

AN ANALYSIS OF THE VOLATILITY, PERSISTENCY AND PRO & COUNTER CYCLICAL BEHAVIOUR OF MACROECONOMIC INDICATORS OF INDIAN ECONOMY

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ABSTRACT

Understanding the nature of cyclical swings in the economic indicators of that particular economy is essential for forecasting changes in that economy. As a result, the purpose of this paper is to examine the characteristics of cyclical oscillations in India's macroeconomic indicators. These characteristics of macroeconomic indicators include volatility, persistency, and pro- and countercyclical behaviour of indicators. The findings show that India's output is volatile and persistent. Real and nominal interest rates, as well as call money rates, are all quite volatile in nature. Oil prices and international trade are both lack stability. High volatility is also evident in bank credit. The cyclical variations in twenty-two of the examined macroeconomic are positively and strongly linked with the cyclical fluctuations in output (GDP). Only the cyclical fluctuations in four series have significant negative correlation with the output these are Real Bank Rate (RBR), Nominal Bank Rate (NBR), Prices of Silver (SIP) and Wholesale Price Index (WPI), making them counter cyclical indicators. Examining the autocorrelation function of output demonstrates that persistence is substantial in all most all the selected macroeconomic variables.

Keywords: GDP, RBR, Macroeconomic Indicators, Indian Economy, Autocorrelation.

Introduction

Any nation's economic operations are characterized by its dynamic and fluctuating environment. There are ups and downs in economic activity, demonstrating that the aggregate economy's trajectory does not run consistently and smoothly across time; rather, it follows the path of economic oscillations. Due to the significance of these fluctuations in understanding the nature of the economy and their role in the development of monetary and fiscal policy, the study of these fluctuations has gained in importance. Some of the fluctuations are regular and roughly periodic in nature like seasonal fluctuations. However, cyclical changes are not as predictable and are more challenging to understand and manage. Since seasonal fluctuations are known to resolve within a set period of time since they are predictable and controlled by nature, they do not pose a significant threat to the economy. Cyclical fluctuations, on the other hand, are irregular and nonperiodic, making it complex to predict their variations.

Understanding the nature or features of cyclical swings in the economic indicators of any particular economy is essential for forecasting and analyzing changes in that economy. Consequently, the purpose of this paper is to examine the characteristics of cyclical oscillations in the Indian macroeconomic indicators. These characteristics of macroeconomic indicators include volatility, persistency, and pro- and countercyclical behaviour of indicators. Twenty-seven macroeconomic indicators were examined from 1996 to 2018 in order to conduct the study. A variety of secondary sources, including the Reserve Bank of India's website, the Ministry of Statistics and Programme Implementation (MOSPI), and the Organization for Economic Co-operation and Development's website (OECD), have been used to gather the relevant data with a quarterly frequency.

- To analyze the above, paper has been divided into three sections.
- The volatility of macroeconomic indicators is examined in Section 1.
- The pro and countercyclical nature of macroeconomic indicators is examined in Section 2.

Section 3 examines the persistency in the macroeconomic indicators, while the section 4 contains the conclusion of the preceding sections.

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Volatility

Underdevelopment is thought to be both a cause and a reflection of high macroeconomic volatility (Loayza, et. al., 2007). Hnatkovska and Loayza (2005) found that a one standard deviation increase in macroeconomic volatility causes an average loss of 1.28 percentage points in yearly per capita GDP growth. High volatility also indicates that a country's institutions and economy are underdeveloped or incapable of developing and enacting countercyclical policies. Developing nations experience greater macroeconomic volatility for three reasons, according to Loayza et al. (2007): the first is higher volatility in terms of trade as a result of exogenous shocks such shifting capital flows or shifting global terms of trade. The second category is indigenous shocks brought on by the inherent volatility of the development process and self-inflicted policy errors. The third is that emerging nations have inadequate shock absorbers. There are two kinds of shock absorbers, and developing nations are lacking in both financial markets and stabilising policies.

Therefore, if volatility is significant, policymakers must implement the proper countercyclical policies because high volatility of macroeconomic variables is harmful to the health of any economy.

Two different types of measures—absolute volatility and relative volatility—have been utilized in this paper to assess the macroeconomic volatility in India.

- **Absolute and Relative Volatility**

Absolute volatility measures the magnitude of fluctuations in the cyclical component of the variables of interest. This measurement determines the size of fluctuations in the variable being examined without taking into account the size of fluctuations in any other variable. The standard deviation of the series serves as a method to measure absolute volatility in the cyclical component of the series. While relative volatility is the ratio of the variable's actual volatility to the volatility of the reference series. Relative volatility demonstrates whether the specific variable's cyclical component is more or less volatile than the reference variable or whether it is equivalent to that variable's volatility. Non-agricultural GDP was used as the reference variable in this study.

Table 1: Absolute Volatility (Measured as Percentage Standard Deviation)

Rank	Series	Volatility	Serial No.	Rank	Volatility
1	CMR	24.3479	15	IIPM	3.21857
2	RBR	22.5518	16	BCCB	2.72218
3	OP	17.5687	17	IIP	2.70452
4	SPI	17.2764	18	CWP	2.4287
5	SIP	13.3557	19	GDP	2.41502
6	IMP	9.12209	20	IIPIG	2.38065
7	EXP	8.4189	21	PFCE	2.10382
8	IIPCAG	8.1608	22	IIPMQ	2.08745
9	NBR	6.37967	23	M ₁	1.81825
10	GFCF	4.48323	24	IIPBG	1.77753
11	ERD	4.29698	25	IPE	1.6659
12	IIPCG	3.76518	26	CPI	1.64988
13	REER	3.35024	27	WPI	1.50377
14	NEER	3.2918			

Source: Computed

Table 2: Relative Volatility

Serial No.	Series	Relative Volatility	Serial No.	Series	Relative Volatility
1	CMR	10.0819	15	IIPM	1.33273
2	RBR	9.33812	16	BCCB	1.12719
3	OP	7.27476	17	IIP	1.11988
4	SPI	7.15372	18	CWP	1.00568
5	SIP	5.53027	19	GDP	1
6	IMP	3.77723	20	IIPIG	0.98577
7	EXP	3.48606	21	PFCE	0.87114
8	IIPCAG	3.37918	22	IIPMQ	0.86436
9	NBR	2.64166	23	M ₁	0.75289
10	GFCF	1.85639	24	IIPBG	0.73603
11	ERD	1.77927	25	IPE	0.68981
12	IIPCG	1.55907	26	CPI	0.68318
13	REER	1.38725	27	WPI	0.62267
14	NEER	1.36305			

Source: Computed

The absolute and relative volatility of the various macroeconomic indicators is displayed in Tables 1 and 2. The output that reflects business cycles is very unpredictable. The GDP series' cyclical component has a standard deviation of 2.4 percent, and this volatility is typically larger than that seen in industrialized nations (Agenor, McDermott and Parsad, 2000). The interest rate series has demonstrated the largest volatility among the other studied variables. The amplitude of the volatility in the Call Money Rate (CMR) series is 24.35 percent, making it 10.08 times more volatile than the output. Real Bank Rate (RBR) volatility is 22.55 percent, 9.34 times greater than production volatility. However, the Nominal Bank Rate (NBR) is 2.64 times more erratic than output. Its cyclical component's changes have an average size of 6.38 percent. As a result, the series of call money rate and real interest rate exhibit greater cyclical volatility than the series of nominal interest rate.

Series of oil prices (OP) is 7.27 times more volatile in comparison to the volatility in output and the magnitude of volatility in this series is 17.8657 percent. The magnitude of volatility in the series of stock prices (SPI) is 17.27 percent which is 7.15 times higher than the volatility in output. Silver prices (SIP) are 5.53 times more volatile as compared to output. The magnitude of fluctuations in silver prices is 13.35 percent.

The cyclical component of the series of imports (IMP) and exports (EXP) is having almost equal magnitude of volatility. Imports are 3.8 times and exports are 3.4 times more volatile in comparison to the volatility in the series of GDP. The magnitude of fluctuations in the series of imports and exports is 9.12 and 8.41 percent.

Volatility in the cyclical component of the gross fixed capital formation (GFCF) is almost double than that of the output; it is 1.9 times more volatile and magnitude of fluctuations in the series of this indicator is 4.48 percent.

The cyclical fluctuation in the exchange rate series is comparatively more volatile than the production, as shown in Tables 1 and 2. Rupee to Dollar exchange rate volatility is 4.29 percent, which is 1.77 times more than output volatility. The Real Exchange Rate (REER) and Nominal Exchange Rate (NEER) series cyclical changes are nearly equally volatile. Real exchange rate volatility is 3.35 percent, whereas nominal exchange rate volatility is 3.3 percent. In comparison to output, both series are roughly 1.3 times more volatile.

The magnitude of variations in the series of capital goods production (IIPCAG) is 8.16 percent, which is 3.38 times more volatile than the volatility in output. This information relates to industrial production. Production of consumer goods (IIPCG) is 1.6 times more volatile than output, with a volatility magnitude of 3.76 percent. The level of volatility in the production of intermediate goods (IPIG) is 2.38 percent, almost the same level as the level of volatility in output. When compared to output volatility, the intensity of the variations in the production of basic goods (IIPBG) is 0.264 times smaller at 1.78 percent. Manufacturing sector series production (IIPM) is 1.3 times more volatile than output with magnitude variations of 3.22 percent. The magnitude of fluctuation in the production of electricity sector (IIFE) is 1.66 percent and this volatility is 31.7 percent less than the volatility in the series of output. The mining and quarrying sector's (IIPMQ) production volatility is 2.08 percent, which is smaller than the output volatility of 13 percent. The industrial sector's (IIP) overall production has swings of about the same size—2.7 percent—as the output volatility.

Volatility in the series of bank credit by commercial banks is almost equal to the volatility in the series of output. The magnitude of fluctuations in the Bank Credit by The Scheduled Commercial Banks (BCCB) is 2.77 percent.

Volatility in the cyclical fluctuation in the series of money supply (M_1) is less than the volatility in the output. Magnitude of the fluctuations in the money supply is 1.82 percent which is 24.7 percent less volatile in comparison to the magnitude of volatility in output. Magnitude of fluctuations in the volume of currency with the public (CWP) is equal to the volatility in the output. Magnitude of volatility in the volume of currency with the public is 2.42 percent.

Consumption expenditure by the private sector (PFCE) is less volatile than the output. The magnitude of fluctuations in the cyclical component of the series of private final consumption expenditure is 2.1 percent. The volatility in the consumption expenditure is 12.89 percent less volatile as compared to output. Volatility in the prices is less as compared to the volatility in the output. Magnitude of volatility in the consumer prices (CPI) and wholesale prices (WPI) is 1.65 percent and 1.5 percent respectively. Volatility in the consumer prices is 31.68 percent less than the output and volatility in the wholesale prices is 37.73 percent as compared to the volatility in the output.

As a result, out of all the selected variable interest rate series exhibits highest volatility. Even the foreign exchange market is less stable than the GDP. Investments expenditure is more erratic than spending on consumption goods. Consumer and wholesale prices have lower volatility than output, making them the least volatile of the metrics we chose. The money supply fluctuates less than the output. The industrial production of capital and consumer goods is more unpredictable than the output, despite the fact that overall industrial production volatility is comparable to output volatility.

Pro-Cyclical and Counter Cyclical Behaviour of Indicators)

The contemporaneous coefficient of correlation is used to assess the degree of co-movement between the cyclical component of the macroeconomic indicator and the cyclical component of the GDP. Depending on whether the contemporaneous coefficient of correlation is positive, negative, or zero, a variable is referred to as pro-cyclical, counter-cyclical, or a cyclical. A series is said to be strongly correlated if $0.26 \leq r < 1$, weakly correlated if $0.13 \leq r < 0.26$ and uncorrelated if $0 \leq r < 0.13$ (the approximate standard error of correlation coefficients for all the series is about 0.13 where null hypothesis is that the value of correlation coefficient is zero).

In order to demonstrate which indicator is countercyclical in nature and which one is procyclical to the business cycles, Table No. 3 demonstrates the association between the cyclical components of the macroeconomic indicators selected under investigation and the cyclical component of output (GDP).

Table 3: Correlation between the Cyclical Component of Macroeconomic Indicators and GDP

Serial No.	Series	Correlation Coefficients	Serial No.	Series	Correlation Coefficient
1	GDP	1	15	CWP	0.245*
2	IIP	0.697**	16	IMP	0.481**
3	IIPBG	0.550**	17	CMR	0.425**
4	IIPCAG	0.587**	18	NBR	-0.434**
5	IIPCG	0.584**	19	M ₁	0.531**
6	IIPIG	0.643**	20	NEER	0.439**
7	IIPPE	0.437**	21	REER	0.323**
8	IIPM	0.669**	22	OP	0.311*
9	IIPMQ	0.434**	23	PFCE	0.219*
10	BCCB	0.339**	24	SIP	-0.614**
11	CPI	0.284**	25	SP	0.600**
12	ERD	-0.431**	26	WPI	0.282*
13	EXP	0.290*	27	RBR	-0.415**
14	GFCF	0.649**			

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

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

Source: Computed

Table 3 shows a substantial correlation between the cyclical component of output and all the selected variables' cyclical components. The cyclical variations in twenty two of the examined macroeconomic variables (with GDP accounting for twenty seven) are positively and strongly linked with the cyclical fluctuations in output (GDP). A positive correlation coefficient indicates that the variables are pro-cyclical with respect to business cycles. Pro-cyclical series are those that grow during an expansionary business cycle and contract during a contractionary business cycle. As a result, these indicators with positive correlations show upward movement and vice versa if the cyclical component in the output series is moving upward or in an expansionary phase. Only the cyclical fluctuations in four series or variables have significant negative correlation with the output these are Real Bank Rate (RBR), Nominal Bank Rate (NBR), Prices of Silver (SIP) and Wholesale Price Index (WPI). Correlation coefficient with the negative sign shows that cyclical fluctuations Only the cyclical changes in four series or variables-the Real Bank Rate (RBR), Nominal Bank Rate (NBR), Silver Prices (SIP), and Wholesale Price Index-have a significant negative association with the output (WPI). The negative sign of the correlation coefficient indicates that the cyclical fluctuations in the variables run counter-cyclically to the business cycles. The extent of pro- or anti-cyclicality of indicators with GDP is indicated by the coefficient of correlation.in the variables are counter cyclical with the business cycles. The value of coefficient of correlation exhibits the magnitude of pro or anti cyclicality of indicators with GDP.

Out of the variables which are pro cyclical with the business cycles, overall industrial production (IIP) has strong pro cyclicity with the cyclical fluctuations of GDP of 69.7 percent, followed by the production in manufacturing sector (IIPM) with 66.9 percent correlation with output. Investment (GFCF) is also positively and highly pro cyclical with the cyclical fluctuations in the output by 64.9 percent. This

reveals that investment expands with the expansion in business cycles and contracts with the contraction in business cycles. Cyclical fluctuations in the industrial production of intermediate goods are correlated with the business cycles and by 64.3 percent. The stock prices also have a strong pro-cyclical attribute. The correlation between cycles in stock prices (SP) and business cycles is 60 percent. Cyclical Fluctuations in the industrial production of capital goods (IIPCAG) are correlated with the business cycles by 58.7 percent. This correlation between IIPCG and output is 58.4 percent. The correlation between specific cycles in M_1 and business cycles is 53.1 percent. Since, exports are not highly correlated with output and imports are significantly more pro-cyclical with the output, this reveals that net exports are counter cyclical in nature. Prices (WPI and CPI) are also pro cyclical with output, but pro-cyclicality of prices is not very high. Consumption expenditure is not highly pro-cyclical with the output.

Out of the four counter cyclical variables, the link between cyclical changes in silver prices and cyclical fluctuations in output is the strongest. Therefore, if the business cycle proceeds in an upward direction, silver prices will move downward. 61.4 percent is the magnitude of counter cyclicity. The behaviour of the exchange rate (Rupees versus Dollar) is also anti-cyclical. Therefore, if the economy expands, the exchange rate will decline. The extent of the negative connection between the cyclical exchange rate component and GDP is 43.1%. Specific cycles in real and nominal bank rates (RBR and NBR) are also notably anticyclical to output business cycles.

Persistence

Persistency in macroeconomic indicators is also an essential element of the business cycles of every nation. This characteristic reveals the shock persistence of the indicators, i.e., whether or not an indicator deviates considerably from its trend line for the specified period due to a shock. If Indicator deviates, then its behaviour is persistent; if not, it is not. "A crucial empirical aspect of the business cycles of industrialised countries is the high persistence of production swings" (Male R.L. 2009, p.56). Using the autocorrelation function, this section explores the persistence of output and other macroeconomic variables in India (Annexure 1).

Examining the autocorrelation function of output demonstrates that output persistence is substantial. Therefore, output is shock-persistent and deviates significantly from the trend whenever any disturbance is caused by a shock. However, as the number of lags increases, the size of persistence diminishes. For instance, the autocorrelation coefficient at lag one is 0.616, after which it decreases to 0.392 and so forth. LB Stat is significant for all autocorrelation coefficients.

Overall industrial output (IIP) demonstrates strong autocorrelation coefficients, indicating that industrial production is persistent. Nevertheless, the scale of persistence in industrial production exceeds output. The IIP's autocorrelation coefficient at lag one is 0.815%, while the output's is 0.616%. In contrast, the magnitude of persistency decreases dramatically in IIP compared to output. The industrial sector's production of basic items is likewise markedly persistent. Examining the autocorrelation coefficients of IIPCAG reveals that there is more persistence than output, and that the amount of persistence is greater in all IIPCAG lags than output. In the first lags, the production of consumer products and intermediate goods is also more persistent than output. However, as the magnitude of these lags diminishes, output becomes more persistent. However, both series exhibit considerable persistence.

Examining the autocorrelation coefficients of the index of industrial output in the electrical sector (IIFE) reveals a substantial degree of persistence. Nevertheless, the magnitude of this persistence is smaller than the output for all lags. IIFE's autocorrelation coefficient at the first lag is 0.336, which is less than the output's autocorrelation coefficient. Thus, IIFE persists less than output. Examining the index of industrial production in the manufacturing sector reveals that this series displays significant persistence. Nevertheless, the scale of persistence exceeds that of output. The autocorrelation coefficient at lag one for IIPM is 0.824%, which is greater than for output, and these coefficients stay greater for IIPM than for output at all lags.

Index of industrial production of mining and quarrying sector is significantly persistent. But the magnitude of persistence is less than the output as the autocorrelation coefficient at first lag for IIPMQ is 0.582 which is less than output.

Examining the autocorrelation coefficients of series of bank credit by scheduled commercial banks reveals that it is extremely persistent. Nevertheless, the degree of persistency in BCCB is greater than output at lag one, as the autocorrelation coefficient for BCCB is 0.841. In contrast, the magnitude of persistence in BCCB decreases significantly more than the output. The value of autocorrelation coefficient at lag five for BCCB reduced to 0.03, while it is 0.147 for output.

Analysis of the autocorrelation coefficients of the consumer price index (CPI) and the wholesale pricing index (WPI) demonstrates that prices are persistent. However, consumer prices have a greater degree of persistence than wholesale pricing. Consumer prices and wholesale prices are both more persistent than production at lag one, given that the autocorrelation coefficient for CPI at lag one is 0.759% and that for WPI is 0.66%. At lag two, however, the coefficient for WPI dropped to 0.254, which is smaller than the output coefficient. At lag three, the CPI coefficient decreased to 0.265, which is smaller than the output coefficient. Consequently, the magnitude of output persistence is greater than that of CPI in and after the third lag and WPI in and after the second lag. Analysis of the autocorrelation function of imports and exports finds that imports and exports exhibit substantial persistence. Nonetheless, the magnitude of this persistence is smaller in both series than in the output. For instance, the import autocorrelation coefficient at lag one is 0.613 and the export autocorrelation coefficient is 0.58, which is lower than for output. Imports persist longer than exports.

The autocorrelation function of Real Bank Rate (RBR) indicates that real bank rate persistence is substantial. As the autocorrelation coefficient on lag one for RBR is 0.317%, the amplitude of this persistence is less than the output persistence. Furthermore, the autocorrelation of nominal bank rates demonstrates that there is a substantial persistence of bank rates. This persistence's magnitude is less than output at all lags. The autocorrelation coefficient at lag one for actual bank rate is 0.317, but it is 0.517 for nominal bank rate. This indicates that nominal bank rate is more persistent than real bank rate.

Examination of the autocorrelation of call money rates reveals a significant perseverance in the series of call money rates. Although the magnitude of this persistence is slightly greater than the output persistence at lag one, given that the autocorrelation coefficient for CMR at lag one is 0.621 and for output it is 0.616, the call money rate persistence is less than the output persistence after that. Call money rate persistence is also greater than real and nominal bank rate persistence. The autocorrelation coefficients of money supply (M1) indicate that it is also significantly persistent, with a greater magnitude than output persistence. Autocorrelation of currency with the public (CWP) analysis reveals that it is not persistent as the LB Stat is not significant.

Examining the autocorrelation of real and nominal effective exchange rates reveals that real and nominal effective exchange rates exhibit substantial persistence. Nonetheless, the magnitude of real effective exchange rate is slightly greater than nominal effective exchange rate; the autocorrelation coefficient at lag one for REER is 0.728% and for NEER it is 0.6728%. However, both real and nominal effective exchange rates are more persistent than output at lag one, but after lag two output is more persistent than real effective exchange rate, and after lag one output is more persistent than nominal effective exchange rate. An examination of the autocorrelation of the dollar-rupee exchange rate reveals that the dollar-rupee exchange rate is highly persistent. At lag one, the magnitude of this persistency is considerably greater than output, as indicated by the autocorrelation coefficient for ERD, which is 0.755%, but by lag three, this magnitude has decreased to 0.042 while output is 0.273%. Thus, the exchange rate is more persistent than output for the first two lags, but then its persistency decreases and it becomes less persistent than output.

Autocorrelation of silver prices (SIP) reveals that silver prices are remarkably persistent. This persistency is greater than the output persistency, as measured by the autocorrelation coefficient at lag one for silver prices, which is 0.786%. At lag four, however, this coefficient's value decreased to 0.07, whereas the autocorrelation coefficient for output at lag four is 0.205. Consequently, silver prices are more persistent than output during the initial lags, but output is more persistent after the second lag period.

Examining the autocorrelations of oil prices (OP) reveals that oil prices have a substantial degree of persistence. Nevertheless, the magnitude of this persistency is greater than output persistency at lag one, given that the autocorrelation coefficient for OP at lag one is 0.758%. However, the autocorrelation coefficients for all lags other than one are smaller than the output autocorrelation coefficients. For instance, the autocorrelation coefficient for OP at lag 3 is 0.076 while it is 0.273% for output. Thus, at lag one, OP persistence is greater than output persistence, whereas output persistence is greater prior to lag one.

Examining the autocorrelations of stock prices (SPI) reveals that there is a substantial persistence in stock prices. Despite this, the magnitude of this persistency is greater than output persistency at lags one and two, as the autocorrelation coefficient for SPI at lag one is 0.784% and at lag two it is 0.47%. Except for lags one and two, the autocorrelation coefficients for many other lags are smaller than those for output. For instance, the autocorrelation coefficient for SPI at lag 3 is 0.207 while it is 0.273% for output. Consequently, SPI persistence is greater than output persistence at lags 1 and 2, whereas output persistence is greater prior to these lags.

The autocorrelation of silver prices (SIP) reveals that the series of silver prices exhibits substantial persistence. This persistency is greater than the output persistency, as measured by the autocorrelation coefficient at lag one for silver prices, which is 0.786%. At lag four, however, the value of this coefficient decreased to 0.07, whereas the autocorrelation coefficient for output at lag four is 0.205. Consequently, silver prices are more persistent than output at initial lags, but output is more persistent after the second lag.

Examination of the autocorrelations of investment (GFCF) reveals that fixed capital investment is remarkably persistent. Nonetheless, the magnitude of this persistency is marginally greater than output persistency through the first three lags. However, the autocorrelation coefficients for all lags other than the first three are less than those for output. Autocorrelations of consumption (PFCE) indicate that the series of private consumption exhibits substantial persistence. However, the magnitude of this persistency is less than the persistency of the output. For instance, the autocorrelation coefficient at lag one for PFCE is 0.39 while for output it is 0.616%. In addition, the value of this coefficient decreased to 0.026 for output at lag seven, but to -0.053 for PFCE.

Concluding Observations

By examining the cyclical component of selected macroeconomic variables, the characteristics of volatility, persistency and pro and anti-cyclicalities have been identified. The level of output volatility, as measured by the standard deviation of the filtered cyclical component of the non-agricultural GDP, is 2.4 percent, as determined by analysing the behaviour of the macroeconomic variables in this paper. According to the literature on business cycles, this volatility is greater than that observed in industrialised nations. Moreover, the output fluctuations of the Indian economy are remarkably persistent. Both real and nominal interest rates are significantly more volatile than output, with real interest rates being significantly more volatile than nominal interest rates. Both nominal and real interest rates exhibit anticyclical behaviour and a high degree of persistence. However, persistence is less than output.

The cyclical component of the call money rate is extremely volatile relative to other macroeconomic variables. It is a pro-cyclical variable with greater and more significant persistence than output. Money supply (M1) is an indicator that is pro-cyclical. It is less unstable than output. The cyclical component of the money supply is more persistent than output. Industrial output is positively and strongly correlated with output, indicating that it is highly pro-cyclical. Both output and industrial production are volatile. However, industrial production is more stable than output.

Foreign trade volatility exceeds output volatility. It has a pro-cyclical character. However, imports have a stronger correlation with output than exports. Therefore, the behaviour of net exports is countercyclical. Both exports and imports are extremely persistent, but imports are more so than exports. Nevertheless, the persistency in both series is lower than the output. The exchange rate is significantly more volatile and persistent than the output. The Rupee-Dollar exchange rate is a counter-cyclical indicator. The nominal and real effective exchange rates, on the other hand, are pro-cyclical indicators.

The nature of oil prices is highly volatile. It has greater volatility than output. Variation in oil prices correlates positively with output fluctuations. The oil price series is highly persistent. The output is more volatile than the cyclical component of consumer and wholesale prices. Prices are pro-cyclical and highly persistent indicators.

Investment and consumption are both pro-cyclical indicators, but investment is more pro-cyclical than consumption. Investment is more volatile and persistent than output, whereas consumption is less volatile and persistent than output.

Moreover, the cyclical component of bank credit is highly volatile. The volatility of bank credit exceeds the output. It serves as a pro-cyclical indicator. The persistence of this indicator exceeds that of the output. Stock prices are extremely volatile and more so than output. It is considerably more durable than the output. This indicator indicates that output is strongly pro-cyclical. The cyclical component of silver prices is anti-cyclical and extremely volatile. Its volatility is greater than its output, and oil prices are highly persistent.

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6	IPIG	ACF	0.752	0.583	0.349	0.134	0.016	-0.125	-0.215	-0.299	-0.28	-0.221	-0.203
		LB STAT	44.171	71.027	80.776	82.238	82.259	83.569	87.487	95.213	102.072	106.429	110.155
		PROB	0	0	0	0	0	0	0	0	0	0	0
7	IPE	ACF	0.336	0.197	0.207	-0.011	0.086	-0.065	-0.174	-0.07	-0.135	-0.029	-0.158
		LB STAT	8.927	12.03	15.523	15.533	16.155	16.517	19.121	19.545	21.149	21.224	23.505
		PROB	0.003	0.002	0.001	0.004	0.006	0.011	0.008	0.012	0.012	0.02	0.015
8	IIPM	ACF	0.824	0.634	0.475	0.292	0.181	0.058	-0.073	-0.131	-0.144	-0.134	-0.156
		LB STAT	53.681	85.872	104.191	111.196	113.924	114.208	114.672	116.168	117.999	119.605	121.813
		PROB	0	0	0	0	0	0	0	0	0	0	0
9	IIPMQ	ACF	0.582	0.43	0.297	0.098	-0.06	-0.079	-0.141	-0.24	-0.201	-0.215	-0.172
		LB STAT	26.767	41.546	48.708	49.499	49.803	50.336	52.047	57.081	60.671	64.82	67.522
		PROB	0	0	0	0	0	0	0	0	0	0	0
10	BCCB	ACF	0.841	0.648	0.428	0.225	0.094	0.054	0.062	0.035	0.001	-0.085	-0.203
		LB STAT	55.873	89.555	104.401	108.58	109.315	109.563	109.891	109.999	109.999	110.642	114.392
		PROB	0	0	0	0	0	0	0	0	0	0	0
11	CPI	ACF	0.759	0.472	0.265	0.106	0.044	-0.007	-0.125	-0.202	-0.226	-0.203	-0.098
		LB STAT	43.848	61.041	66.535	67.423	67.581	67.585	68.883	72.336	76.711	80.291	81.141
		PROB	0	0	0	0	0	0	0	0	0	0	0
12	WPI	ACF	0.649	0.254	0.016	-0.12	-0.118	-0.037	-0.037	-0.146	-0.182	-0.21	-0.22
		LB STAT	33.256	38.41	38.429	39.61	40.766	40.88	40.996	42.848	45.785	49.744	54.138
		PROB	0	0	0	0	0	0	0	0	0	0	0
13	IMP	ACF	0.613	0.206	0.006	-0.024	0.073	0.085	-0.012	-0.212	-0.359	-0.339	-0.26
		LB STAT	29.656	33.07	33.072	33.118	33.568	34.174	34.186	38.092	49.484	59.795	65.966
		PROB	0	0	0	0	0	0	0	0	0	0	0
14	EXP	ACF	0.58	0.237	-0.077	-0.293	-0.25	-0.182	-0.027	-0.049	-0.089	-0.158	-0.226
		LB STAT	26.572	31.073	31.555	38.621	43.845	46.653	46.715	46.926	47.634	49.89	54.553
		PROB	0	0	0	0	0	0	0	0	0	0	0
15	RBR	ACF	0.317	-0.157	-0.335	-0.32	0.02	0.206	0.094	-0.045	-0.106	-0.02	-0.021
		LB STAT	7.85	9.809	18.832	27.184	27.217	30.754	31.509	31.682	32.661	32.697	32.738
		PROB	0	0	0	0	0	0	0	0	0	0	0
16	CMR	ACF	0.621	0.377	0.085	-0.095	-0.084	-0.113	-0.069	-0.237	-0.254	-0.251	-0.306
		LB STAT	30.477	41.873	42.463	43.208	43.795	44.878	45.289	50.197	55.911	61.56	70.075
		PROB	0	0	0	0	0	0	0	0	0	0	0
17	NBR	ACF	0.517	0.282	0.093	-0.018	-0.15	-0.096	-0.243	-0.263	-0.324	-0.187	-0.15
		LB STAT	21.145	27.513	28.212	28.238	30.128	30.905	35.962	41.991	51.275	54.415	56.454
		PROB	0	0	0	0	0	0	0	0	0	0	0
18	M _t	ACF	0.788	0.545	0.347	0.206	0.157	0.128	0.029	-0.02	-0.034	-0.063	-0.159
		LB STAT	49.072	72.863	82.658	86.088	87.23	88.016	88.025	88.37	88.474	88.832	91.133
		PROB	0	0	0	0	0	0	0	0	0	0	0
19	CWP	ACF	0.049	0.025	-0.125	0.643	-0.204	-0.148	-0.207	0.558	-0.229	-0.202	-0.257
		LB STAT	0.187	0.236	1.513	35.528	38.99	40.836	44.505	71.614	76.252	79.921	85.93
		PROB	0.665	0.889	0.679	0	0	0	0	0	0	0	0
20	REER	ACF	0.728	0.422	0.024	-0.262	-0.384	-0.478	-0.387	-0.357	-0.257	-0.196	-0.099
		LB STAT	41.835	56.096	56.142	61.803	74.124	93.444	106.318	117.408	123.234	126.677	127.573
		PROB	0	0	0	0	0	0	0	0	0	0	0
21	NEER	ACF	0.672	0.344	0.031	-0.236	-0.349	-0.43	-0.272	-0.235	-0.198	-0.168	-0.069
		LB STAT	35.694	45.193	45.27	49.873	60.016	75.664	82.023	86.846	90.309	92.839	93.279
		PROB	0	0	0	0	0	0	0	0	0	0	0
22	ERD	ACF	0.755	0.445	0.042	-0.25	-0.367	-0.421	-0.376	-0.316	-0.204	-0.051	0.07
		LB STAT	43.866	59.308	59.446	64.475	75.476	90.139	102.032	110.561	114.159	114.386	114.828
		PROB	0	0	0	0	0	0	0	0	0	0	0
23	SIP	ACF	0.786	0.513	0.243	0.07	-0.008	-0.092	-0.213	-0.389	-0.491	-0.573	-0.509
		LB STAT	47.616	68.141	72.827	73.218	73.223	73.929	77.735	90.62	111.505	140.338	163.472
		PROB	0	0	0	0	0	0	0	0	0	0	0
24	OP	ACF	0.758	0.381	0.076	-0.161	-0.248	-0.246	-0.312	-0.37	-0.35	-0.289	-0.196
		LB STAT	44.223	55.577	56.036	58.127	63.147	68.154	76.344	87.982	98.605	105.926	109.354
		PROB	0	0	0	0	0	0	0	0	0	0	0
25	SPI	ACF	0.784	0.471	0.207	0.023	-0.106	-0.147	-0.155	-0.165	-0.205	-0.199	-0.176
		LB STAT	45.526	62.21	65.477	65.517	66.406	68.13	70.064	72.302	75.811	79.172	81.86
		PROB	0	0	0	0	0	0	0	0	0	0	0
26	GFCF	ACF	0.626	0.401	0.296	0.145	0.068	-0.028	-0.138	-0.244	-0.284	-0.194	-0.172
		LB STAT	30.618	43.362	50.388	52.104	52.49	52.554	54.176	59.315	66.347	69.696	72.377
		PROB	0	0	0	0	0	0	0	0	0	0	0
27	PFCE	ACF	0.39	0.298	0.208	0.104	0.164	0.029	-0.053	-0.063	-0.075	-0.104	-0.202
		LB STAT	12.043	19.179	22.7	23.593	25.841	25.912	26.151	26.492	26.992	27.969	31.687
		PROB	0	0	0	0	0	0	0	0	0	0	0

Source: Computed

