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The relationship between Output Uncertainty and Economic Growth-Evidence from India

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Abstract

This study examines the causal nexus between output growth and its uncertainty for India using monthly time series data for the period from April 1980 to April 2011. In this regard, both simultaneous equation method and two-step procedure methods are estimated. In two-step procedure method, conventional Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models and Stochastic Volatility (SV) models are used to measure output uncertainty. The empirical evidence suggests for both measures of uncertainty, there exists a unidirectional causality from output growth to its uncertainty with a positive sign. The results for both pre and post economic reform period in India are also same and identical.

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1. Introduction

The nature of association between the growth rate of an economy and its deviations has received significant attention recent times because of its commendable influence in framing growth policies. Until the early 1980's, the empirical macroeconomic literature doesn't found any promising relationship between real business cycle theories and growth theories, where growth theories focused on the determinants of growth and business cycles theories deals only with the deviations of output. Blanchard and Simon (2001) pointed out that the volatility of output growth is profoundly important in assessing economic growth because it causes random shocks that contract the economy to fall into a recession.

The important contributions of Nelson and Plosser (1982), Kydland and Prescott (1982), Long and Plosser (1983), and King et al. (1988) in the field of real business cycle theories have changed the conventional idea on this association. They proposed different models where the business cycles theories and growth models are integrated together. Only after the emergence of this idea, the issues on the relationship between the business cycles fluctuations and output growth received more attention in the empirical macroeconomic literature[1]. The recent growth theories have shown a significant attention to the mechanism by which output volatility influences output growth and the sign and direction of this relationship. However, there is a lack of solid theoretical consensus and hence economic theory put forwarded different possibilities on this association[2].

The traditional business cycle models deny the possibility of any promising interdependence between output fluctuations and economic growth. The business cycle models based on the natural rate hypothesis (Friedman, 1968) suggests no relationship between output variability and growth. These models argue that the output moving away from the natural rate is a result of price level misperceptions by agents in the economy. Hence, the long-run output growth is independent of these information asymmetries.[3] Lucas (1988) also pointed out that long-run growth and business cycles as an independent occurrence from the output fluctuations and there is no trade-off between the two variables.

The possibility of a positive relationship between output volatility and growth rates is credited to Schumpeter's (1942) idea of 'creative destruction', where the fluctuations in output is associated with recessions leads to more spending on research and development which in turn geared up the growth rates. In contrary to the conventional business cycle theories, Black (1987) argues for a positive relationship between growth volatility and average growth. This argument commonly known as the "*Black's hypothesis*" which is based on the assumptions that technology choices are made from a menu of all possibilities where the technology which produces faster average growth is inherently more risky. Sandmo (1970) and Mirman (1971) also support a positive link based on the theory of saving under uncertainty. Higher real uncertainty causes higher precautionary savings and subsequent rates of investment that positively impact the output growth. [4]

[1] See Aghion and Saint-Paul (1998) for detailed theoretical evolution.
[2] The terms volatility of growth, output variability, fluctuations in output and business cycle volatility are used as an identical phrase for output uncertainty.
[3] Phelps (1969), and Lucas (1973), Caporale and McKiernan (1998) are also holding similar view.
[4] See Sandmo (1970), Mirman (1971), Abel (1983), Caballero and Hammour (1994), and Aghion and Saint-Paul (1998) for detailed alternative theoretical justification for how volatility and growth may have a positive association.

In contrast, there are theories which show a negative relationship between real uncertainty and average output growth. Keynes (1936) argues that in the presence of large fluctuations in economic activity, entrepreneurs perceive investment projects as riskier. This in turn, lowers the demand for investment and output growth. . In contrast to Schumpeter's "*creative destruction", Stiglitz (1993) expounded a different argument that in an uncertain economic situation, the budgets allotted to the research and development are cut down and ended up with lack new inventions and which may reduce the growth rates. Thus output volatility may cut down the growth rate through its negative impact on research and development[5].

The different possibilities discussed above are particularly concerned only about the sign and the direction of the relationship running from output fluctuations to output growth. But, there is also a possibility of the reverse causality that may run from output growth to output variability with different signs. Theoretically, the sign of this relationship is ambiguous. The possibility of negative sign is advocated by arguing that an increase in output growth results an higher inflation (the short-run Phillips curve effect) and the high inflation leads to high inflation uncertainty (Friedman, 1977) and according Taylor, (1979), there is a tradeoff between inflation uncertainty and output uncertainty and therefore raising inflation uncertainty will lower real uncertainty. The possibility of positive impact of output growth on its uncertainty is also obtained by make use of Taylor effect, where a fall in output growth in response of the monetary policy shocks results higher uncertainty about future prices, which consequently reduce the output uncertainty.

On the issue of output and output uncertainty relationship, there is a plethora of studies are available in the literature and the existing empirical studies provide conflicting evidences. These conflicting evidences may be due to the sensitive nature of test results, the description of data and the measure of uncertainty used for investigations. Besides, the existing literature is mainly pertaining to advanced industrialized economies and test the relationship between output growth and output variability rather than the output uncertainty which is more scientific than simple variability. To our knowledge, there is no empirical exercise exclusively discussing this issue in Indian context. However, Jiranyaukul (2011) studied this association in Indian scenario with a basket of five crises affected Asian countries which is criticized for testing only the possibility of Black's hypothesis and not considering the other prospects.

In this background, this paper intends to study the sign and direction of the association between output and output uncertainty in India from a developing country perspective[6]. The contribution of this paper is twofold. First it used a simultaneous estimation method to examine the association between output growth and its uncertainty, where the conditional variances are allowed to influence the conditional mean (GARCH in Mean models) and also conditional mean are allowed to influence the conditional variance (Mean in GARCH models). Second, as a two-step procedure method, it applies both GARCH and Stochastic Volatility models to derive output growth uncertainty measure, mainly to examine whether the inference is sensitive to alternative measures of uncertainty. The rest of the paper is organized as follows: Section 2 outlines the methodology adopted in this study; Section 3 discusses the data and presents the empirical results with interpretations; and the final section provides the concluding remarks.

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[5] See Bernanke (1983) and Pindyck (1991), Ramey and Ramey (1995), Martin and Rogers (2000), Macri and Sinha (2000) Blackburn and Pelloni (2004), Aghion and Howitt, (2006), for different arguments on negative relationship between output growth and its volatility.

[6] See Fischer (1993), Macri, and Sinha (2000), Fountas, et al. (2004), Norrbin and Pinar (2005), Rafferty (2005), Imbs (2007), Beaumont (2008), Fountas and Karanasos (2008) for more information.

2. Data and Methodology

2.1. Data

The empirical investigation has been conducted using monthly data on output growth, measured as monthly percentage change in Index of Industrial Production (IIP), adjusted for seasonality for the period from April 1980 to April 2011[7]. All the data are obtained from various issues of the Handbook of Statistics on Indian Economy and Central Statistical Organization (CSO), Government of India.

2.2. Simultaneous estimation method

In simultaneous approach method, different types of GARCH-in-mean models are used to verify the growth effects of output variability. First, we define the GARCH-in-mean model as follows:

$$\begin{aligned} y_t &= \beta_0 + \sum_{i=1}^{n} \beta_i y_{t-i} + \delta h_t + \varepsilon_t \\ h_t &= \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} \end{aligned} \tag{1}$$

where y_t is the output growth at time t; and h_t is a conditional variance of output growth. The GARCH term, h_t is included in the mean equation of the model measure the effects of output growth uncertainty on the mean values of output growth.

Further, the effects of output growth its volatility is measured in the model (2) where the lagged mean output growth, y_{t-1} is included in the variance equation,

$$\begin{aligned} y_t &= \beta_0 + \sum_{i=1}^{n} \beta_i y_{t-i} + \varepsilon_t \\ h_t &= \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} + \gamma y_{t-1} \end{aligned} \tag{2}$$

Following Caporale and McKiernan (1996), Fountas and Karanasos (2008), the following comprehensive GARCH-M model is defined as follows

$$\begin{aligned} y_t &= \beta_0 + \sum_{i=1}^{n} \beta_i y_{t-i} + \delta h_t + \varepsilon_t \\ h_t &= \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} + \gamma y_{t-1} \end{aligned} \tag{3}$$

where y_t stands for the output growth at time t ,n is the number of lags, h_t symbolized the conditional variance of the errors which is referred as output uncertainty and the term y_{t-1} represents the one period lagged growth rate. This model allows us to simultaneously estimate the influence of uncertainty on output growth and the effects of growth fluctuations on output

[7] The real GDP data is available only on quarterly time-series data on is available only from 1996:Q2 and hence, we are using IIP as a proxy variable for growth. The real GDP data is available only on quarterly basis from 1996:Q2 and hence, we are using IIP as a proxy variable for growth. As a robustness, we also test the association between output and output uncertainty using the Quarterly GDP data and the results are similar to both the measures of uncertainty. The results can be obtained from the authors upon request.

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growth rate[8]. We test the influence of uncertainty on the growth rates, by only keeping the conditional variance (h_t) in the mean equation. The influence of growth on its uncertainty is verified by including only lagged growth rate y_t in the conditional variance equation and excluding the variance (h_t) from the mean equation. By keeping the variance in the mean equation and the lagged growth in the variance equation, the above model simultaneously tested the all the possible relationships between output growth and its uncertainty.

2.3. Two-step procedure method

The validity of using GARCH-in-mean models are quite debatable in the literature, because these models does not allowed the lagged effects of more than one period conditional variance in the mean equation. But the conditional mean values may be influenced by more than one period ahead conditional variance. Estimating GARCH-M models in such situation leads to a misleading conclusions. Jiranyakul (2011), has pointed out that the two-step procedures are more superior than GARCH-M in studying the relationship, because this models are criticized for not including the lagged values of conditional variance in the mean equation. Thus following Jiranyakul (2011) we have estimated the following simple GARCH models for two-step procedures

$$\begin{aligned} y_t &= \beta_0 + \sum_{i=1}^{n} \beta_i y_{t-i} + \varepsilon_t \\ h_t &= \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} \end{aligned} \tag{4}$$

where y_t is the output growth at time t; and h_t is a conditional variance of output growth. Further, we construct an alternative measure of output fluctuations using the stochastic volatility (SV) model becasue the superiority of SV model over conventional GARCH model is well established in the literature[9], and the causality inference is highly sensitive to measurement errors in variables. The Stochastic Volatility model is defined as

$$y_t = \alpha_0 + \sum_{i=1}^{k} b_i y_{t-i} + \sigma_\eta \varepsilon_t \tag{5}$$

Where ε_t is independently and identically normally distributed with zero mean and unit variance. The variance equation for SV model is specified in logarithmic form as

$$\sigma_t = \sigma^* \exp(0.5 h_t), \tag{6}$$

where σ* is the scaling factor. As a stochastic process, $h_t = \ln(\sigma_t^2 / \sigma^{*2})$; hence, the above equation can be rewritten as

$$h_t = \phi h_{t-1} + \sigma_\eta \eta_t, \ \eta_t \sim NID(0,1) \tag{7}$$

Where ϕ is persistence parameter and to ensure stationarity, this parameter is restricted to be $|\phi| \prec 1$. The errors in mean (ε_t) and variance (η_t) equations are assumed to be mutually uncorrelated.

[8] Engle, Lilien, and Robins, (1987) has introduced ARCH-M model. For a detailed survey of the use of conditional variance in mean equation, see Bollerslev, Chou, and Kroner (1992).
[9] For more details, refer to Pagan, A (1984), Koopman and Uspensky (2002) and Berument et al. (2009, 2011).

3. Empirical results

We examine the time series properties of Index of Industrial Production (IIP), data using Augmented Dickey–Fuller (ADF), Phillips–Perron (PP) and KPSS unit root tests, and the results are presented in Table 1. It is evident from the reported results that the ADF and PP tests reject the null of unit root and the KPSS test statistics is found to be very low, suggesting the null hypothesis is stationary can be accepted. Thus, all the three tests consistently confirm that the calculated output growth is a stationary process. Zivot and Andrews (1992) unit root test with structural breaks is also employed and the results shows that there is no structural break in the data which are similar to the conventional unit root tests.

Table 1: Unit Root Test Statistics for Monthly Output

Unit root tests	Coefficient
ADF	-19.259* (0.00)
PP	-34.420* (0.00)
KPSS	0.0844*
Zivot-Andrews	-13.135 (0.01)*

Figures in parenthesis are *p* values.

Prior to estimating GARCH models, the presence of time varying heteroscedasticity is tested by using ARCH-LM test statistic and the corresponding *F* statistics are reported in Table 2. The test results confirm the presence of ARCH effects, where the null hypothesis of 'no ARCH effects in the errors' is rejected at 1% level of significance irrespective of the different lag specifications. The significant higher order ARCH tests results indicates that the output series is conditionally heteroskedastic which enforced to use the GARCH class models for measuring conditional volatility over the OLS techniques.

Table 2: The test results of ARCH effects

Lags	Coefficients
2 lag	29.40 (0.00)
4 lag	31.06 (0.00)
8 lag	34.95 (0.00)
12 lag	45.70 (0.00)

Figures in parenthesis are *p* values

The parameters estimated from various GARCH models are reported in Table 3. We have considered only those lags of output as explanatory variables that turned out to be statistically significant in the mean equation of GARCH model. The necessary conditions ($\alpha_i \geq 0$), ($\beta_i \geq 0$) and ($\alpha_1+\beta_1 < 1$) that ensure a positive and stable conditional variances are satisfied for all the three models and the coefficients of Q statistic advocate that there is no any serial correlation in the residuals of mean and variance equation and the ARCH-LM test statistics also rejects the presence of remaining ARCH effects.

The Model 1 reports the estimated results of GARCH-in-mean specifications, where the impact of output fluctuations on output growth is examined. The results show that, the estimated coefficient of the conditional variance (δ) in mean equation is negative (-0.0066) and insignificant (0.90), which indicates that the output growth volatility does not have and significant impact on the output growth. However, the estimated results of model 2, shows that the lagged output growth coefficient (γ) influences the conditional variance of the output growth positively (0.2455) and significantly (0.00), which implies a positive relationship running from output growth to output variability. These findings is contradiction to most of the existing empirical studies.

Table 3: The GARCH-in-Mean Models of Output

Parameters	**Model 1**	**Model 2**	**Model 3**
Mean Equation			
b_0	0.9022 (0.00)	0.6491 (0.00)	0.9890 (0.00)
b_1	-0.5103 (0.00)	-0.4699 (0.00)	-0.4785 (0.00)
b_2	-0.2006 (0.00)	-0.1677 (0.00)	-0.1946 (0.00)
b_{11}	0.1040 (0.01)	0.0917 (0.06)	0.1269 (0.00)
b_{18}	-	0.0932 (0.09)	-
b_{24}	-	-0.1140 (0.02)	-
δ	-0.0066 (0.90)	-	-0.0331 (0.51)
Variance Equation			
a_0	0.0393 (0.10)	-0.0911 (0.00)	-0.0929 (0.00)
a_1	0.0719 (0.00)	0.0394 (0.00)	0.0362 (0.00)
a_2	0.9228 (0.00)	0.9478 (0.00)	0.9568 (0.00)
γ	-	0.2455 (0.00)	0.2201 (0.00)
Diagnostic Statistics			
Q(4)	1.82 (0.76)	2.48 (0.64)	1.59 (0.81)
Q(12)	10.25 (0.59)	9.80 (0.63)	10.25 (0.59)
$Q^2(4)$	1.62 (0.80)	6.30 (0.17)	2.04 (0.72)
$Q^2(12)$	11.23 (0.50)	18.58 (0.09)	8.26 (0.76)
ARCH-LM (4)	1.64 (0.80)	1.58 (0.17)	2.03 (0.73)
ARCH-LM (12)	12.15 (0.43)	17.95 (0.11)	9.09 (0.69)

Figures in parenthesis are p values. Q (k) and Q^2 (k) are the Ljung-Box test statistic of the levels and the squared residuals respectively. LM (4) and LM (12) are ARCH-LM statistics of chi-squares.

The reported results of model 3, where the influence output growth uncertainty on output growth and impact output growth on output growth uncertainty is measured, shows that the GARCH coefficient (δ) in the mean equation is negative (-0.0331) and statistically insignificant (0.51). But the coefficient (γ) that measures the effect of output growth on output uncertainty is positive (0.2201) and statistically significant (0.00). Altogether, the estimated results from this model shows that the output growth does affect its volatility and volatility does not affect output growth.

As mentioned in the methodology, the uncertainties may have a lagged impact over the macroeconomic performances and the GARCH-M models do not capture the lagged effects of uncertainties. Thus, to test influence lagged uncertainty effects, we estimate a two-step procedure method. For the two procedures method, first, we are estimating a simple GARCH model[10] and the results are presented in Table 4. The coefficients in variance equations are statistically significant and the sum of the ARCH and GARCH coefficients ($\alpha + \beta$) in the conditional variance equation is 0.99, which indicates that the volatility exhibits high degree of

[10] Engle and Ng (1993) asymmetric tests are estimated to check the presence of asymmetric response of the volatility to the past innovations. Results show that there is no evidence for asymmetry and thus we used the conditional variance of the simple GARCH model as a proxy for output uncertainty.

persistence, but mean reverting as $\alpha + \beta \prec 1$. The reported Ljung-Box Q-test statistic for standardized residuals and standardized squared residuals suggest that the null hypothesis of no autocorrelation can be accepted for different lag orders. The ARCH-LM test statistic indicate that there is no remaining ARCH effect in the square of the standardized residuals (v_t^2). These diagnostic statistics confirm the adequacy of the chosen model; hence, the estimates of mean and variance equations do not suffer from misspecification bias[11].

Table 4: The GARCH model for Monthly Output Growth

Parameters	Symmetric model
Mean Equation	
b_0	0.8839 (0.00)
b_1	-0.5105 (0.00)
b_2	-0.2007 (0.00)
b_{11}	0.1030 (0.01)
Variance Equation	
a_0	0.0390 (0.10)
a_1	0.0726 (0.00)
a_2	0.9223 (0.00)
Diagnostic Statistics	
Q(4)	1.82 (0.76)
Q(12)	10.22 (0.59)
$Q^2(4)$	1.64 (0.80)
$Q^2(12)$	11.22 (0.50)
ARCH-LM (4)	1.65 (0.79)
ARCH-LM (12)	12.13 (0.43)

Figures in parentheses are p values; Q (k) and Q^2 (k) are the Ljung-Box test statistic of the levels and the squared residuals respectively. LM (4) and LM (12) are ARCH-LM statistics of chi-squares.

The estimated coefficients of SV model are presented in Table 5[12]. The parameters of the mean and variance equation are presented in the first column, and the lower and upper critical values with 95% confidence intervals are presented in the second and third columns, respectively. The mean equation includes a constant and 12-period lagged output growth, and the variance equation includes one-period lagged output growth volatility. Results shows that all the estimated parameters are statistically significant because their confidence bands do not include any zero. The volatility persistence parameter (ϕ) is statistically significant and less than one (ϕ= 0.820) implying that h_t is stationary. The presence of autocorrelation of the standardized residual is tested using Lagrangian multiplier test, suggested by Wooldridge (1991). In this respect, Q statistic for 12 lags accepts the null of no autocorrelation in the standardized residuals and disprove the non-normality condition.

[11] For more details, refer to Engle, R.F. (1982) and Bollerslev, T (1986)

[12] The model is estimated using the OX code developed by Yeliz Yalcin

Table 5: Stochastic Volatility model for Monthly Output

Parameters	Coefficients	LCL	HCL
α	0.5286	0.4102	0.6470
b_{t-12}	0.0000017	0.0000016	0.0000019
σ_η	2.9407	2.3169	3.7325
ϕ	0.8205	0.7995	0.8398
η_t	0.2944	0.2051	0.4226
Q (12)Statistic = 81.39	Normality test statistic = 5.065		AIC= 1459.58

Table 6 reports the results of pair wise *F* statistics of Granger-causality analysis between output growth uncertainties and output growth for various lag periods. Since the inference is highly sensitive to the number of lags used, we used standard lag length criterions for choosing an optimal lag length. The y, h_{Gt} and h_{St} given in the first row of the table represent output and its conditional variance obtained from GARCH and SV models, respectively. The symbol $x \nrightarrow y$ indicates that the null hypothesis of *x* does not Granger cause *y*. The sign of the sum of the lagged coefficients are taken into account for to understand the direction of relationship between the variables. [13]

Table 6: Causality between Output and Uncertainty

$y_t \nrightarrow h_{Gt}$	$h_{Gt} \nrightarrow y_t$	$y_t \nrightarrow h_{St}$	$h_{St} \nrightarrow y_t$
9.7594^{+} (0.00)	0.8105 (0.51)	4.6016^{+} (0.00)	1.1551 (0.33)

The figures in parenthesis are *p* values. The sign (+) or (-) indicates the direction of the relationship.

The reported *F* statistics presented in the table shows that the null hypothesis of output growth does not Granger-cause output growth uncertainty can be rejected at 1 percent level of significance for both GARCH and SV measure uncertainties and the null of output growth uncertainty does not cause output growth is accepted for both measures. The + sign that appears as superscript of the F statistics suggests that output growth uncertainty increases in response to rise in output growth, irrespective of measures of conditional variance used. This results shows that in Indian scenario, the output growth uncertainty is strongly influenced by the output growth and there is no any evidence for relationship on the other way.

In addition, we check the presence of structural breaks in the output series and also verified whether the economic reforms implemented in India in the early 1990s have an influential impact on the association between output growth and its uncertainty.[14] The results concerning the causality tests for pre and post economic reform period are presented in Table 7. The reported results shows that uncertainty measure obtained from GARCH model only rejects the null hypothesis of output and does not cause uncertainty and implies a positive association between output growth to output variability whereas and SV measure of uncertainty rejects both the null and does not support any possible association. For the post economic reform period, both GARCH and SV uncertainty measures provide evidence for the positive impact of

[13] The AIC and SBC criterions are suggesting 4 lags as a maximum lag length.

[14] To check the presence of structural breaks in mean and variance equations, we have employed the Bai and Perron (1998, 2003) multiple break test. The test results have not identified significant break point in the mean as well as the GARCH variance and found only one break for the variance generated from SV model which is very closely associated with the historical break of economic reforms period in India.

output growth to its uncertainty and the causality is running from output growth to uncertainty and not the other way around. This shows that even when the historical breaks are taken into account, there is only unidirectional causality between output growth and its variance.

Table 7: Causality between Output and GARCH & SV – Historical Break

Regime 1 - (1981:04 - 1991:03)			
$y_t \nrightarrow h_{Gt}$	$h_{Gt} \nrightarrow y_t$	$y_t \nrightarrow h_{St}$	$h_{St} \nrightarrow y_t$
3.7008$^+$ (0.00)	1.5477 (0.19)	1.8066 (0.13)	1.2253 (0.30)
Regime 2 - (1991:04 - 2011:04)			
9.5740 $^+$ (0.00)	1.9084 (0.51)	4.6029$^+$ (0.00)	0.9838 (0.41)

The figures in parenthesis are *p* values. The sign (+) or (-) indicates the direction of the relationship.

Most of the empirical studies in the literature of output growth and business cycle fluctuations have documented mixed results on the association between output growth uncertainty and output growth. Our results are in contrast to the existing literature by showing a positive association between output growth and its uncertainty. One argument for this positive effect may be due the fact that India as an emerging economy always has a gap between the potential and actual output and any policy reaction to bridge this gap may have a positive impact on the uncertainty. On the other hand this may also be due to the tradeoff highlighted by Taylor (1979) between inflation uncertainty and output uncertainty. To validate and understand this dynamics we need a more comprehensive analysis on both output growth, inflation and its uncertainties which we leave it for future research.

From a policy perspective, it is very imperative to understand the sources of business cycles and fluctuations in economic activity. The sign and direction of the association between output growth and its uncertainty indicate that real uncertainty is an important variable to be considered while designing economic policies in India.

4. Concluding remarks

This paper examines the nature of the relationship between cyclical volatility and output growth rate for India using monthly time series data for the period from April 1980 to April 2011.The empirical results show that output volatility has an insignificant impact on economic growth whereas there is a strong evidence to claim a positive effect of output growth on its own uncertainty. The causality test results for both the GARCH and SV models indicate a positive effect from the output growth to its volatility and not vice versa for both post and pre economic reforms period. This similar results for both pre and post economic reforms period are mainly due to usage of Index of Industrial Production (IIP) as a proxy for output. Since IIP focus mostly on manufacturing and industrial components whereas the trade and financial reform policies are having a major impact on the services sector in India. The findings are partly consistent with the works of growth and real business cycle theories where output growth has a positive impact on output uncertainty and no impact of uncertainty on the output growth.

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