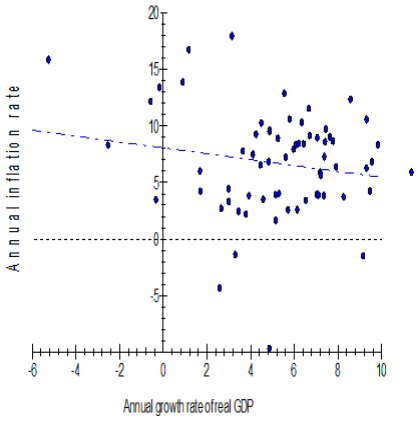


Fig. 2: Scatter Plot of Annual Rate of Inflation on Growth Rate of Real GDP



Note: Shaded areas represent Indian macroeconomic growth-rate downturns & inflation peaks

Source: CSO, *National Accounts Statistics*, *Economic Survey*, various issues

It is argued that 1980-81 marked a break in the trend rate of economic growth surpassing 5.5 per cent from the infamous 'Hindu rate of economic growth' of around 3-3.5 per cent in comparison with averaging 1950-51 to 1980-81. Real growth rate plummeted massively during 1965-67 and 1971-74, a jumped during 1975-77, again declined in 1979-80, again climbed up in 1980-82, upsurged in 1988-90 and to a dismal in 1991-92, steeply upward trajectory during 1995-97, since then drops to slightly more than 5 per cent, decelerated and plateaued up to 2002-03, then a period of

exceptionally high and stable growth nearly double digit till 2007-08 followed by a sharp deceleration in 2008-09 and then by rapid recovery during 2009-11, then economic slowdown during 2011-13 and then slight recovery during 2014-16. This fragile growth pattern itself raises doubts about sustainability about growth rate over long haul.

So far as inflation proxied by GDP deflator is concerned, its phasing over the reference period varies significantly unlike GDP. There found considerable differences in terms of amplitude, volatility, range of fluctuations and divergent time paths. There has been found wide disparity with respect to magnitude, co-efficient of variation and phasing in the short-run as well as long-run time path. India experienced high double digit inflation rates during the following growth-crises phases: 1964-66, 1972-74, 1979-81, 1990-92, 1997 and 2009-12; and hovering around negative and zero inflation rates during a couple of years. The inflation rate after the second half of the 90s remained relatively low. It is not clearly evident that inflation was relatively modest during the high and stable growth phases. When the growth rate of GDP is 'V'-shaped, inflation during some sub-periods was distinctly cyclical with a rapid upturn and prolonged period of steeply rising. The shaded regions and lines indicate growth downturns and inflation peaks. The year-by-year average correlations (dotted) density is much higher on the negative side than on the positive side (see Fig. 2). The correlation coefficient is not significant in magnitude, but negative in value. This sub-section paves the way for more rigorous analysis to validate this hypothesis empirically.

SECTION III. ECONOMETRIC INVESTIGATION

THE INDIAN REAL GDP & INFLATION ANALYSIS

Identical results of the Indian real GDP at level value to be non-stationary and at rate value stationary are supported from the results of the estimated autocorrelation and partial autocorrelation functions as shown in the following Table 1 and the similar estimation of the first-order AR model as shown in Table 2 and the corresponding graphical plot of correlogram in Figure 3.

TABLE 1
Estimated correlogram Function of India's Real GDP 1950-51 to 2015-16

Lags	Autocorrelation coefficient	Standard error	Partial autocorrelation coefficient	Box – Pierce Q-Stat	Probabilities
1	0.919	0.13	0.919	48.144	0
2	0.846	0.22	0.011	89.72	0

3	0.774	0.27	-0.029	125.22	0
4	0.704	0.31	-0.023	155.24	0
5	0.635	0.34	-0.037	180.16	0
6	0.571	0.36	-0.01	200.73	0
7	0.511	0.37	-0.016	217.51	0
8	0.45	0.39	-0.036	230.84	0
9	0.395	0.401	-0.008	241.32	0
10	0.344	0.408	-0.006	249.47	0
11	0.299	0.413	-0.004	255.75	0
12	0.254	0.417	-0.022	260.41	0
13	0.212	0.42	-0.021	263.73	0
14	0.168	0.422	-0.048	265.86	0
15	0.126	0.423	-0.02	267.09	0
16	0.086	0.4244	-0.022	267.68	0
17	0.052	0.4248	-0.001	267.9	0
18	0.019	0.4249	-0.019	267.94	0

Source: Author's calculation from CSO, National Accounts Statistics, various issues

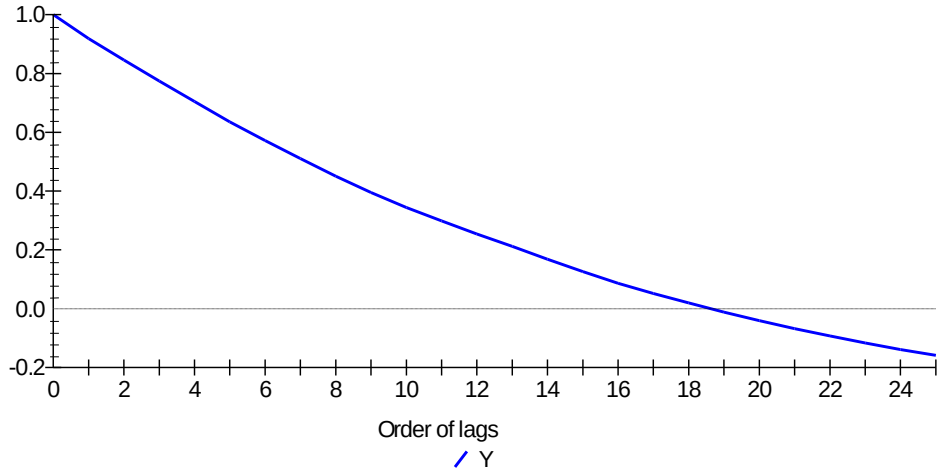
TABLE 2
Autoregressive Time-Series Model of Real India GDP

Variable	Coefficient	Std. Error	T-Ratio	Prob.	5% Critical Value
Real GDP (-1)	0.069021	0.014465	4.771706	0	-3.4969
C	-6383.06	3887.05	-1.64214	0.107	
Trend@ 1950=1	-114.9436	345.0802	-0.33309	0.7405	
R-squared	0.740522				
Adjusted R-squared	0.729931				
S.E. of regression	14101.43	Akaike info criterion		22.0019	
Sum squared resid	9.74E+09	Schwarz criterion		22.11447	
Log likelihood	-569.0494	F-statistic		69.92029	
Durbin-Watson stat	2.137456	Prob (F-statistic)			

Note: Dependent Variable: DGDP

Adjusted Sample: 1952 2016
Source: Author's calculation from CSO, National Accounts Statistics, various issues

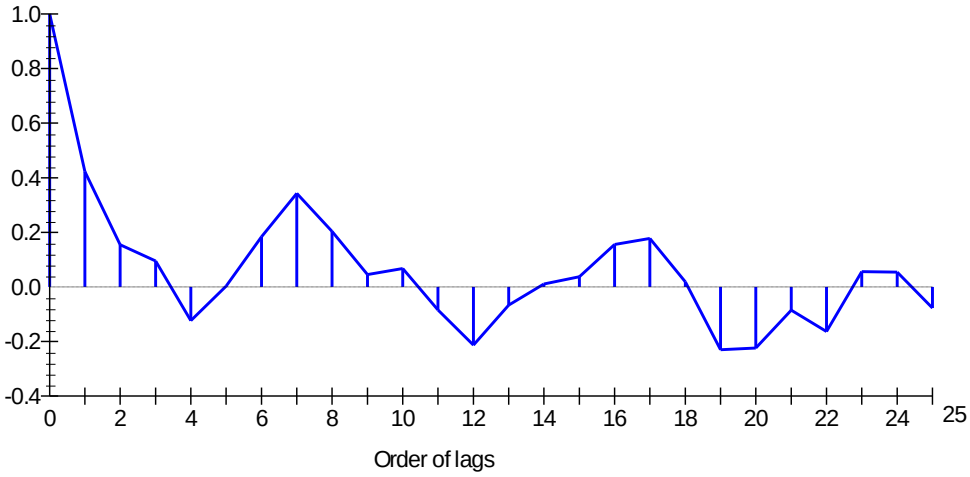
Fig. 3
Correlogram of the Indian Real GDP (Y) at level value over the sample period from 1950 to 2016



Source: Author's calculation from CSO, National Accounts Statistics, various issues

The Indian rate of inflation found stationary as the following plot 4 suggests.

Fig. 4
Correlogram of the Indian Annual Inflation Rate, 1951 to 2016



Source: Author's calculation from CSO, National Accounts Statistics, various issues

Now the question is has India been a low inflation country? Have the Indian fiscal and monetary stances been conservative or rather countercyclical throughout the studied sample period? The argument seems to attribute the fact that India's pre-80s the conservative fiscal and monetary stances diluted or rather eroded to chase debt burden, deficit monetization and to combat foreign exchange constraint, especially after 1991. Meanwhile the India's administered interest rate cum financial repression approach in bank nationalization spirit to induce import substituting development strategy of the late 60s has changed radically to deregulated interest rate cum market determined financial deepening exchange rate regime. India had to face various exogenous shocks particularly due to droughts, oil price rises and political aberration such as war from time to time. That might have led inflationary bubble for some time period but could not sustain shocks for longer period; however, that made foreign reserve depleted and current account deficit worsen via adverse terms of trade shocks and exchange rate shocks. Substantial fiscal consolidation is achieved in 1992-93 in order to eliminate macroeconomic destabilization. However, these gaps widened again after the mid-90s. Significant fiscal correction is made through FRBMA (Fiscal Responsibility and Budget Management Act) to strengthen fiscal discipline for rapid economic growth and price stability.

However, this uni-variate naïve version of unit root tests may cast doubt and be conjecture one in specifying modeling to be statistically significant to evaluate growth-inflation trade-off particularly to explore the episodes of macroeconomic dips in the Indian economy. However, the predictive information of this sub-section came to help for the subsequent economic discussion.

NATURE OF DATA

This section has basically two purposes. The first one is to examine the co-integrating long-run stable equilibrium relationships between economic growth, inflation rate, constituents of aggregate demand and other policy variables while the second one is to examine their short-run and long-run causal relationship to shed light on the direction of contemporaneous movements and on the adjusted dynamics out of equilibrium. The basic testing procedure requires three steps. The first step is to check whether the variables contain a unit root to confirm the nature of each variable. This is done by using the Augmented Dickey–Fuller (ADF) test. In the second step, it

examines the existence of a long-run co-integrating relationship between the variables, which is done by co-integration regression. Finally, in the last step, for the variables, which are integrated of order one I(1) or co-integrated, long-run elasticities and for others short-run elasticities are computed using the vector error correction model (VECM) method suggested by Engle and Granger (1987).

The theoretical justification of applying unit root tests is avoiding the risk of spurious regression as conventional ordinary least square (OLS) method may prevent to get the true short-run (disequilibrium or instability) and long-run (stable equilibrium) macroeconomic relationships. To make inference about the presence of unit roots as graphical (correlogram) evidence may be unreliable, the Augmented Dickey – Fuller (ADF) regression is useful in view of the size-power trade-off to choose appropriate model selection criteria indicating correct lag length with optimal order of augmentation based on Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) leading to a parsimonious model as reported in the following Table 3 while finding the studied variables whether I(1) or I(0).

However, the ADF tests are sensitive to the choice of lag length and over-parameterization for the selected model can happen when the lag length chosen exceeds the 'true' lag length. It is important to note that ADF test were not correctly capable to differentiate between non-stationary and stationary series had there been high degree of auto regression, serial correlation, time dependent heteroscedasticity, and a structural break in the studied time-series; and, against this background, the PP (Phillips and Perron) test would have been employed because of its improvement over the ADF test.

Prior to testing for a causal relationship between the time-series, the first step is to check the stationarity and the order of integration of the variables employed, which is done by using the augmented (standard) Dicky-Fuller (ADF) procedure as is reported along with description of the variables in the following Table 3.

DESCRIPTIONS OF THE VARIABLES:

Notations	*Description*
Y	gross domestic product (GDP) at constant prices
RY	growth rate of gross domestic product at constant prices
P	gdp deflator
RINF	inflation rate
CG	government final consumption expenditure at constant prices

CP	private final consumption expenditure at constant prices
SG	gross savings of the government sector
SP	gross savings of the private sector
SH	gross savings of the household sector
SC	gross savings of the private corporate sector
SZ	Gross domestic savings
IG	gross capital formation of the government sector
IP	(gross capital formation of the private sector)
IH	gross capital formation of the household sector
IC	gross capital formation of the private corporate sector
GDCF	gross capital formation at constant prices
XZ	exports of goods and services at current prices
MZ	imports of goods and services at current prices
E	Nominal exchange rate (Rs. Per US$)
RER	Real exchange rate
ID	Total internal debt
ED	External debt of the central government
INT	Nominal interest rate
M3	Broad Money
RINT	Real interest rate
NFIFAZ	Net factor income from abroad or remittances
TOT	Terms of trade

TABLE 3
Tests for Unit Roots of Variables Used in the Econometric Analysis

Notations / Data Series	*ADF test of H_0: I (1) versus H_1: I(0)*	*Whether I(1) or I(0)*
RY	-2.92(0)[3]	I(0)
RINF	-2.49 (0)[3]	I(0)
CG	0.96 (0)	I(I)
CP	2.86 (0)	I(I)
SG	-0.61(0)	I(I)
SP	7.08 (0)	I(1)
SH	8.01(0)[3]	I(0)
SC	0.20 (0)	I(I)
SZ	5.17(0)[3]	I(0)
IG	0.79 (0)	I(I)
IP	2.82 (0)	I(I)
IH	5.09 (0)[3]	I(0)

IC	-0.77(0)	I(I)
GDCF	0.03(0)	I(I)
XZ	9.02(0)[3]	I(0)
MZ	8.46(0)[3]	I(0)
E	0.02 ())	I(1)
RER	-1.69 (0)	I(1)
ID	7.9 (0)	I(0)
ED	-0.08 (0)	I(1)
INT	-0.85	I(1)
M3	1.31 (0)	I(1)
RINT	-1.86 (0)	I(1)
NFIFAZ	.52 (0)	I(1)
TOT	-2.40 (0)	I(1)

Notes:

1. Except in the cases of RY and RINF all the tests are performed with 'trend and intercept' to allow for the possibility that for most economic time-series, the usual competing alternative to the presence of a unit root is a deterministic linear trend. The critical value at the 5 per cent level is -3.49 and for RY and RINF allowing no intercept and no trend, the critical value at the 5 per cent level is -1.94.
2. Figures in parentheses imply the order of augmentation required to obtain residual whiteness.
3. Rejection of null hypothesis

Source: Author's calculation from CSO, National Accounts Statistics, various issues and other official sources as is mentioned in the section: data sources.

The results for the ADF test (presented in the above Table 3) suggest that the variables do not have the same order of integration. It suggests that the variables- government final consumption expenditure, private final consumption expenditure, government savings, private savings, private corporate savings, government investment, private investment, private corporate investment, gross domestic capital formation, nominal exchange rate, real exchange rate, external debt, nominal interest rate, money supply, real interest rate, remittances, terms of trade, are found to be integrated of order one I(1) retaining long-run information against the variables – growth rate of real GDP, growth rate of inflation, gross domestic savings, household savings and household investment, exports of goods and services, imports of goods and services, internal debt belong to the I(0) category. Results of the unit root test with ADF points out that growth rate of GDP (RY) is integrated of order

zero and the inflation rate (RINF) is also integrated of order zero when a time trend is incorporated. It may be attributed to the possibility of no structural changes that have taken place in India over the studied period.

CAUSALITY & COINTEGRATION

To determine the nature and the direction of causality between the selected macroeconomic variables, the basic methodology requires conducting three Granger causality tests: short-run causality, long-run causality and the joint short and long run. To estimate short-run dynamics and causal correlation between the macroeconomic variables of the model, the first test indicates the joint significance of the sum of lagged terms of each explanatory variable by employing the F-test; the second test reveals the significance of the error correction term by the mean of the t-test and finally the third test is the short-run adjustment to restore the long-run stable equilibrium relationships. It was found by Engle-Granger (1987) that if the Granger causality test is carried out at first-difference through vector auto regression (VAR) modelling, it will be misleading in the presence of co-integration. Therefore, by adding the lag EC terms, not only the direction of causation is determined but also one can differentiate between the short-run and long-run causality. The long-run causality is confirmed by the negative sign and the statistical significance of the lag EC terms included in the vector error correction (VECM) model. Table 4 presents the estimated short-run results of the pair-wise Granger-causality test. Based on AIC for optimum lag length determination, it has tested the standard zero restriction of H_0. Following the F –statistic and corresponding probabilities nearing zero, it cannot reject the null hypothesis when the second one is rejected at 5 per cent level of significance. Thus one-way Granger cause implies not the reverse is true while bidirectional causality refers the reverse is also true. Given the granger causality, it helps to concentrate on the regressions in determining dependent and explanatory variables.

TABLE 4

Results of Causality for GDP and the Macroeconomic Variables (pair-wise Granger Test) & Summary of the Causal Relationships (Full Sample 1950-51 to 2015-16)

Variables	Null Hypothesis		
	Variables do not Cause GDP F- statistic(Prob.)	GDP does not Cause Variables F – statistic(Prob)	Direction of Causality
	GR	GR	Granger

RINF	6.96	5.94	RINF↔GDP
	(0.0023)	(0.0051)	
GDCF	6.96	5.94	GDCF↔GDP
	(0.0023)	(0.0051)	
CG	3.10	5.009	GDP→CG
	(0.0021)	(0.0108)	
CP	4.40	15.52	GDP→CP
	(0.01)	(1E-05)	
Ig	4.80	16.53	GDP→ Ig
	(.003)	(4E-06)	
Ip	17.30	3.67	Ip →GDP
	(2E-06))	(0.033)	
Ic	15.75	1.13	Ic →GDP
	(6E-06))	(0.33)	
SG	4.81	15.70	GDP→ Sg
	(.003)	(6E-06)	
SC	6.96	5.94	SC↔GDP
	(0.0023)	(0.0051)	
E	4.40	15.52	GDP→E
	(0.01)	1E-05	
ED	3.87	2.27	GDP→ED
	(0.02)	(0.11)	
INT	2.51	2.18	GDP→INT
	(0.09)	(0.12)	
M3	11.74	9.9	X
	(.23)	0.46	

Note: 'x' denotes no causality; ' →' denotes unidirectional causality; and, '↔' denotes bidirectional (feedback) causality

Source: Author's calculation from CSO, National Accounts Statistics, various issues and other official sources as is mentioned in the section: data sources

RESULTS

It is found that real GDP significantly causes mostly the non-stationary variables such as government final consumption expenditure, government investment, government savings, private final consumption expenditure, private corporate investment, private corporate savings being found non-stationary and has barely caused the stationary variables like household savings and household investment. Thus Indian real GDP and constituents of aggregate demand and other policy variables are believed to be in the long-run relationship as co-integrated at order one not only using ADF tests but also based on CRDW (co-integration regression Durbin – Watson) test (results are

not reported). There is strong evidence of bidirectional causality between real GDP and inflation and with investment. The hypothesis inflation causes growth holds particularly when the inflation is above a threshold level. Moreover, if the relatively high inflation years are dropped in the dummy variable construction, the impact of exogenous shocks becomes sluggish. However, that does not change the basic inference of bidirectional causality between real output and inflation rate in India. The findings suggest unidirectional causality from changes in investment (either of govt. or private or private corporate sectors) to real GDP. On the other hand, other policy variables like interest rate and exchange rate unlike broad money are found having reasonable causation from real output.

As all the series - real GDP, investment, price level, nominal interest rate, real exchange rate and broad money are found to be non-stationary, next proceeds to test whether there is any long-run equilibrium co-integration relationship between these variables. Table 5 reports ARDL bounds test for co-integration of the candidate macroeconomic variables. As noted earlier, the presence of cointegration between the variables is confirmed if the F-test of joint significance of lagged levels of the variables and the t-test on lag level of the dependent variable incorporated in the model rejects the null hypothesis of no cointegration. The optimal lag length to be employed in the estimation of ARDL model has been decided by AIC.

Table 5: Results of ARDL Bounds Test for Co-integration

Model	F-statistic (Upper Bound value)	t-statistic (Lower Bound value)	Results
GDP = f (GDCF, P, RER, INT,M3, D)	6.58**	-5.28**	Co-integration

Notes:

1. Critical bound values of F – statistic at 95% level of significance as reported in Pesaran et al. (1996) is 4.059
2. Model: Unrestricted intercepts and no trend
3. ** denotes rejection of the null hypothesis of no co-integration at 95% level of significance
4. Dummy Crisis variable (D) is used to capture combined effects of exogenous shocks like droughts in 1965-66 and 1966-67; wars with China in 1962 and with Pakistan in 1965 and in 1971; economic ban of USAID and non-renewal of US food aid (PL 480) in the 1960s, oil shocks in

1972-74, 1979-80 and in 1990 due to Gulf War; political emergency in 1975-77. The value of D for these years is 1 and zero otherwise,

Source: Author's calculation

The bounds test confirms the assertion that investment, price level, nominal interest rate, real exchange rate and broad money share a long-run co-integrating equilibrium relationship with real GDP when the latter is the dependent variable. The results also support the reverse co-integration relationships when the price level and gross domestic capital formation are the dependent variables.

Once a co-integrating relationship is specified, the conditional long-run relationship is estimated between the real GDP and its determining variables following the dynamic vector error correction model and the specification takes the following form:

$Y_t =$	3.65	+0.87	ΣY_{t-i}	+0.19	ΣI_{t-i}	-0.27	ΣP_{t-i}	+0.13	Σ RER$_{t-i}$ +
	(8.65)**	(0.52)		(3.84) **		(-2.78) **		(2.56) **	
				-0.07	Σ INT$_{t-i}$	+0.17	M3	-0.02	D.....(1)
				(-4.12)**		(3.73)		(0.07)	
F-statistics	6.58***	t-statistics	-5.28**						

Source: Calculated by author.

Notes:

1. ***, ** denote non - rejection of the null hypothesis of no co-integration at 99% and 95% confidence level respectively
2. At 0.01 and 0.05 level of significance with constant and no trend, the critical values of the upper bound as per Pesaran et al. (1996) are 5.212, 4.059 respectively.
3. Figures in parentheses are the estimated t-values

The equation (1) reports the results of the long-run equilibrium bound test for co-integration of the selected variables used. The estimated F-statistic and t-statistic are compared with the critical bound values reported in Pesaran et al. (1996). It is found that the calculated F-statistics to be above the upper critical bound values at 99% and 95% confidence level of Pesaran et al. (1996). It is also found that the lag level of the dependent variable to be significant at 95% level as indicated by t-statistics. The empirical results claim that the null

hypothesis of no co-integration (the zero co-integrating vector) is rejected, which necessarily supports the selected variables are co-integrated with at least one co-integrating vector. Results of the Trace test and Max-Eigen value of the Johanson's co-integration tests suggest the existence of one co-integrating vectors at 1% level of significance (results are not reported). In other words, the empirical findings suggest the presence of long-run equilibrium co-integration relationship among the selected variables and there exists strong macroeconomic linkages in the long-run. Empirical findings indicate that if own lag of real GDP, investment and real exchange rate were to increase by 1 percent, then real output is likely to stimulate by about 0.87 percentage point, 0.19 percentage point and 0.13 percentage point respectively as exhibit the positive sign of the coefficients of incorporated variables. The results support that depreciations may have negative effects on growth and appreciations may have positive effects on growth as imports of capital goods and other imports become costlier due to depreciation and thereby likely to cause supply side factors constraint in real output. As against this, in the case of price level and nominal interest rate, real output falls by 0.27 percentage point and 0.07 percentage point respectively, which confirms the economic rationale that growth causes the rate of inflation to fall i.e., inflation rate below the threshold level may have some positive effect on growth. The estimated coefficient of dummy variable is found to be negative but statistically insignificant in the long-run. The estimated coefficients of the remaining variables money supply and dummy are found to be statistically insignificant despite negative value found for the latter and thus to be excluded subsequently. However, the overall fit of the estimated regression equation is found to be statistically satisfactory.

However, the co-integration merely shows the degree of long-run association and not direction of inter-linkages. This sub-section has conducted Granger causality tests among the co-integrated variables following the above dynamic vector error correction model (VECM), which helps to analyse the long-run adjustments between the variables. The advantage of the VECM approach is, besides showing the direction of Granger causality among the variables, enables one to distinguish between "short-run" and "long-run" Granger causality. The former (generally referred to as weak Causality) is done using the F test by testing whether the estimated coefficients on lagged values are jointly statistically significant while the later (long-run Granger causality), on the other hand, is generally done by testing whether the coefficient of the error-correction (EC) term in the estimated equation is statistically different from zero by a t-test. The estimated coefficient of error correction term is expected to capture the speed of adjustment of the variables towards the long-

run equilibrium. To determine the nature and direction of short-run dynamics and causal correlation of the selected macroeconomic variables, Table 6 presents the estimated results.

Table 6: Granger Causality Test Results using VECM

Dependent Variable↓	Explanatory Variables (Regressors)							
	$\Sigma\Delta Y_{t-i}$	$\Sigma\ \Delta I_{t-i}$	$\Sigma\ \Delta P_{t-i}$	$\Sigma\Delta$ RER_{t-i}	$\Sigma\Delta INT_{t-i}$	$\Sigma\Delta M3_{t-i}$	$\Sigma\Delta SCI_{t-i}$	ΔECM_{t-1}
ΔY_t	H_0: $\Sigma\ \partial_i=0$ implies the variable does not Granger Cause to Change in real GDP in the short-run; H_1: there is Granger Causality							$\varrho = 0$
	F-stat (p-value)	F-stat (p-value)	F-stat (p-value)	F-stat (p-value)	F-stat (p-value)	F-stat (p-value)	F-stat (p-value)	t-stat (p-value)
	----------	6.92***	2.62**	0.33	0.65**	0.64	0.03	-2.12***
		(0.005)	(0.06)	(0.21)	(0.07)	(0.57)	(0.94)	(0.03)

Source: Author's calculation from CSO, National Accounts Statistics

Notes:

1. Numbers in parentheses are probabilities; the asterisks (***) and (**) indicate the levels of significance at1%, 5%.
2. The optimal lag-structure is determined based on AIC criterion.
3. Diagnostic tests for residual autocorrelation conducted are overall found to be satisfactory (not reported).

The above Table reports that the change in lagged real GDP does not Granger cause to change in current real output as it implies that the inclusion of past information of its own contribution on its present is not found to be statistically significant. The empirical findings suggest that in the short-run, investment, price level and nominal interest rate are found to be non-neutral to real output and cause the changes in real GDP. On the other hand, real output remains neutral to change in real exchange rate, broad money, non-oil exports and structural change index (SCI) in the short-run.

Based on the t-statistics of the error correction term included in the above table is found negative and to be statistically significant confirming the results obtained under the bounds test of co-integration regression that real GDP is caused by investment, price level, real exchange rate, nominal interest rate and money supply in the long-run. Therefore, the selected variables are endogenous in the long run. In other words, the null hypothesis of no long-run causality from these selected variables to real GDP is rejected at 1% and 5% critical level of significance. The estimated coefficient of the error

correction term (-2.12) indicates that the annual adjustment of real output would be corrected by more than two per cent of the deviation of its preceding year from its co-integrating value. In other words, if real output is above its equilibrium value by one point in any time, then it falls by 2.12 points on average in the very succeeding year and vice-versa. The empirical results also show that the evidence of selected variables causing the changes in the level of real GDP in the short-run.

The gross fiscal deficit is financed either by private surplus or current account deficit and the gross capital formation is financed by the savings of the public, private – corporate and household and foreign (external savings) sectors. The sectoral savings and investment behavior to the Indian macroeconomic growth process over the studied period was found cyclical and their disjunction leads periodic instability depending on how government makes use of corporate surplus.

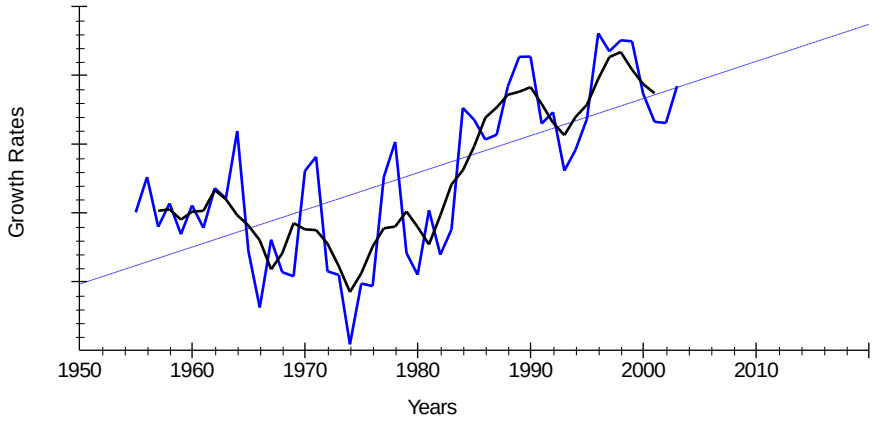
Both the Indian gross domestic savings and capital formation at margin have grown over time and the latter found predominantly being financed by the former. The increase in overall gross capital formation till the early 1980s was mainly due to increase in government investment though was more volatile compared to private investment. Private savings accounted for the bulk share of gross domestic savings. However, government savings witnessed a sharp declining trend since the early 1980s while private savings increased at different pace across sub-periods. Of which, household savings was found to be the lion sharer. The rise in investment rate from the mid-1980s onwards could be attributed mostly due to the increase in private investment consequent to a steady decline in government investment. The rise in private investment in the 1980s and 1990s was mainly due to a rapid rise in private corporate investment, particularly in the 1990s resulting to a fall in household investment. The share of corporate savings in total savings increased in the 1990s. Making use of private surplus resulted from appropriate macroeconomic policies could have been the major source of financing the gross fiscal deficit to maintain macroeconomic stability with sustained rapid growth and low inflation. The tendency to relentless increase in the gross fiscal deficit and the current account deficit continued to exist and even though culminated in 1991-92 crises. However, gross fiscal deficit and current account deficit were reduced instantaneously and significantly in 1992-93 because of stabilization cum structural reforms measures like fiscal consolidation of policy commitments and these gaps widened again after the mid-90s. A high inflation rate can have a deleterious effect on growth and one transmission mechanism by which it may occur is via the efficiency of

investment due to its misallocation across sectors in an economy. To evaluate the growth-inflation trade-offs, the next sub-section concentrates to account a general assessment of causes, policy responses, consequences and aftermath of each crisis of instability stages in a chronological manner summarizing the findings in a nutshell.

SECTION IV. STAGES OF INDIAN MACROECONOMIC DIPS

Fig.5

Stages of Macroeconomic Instability and Real GDP Behaviour in the Indian Economy, 1950-51 to 2015-16



Note: For smoothed GDP growth rate, annual GDP series at 1993-94 prices has initially been smoothed out by using five-years moving average method and estimates of growth rate were then computed from these smoothed data-series. The rationale of smoothing out of the annual GDP time-series by using five – year moving averages is to synchronise the tendencies and magnitudes of the economy's movement with reference to the terms of Indian five-year plans.

Source: compiled from NAS, CSO, EPWRF, various issues

The sources of macroeconomic recession during 1964-66.were the two wars, a drop in agricultural output, industrial deceleration, restrictive fiscal policies. All that triggered government's fiscal deficit, high inflation and the BOP crisis. In its response, India adopted the liberalization- aid-cum explicit devaluation package in 1966 to boost exports and the HYV strategies in agriculture. During 1970s, the years 1972-73, 1973-74, 1974-75 and 1979-80 were identified as crises years. The origins of the crises were: a sharp rise in

non-plan expenditure due to war in 1971; a sharp drop in food-grain and agricultural production due to disastrous droughts in 1972-73 and in 1978-79; oil prices shocks in 1973 and in 1979; growing political instability and the imposition of a national emergency in 1975. All that crises led the government to increase borrowing from the RBI and from abroad, fuelling inflationary impacts; fiscal deficits rose, BoP became unsustainable, and terms of trade deteriorated. In its response, the government attempted to bring about an expansionary macro policies as diluted fiscal conservatism through some liberalization measures like greater flexibility in the exchange rate. After the short-lived recession, Indian economy grew up rapidly during the 1980s and this expansion lasted till 1990. The economic reforms initiated in the early eighties were concerned with gradual deregulation of industrial licensing and softening of the restrictions on monopolies. Since the mid-eighties onwards that was accompanied with more liberalized policies such as industrial deregulation, import deregulation, export incentives, and tax reforms. The expansionary fiscal and expansive monetary policies weakened the macroeconomic fundamentals reflected in a rise in fiscal and current account deficits, steep depletion in foreign exchange reserves, larger the burden of domestic and foreign debt, high inflation, and unsustainable BOP. These factors along with sharp spike in oil prices due to Gulf War in 1990 set the Indian economy on a full-blown crisis in 1991. As its measures in 1991, structural reforms such as fiscal contraction, a credit squeeze, reforms in public sector enterprises, devaluation of the rupee, trade liberalization, financial liberalization were initiated to stabilize the economy. The macroeconomic growth rate once again downturned in 1997 and the package of 'second- generation' reforms including measures for technological developments, institutional reforms, fiscal consolidation and policy innovations for further growth prospects were adopted.

Three broad periods are identified in terms of pace and scope of the evolution of economic policies in the post-independence India. The *first* phase – since independence to the mid 1980s- state controlled inward looking posture; the *second* phase - from the mid 1980s to prior to 1991- a period of gradual piecemeal measures of economic reforms; and, the *third* phase - from 1991 to the present - IMF-World Bank led stabilisation cum structural adjustment with general expectation to stimulate investment and growth and putting the economy on a sustainable path [Bhagwati, 1984 & 1993; Srinivasan, 2005; Joshi and Little, 1998; Kurien, 1996; Byres, 1999].

SECTION V. CONCLUSIONS WITH POLICY IMPLICATIONS

There have been occasional shifts in the Indian macroeconomic policies in response to various economic and political shocks. The Indian policy regime has undergone towards a market friendly orientation from highly interventionist over-centralised planning and overt-protectionism inward looking posture in terms of pace and scope. The objectives of macroeconomic policy have long included the avoidance of protracted recessions that can jeopardise reasonable price and exchange rate stability. The success of macroeconomic policies is judged by how efficiently they cause changes in the intensity of use of resources within which they are formulated for short- to medium- to long-run in the real growth process. Fiscal, monetary, trade and exchange rate policies are mainly demand management policies to maintain internal and external stability. For the countries plunged into macro instability, it is important to measure how policies had direct bearing upon to increase savings and domestic capital formation as is the key transmission channel in mediating the real and financial factors in the long-run growth process. It also judges whether adopted policies are counter-cyclical or pro-cyclical and expansionary or contractionary in nature.

The empirical results indicate that the negative growth effects of inflation are more pronounced when inflation is beyond threshold level of about 5.5 per cent. Inflation targeting as a macroeconomic policy tool as currently conducted by the RBI is being disrupted by the sources of inflationary pressures and volatility of capital flows. To maintain macroeconomic stability with sustained rapid growth and low inflation, appropriate macroeconomic policies got to be carried out to make use of private surplus to financing the gross fiscal deficit; the central bank to design its monetary policy by targeting interest rates; exchange rate to be an efficient intermediate target variable for the monetary policy through effective intervention of RBI; the policies are made to be internally sound and externally competitive to ensure price, exchange rate and growth stability; diversifying economic activities more to service and industrial sectors from agriculture as are less vulnerable to exogenous supply shocks.

The scope of evaluation of supply side policies (like license, quota, rationing, administered prices, buffer stock, food management, etc) is limited as they are short-run, anticipatory and erratic in nature despite having stabilization consequences for distributional shift on production, consumption and income processes. Macroeconomic evaluation in the ambit of control, instrument (policy), target, and objective variables in feedback approach is not always easy particularly when objectives are open ended or implied in

intermediate target or the targets are policy mix issue. The findings of this paper are very suggestive, which are carefully analysed pertaining with key policy shifts along with certain important stylized facts of historical factual information in India. It intends to be a comprehensive Indian case study of the subject, rather than a study of India *per se*.

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