Asian Development Policy Review
ISSN(e): 2313-8343
ISSN(p): 2518-2544
DOI: 10.18488/journal.107.2019.74.219.238
Vol. 7, No. 4, 219-238

URL: www.aessweb.com

SENSITIVITY OF MACROECONOMIC POLICY GOALS TO TRILEMMA AND QUADRELIMMA CHOICES

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Article History
Received: 20 March 2019
Revised: 23 April 2019
Accepted: 29 May 2019
Published: 9 August 2019

Keywords
Economics
Macroeconomics
Capital account convertibility
Exchange rate
International reserves
Monetary policy impossible trinity
Econometric analysis.

JEL Classification:
A10; C01; E23; E52; F31.

ABSTRACT

This study aims to check the effect of trilemma and quadrilemma choices on price and output stability of the Indian economy over the period of 1980-2016. All the three combos of trilemma triangle have been put into an empirical framework in order to check their effect upon the inflation rate, growth rate, inflation volatility, and output volatility. The role played by the international reserve hoarding has also been taken into account as the many studies have proved that trilemma framework is converting into the quadrilemma due to an increasing amount of reserves as well as due to the decisive role played by these reserves in the effectiveness of trinity choices upon the macroeconomic stability. The Autoregressive Distributed Lag Model (ARDL) has used and concluded that trinity choices could successfully affect the macroeconomic stability of the Indian economy. Another important conclusion is that the quadrilemma framework choices are better than the trilemma as the presence of interaction variable of the trinity indices and international reserves have altered the policy effects in an efficient manner and made these policy choices more stabilizing.

Contribution/ Originality: This study contributes to the existing literature by check the effect of trilemma and quadrilemma choices on price and output stability for the Indian economy.

1. INTRODUCTION

A stable macroeconomic system is the ultimate goal of every economy of the world. A country with more stable economic indicators is always a preferred choice for every economy to make investments as well as to accept investments. The price and output stability are the two paramount pedestals of this overall economic stability. The policymakers, through the formulation of best possible policies, leave no stone unturned to accomplish this decisive task. There is a long list of policies affecting macroeconomic scenario, though the focus of this study is upon the effectiveness of international trinity choices of the economy in tackling the volatility of output and prices. In 1960s, Markus Fleming and Robert Mundell have grabbed the attention of the whole economic fraternity through the introduction of "International Trinity Hypothesis". This hypothesis states that it is beyond the reach of an economy to simultaneously pursue all the three trinity choices of monetary policy autonomy, exchange rate stability and full capital account convertibility. Rather, it has to choose any two depending upon its requirements, economic conditions and its position in the international market. Moreover, there are associated costs with every policy

choice along with its benefits, thus, it is always mandatory to consider all the pros and cons before making the selection of any policy goal.

The price and output stability are the two major objectives of the monetary policy. The central banking authority always tries its best to achieve these two with accuracy. An expansionary (contractionary) monetary policy will increase (decrease) the output level as well as price level. More independent the policy is from the international interest rate movements, more efficiently it can alter itself to achieve its final targets. Therefore, the greater monetary independence could allow the central bank to stabilize the economy through monetary policy without being subject to other economies' macroeconomic management, thus potentially leading to stable and sustainable economic growth. Nevertheless, there are some serious side effects of sovereign monetary policy. The monetary authorities could monetize the fiscal debt by misusing this autonomy further leading to destabilization of economy due to high and volatile inflation. The next policy objective is of stable exchange rate system and this can reduce the uncertainties by stabilizing the value of the domestic currency and the price level, in turn, stimulates the economic growth. However, policy makers could also use this policy of stable exchange rate as a tool to absorb external shocks. Exchange rate rigidities could prevent policy makers from implementing appropriate policies consistent with macroeconomic reality, implying that they would be prone to cause asset boom burst by overheating the economy.

Further, regarding the third corner of trinity triangle, i.e. of full capital account convertibility, it is generally expected that the higher degree of capital inflows can increase the growth rate as well as inflation rate through raising the supply of funds and reducing the lending rates. Nevertheless, there is no strong theoretical explanation behind the link between capital account openness and macroeconomic stability as it is mainly an empirical question (Kose *et al.*, 2003). Due to a long list of risks and benefits of financial openness, it is pertinent for the policy makers to carefully evaluate and understand its impacts on domestic macroeconomic performance through measurement of its relationship with output and price variables. The effect of capital account openness upon output volatility is not necessarily the direct effect, rather it could depend upon nature of shocks in the economy, i.e., monetary shocks, fiscal shocks, terms of trade shocks, etc. More degree of capital openness will increase the level of output volatility if the monetary shock is present in the economy. On the other hand, the presence of fiscal shock will lead to decline in the level of output volatility with an increasing level of financial integration. Moreover, the output volatility is largely dependent upon terms of trade shocks. Further, when an economy is more financially integrated with the rest of the world, there is a huge risk of importing inflation from other major economies. This angle is directly linked with the monetary policy independence as an independent monetary policy can protect the domestic rate of interest and prices from the international fluctuations. Therefore, a country can choose an autonomous monetary policy with exchange rate stability if it wants to control inflation and output volatility. Meaning thereby that the scrutinizing the effectiveness of all the three possible pairs of trinity choices is even more crucial as compared to the individual policy goals. Different policy combinations could have different outcomes for the domestic macroeconomic performance indicators like output and price. For instance, it will be more stabilizing for the economy if a stable exchange rate system is paired with autonomous monetary policy as against its pairing with capital openness. However, in the globalized world where almost every economy is opening up its capital account, is it possible to completely ignore this corner of full capital account convertibility of trinity triangle. An answer is given by Aizenman (2013) that an economy should introduce a high degree of domestic financial development along with an increasing level of financial openness, in order to reduce its macroeconomic volatility.

Further, the role of international reserves is also very vital in understanding the efficacy of trilemma choices on growth, inflation and volatility. As per the precautionary motive views, more stock of these reserves acts as a source of financial security against the sudden capital flights and it helps in better management of exchange rate and interest rates of the domestic economy. In the last 20-30 years, the developing economies have drastically increased their international reserve hoardings, and it has been considered as an outcome of the Balance of Payment crisis and

the East Asian crisis of 1990s. During these crises, it has been noticed that the economies with more foreign exchange reserves hoardings were the least effected from these crises. Moreover, the trinity choices of most of the emerging economies are converging towards the middle grounds as these have pursued a managed exchange rate system with a decent amount of monetary policy autonomy and capital account convertibility. The main reason behind this convergence is nothing but the increasing buffers of foreign exchange reserves (Aizenman and Ito, 2012). The Indian economy was also a big victim of the balance of payment crisis in the late 1980s, thus it has learned a lesson from its experience and started maintaining a high level of reserve hoardings. In addition, India also prefers the middle ground solutions of trinity choices and at the same time and the more amount of international reserve could be working as a helping force in maintaining its policy goals.

The objective of this study is to evaluate the effectiveness of trinity choices for the macroeconomic stability of the Indian economy and to understand that which out of three policy combinations is the best suitable to achieve the goals of the lower inflation rate and high growth rate of output. At the same time, the efficacy of trilemma selections has also been tested in interaction with international reserves.

2. REVIEW OF LITERATURE

It is always pertinent to review the available literature to understand the prevailing line of thought on a particular research issue. Therefore, relevant studies have been reviewed in order to understand the working of trinity hypothesis and its effectiveness in altering the inflation rate, output growth rate, inflation volatility and output volatility.

An empirical study conducted by O'Donnell (2001) has covered 93 countries for the time period of 1971-1994. This study supported the positive effect of financial openness upon output volatility in the presence of high degree of financial development. A completely similar view is of Aizenman (2013) that an economy should introduce high degree of domestic financial development along with increasing level of financial openness, in order to reduce its macroeconomic volatility. On the other hand, Rose (1994) have conducted empirically research on the sample of 138 countries by covering the period from 1950 to 1988. They have concluded that there is no significant relationship between macroeconomic volatility and financial openness of these economies. Sadeh (2011) has made use of Prais-Winsten estimator and instrumented variables on the pooled cross-section time series data from 22 OECD countries for the period 1990-2004. The results have shown that if central bank is fully independent and price stability is the major objective of central bank then left wing parties to prefer more stable exchange rate and they become more dependent upon fiscal policy to achieve their goals. In contrast, rightist parties will prefer market mechanism and price stability by focusing upon monetary policy.

Hsing (2012) through an empirical study has concluded that all the three trilemma policy choices can effect significantly to the level of inflation and growth rate as well as to the output and price volatility. The choice of perfect policy mix will depend upon the economic situations prevailing in a particular economy. Another empirical work has been conducted by Mansour (2014) to check the effectiveness of trinity choices on output volatility. In this study, the author has focused upon the role of international reserves in altering the trinity choices as well as on the impact of these choices on output volatility. The ratio of international reserves with external debt can help the central monetary authority to simultaneously achieve all the three corners of trinity triangle, but the ratio of reserves with GDP is of no use in improving the trinity choices. However, the international reserve hoardings are successful in changing the relationship of trinity choices with output volatility in the opposite direction.

Majumder and Nag (2017) have empirically proved that in the Indian economy, trinity hypothesis is valid in the long run and the intervention by the Reserve Bank of India through the use of international reserves can relax this trinity constraint. Moreover, they have also investigated the affect of trinity choices on the inflation rate, growth rate and output gap in the Indian economy. It has been concluded that it is the monetary policy independence index which is negatively related with the rate of inflation, while the high values of other two indices

are helpful in increasing the level of output growth as well as the output gap in the Indian economy during the time period of 1991 to 2015. Arora and Kaur (2019) have done an empirical study to test the trinity hypothesis in the Indian economy and it has been concluded that the trinity hypothesis is valid in case of India. Kaur (2018) has empirically proved that Indian prices and output levels are very sensitive to changes in the monetary policy of the Indian economy. In another study, Kaur (2019) proved that independence of monetary policy is very effective in making changes in the output and price stability of India.

3. DATABASE AND METHODOLOGY

The empirical analysis conducted under the present study is based upon the secondary data for the time period 1980-2016. The data of monthly frequency has been used for some variables, i.e., Call Money Rate (CMR), Federal Rates (FR) and Exchange Rate of Indian Rupee in Dollars (ER). The remaining variables are of annual frequency and the whole data set is adjusted to the common base period of the year 2011. The data series comprises of domestic monetary units and international monetary units are deflated with the help of Gross Domestic Product (GDP) deflator and GDP Purchasing Power Parity (PPP) deflator, respectively. The Handbook of Statistics on Indian Economy is the source for the variables namely CMR, FR, ER, Wholesale Price Index (WPI), GDP at Factor Cost, Bank Credit (BC), Broad Money (M3), Net Capital Inflows (Net Flows) and International Reserves (IR). The data on Net Barter Terms of Trade, GDP PPP Deflator, and United States of America Inflation Rate has been sourced from the World Development Indicators (WDI). The Crude Oil Price data series has been retrieved from inflationdata website.

The Index of Monetary Policy Independence (MI) and the index of Exchange Rate Stability (ERS) are created by following the methods suggested by Aizenman *et al.* (2008). The index of monetary independence has been constructed as follows:

$$MI_t = 1 - \frac{corr(i_{mt}^{India}, i_{mt}^{*}) - (-1)}{1-(-1)} \Bigg\}; \begin{matrix} m = 1,2\ldots,12\ months \\ t = 1,2\ldots,T\ years \end{matrix}$$

Where i_{mt}^{India} refres to CMR of India and i_{mt}^{*} implies FR of United States in m^{th} month of t^{th} year. The *corr* implies the annual correlation between i_{mt}^{India} and i_{mt}^{*}. Due to the close association of the Indian economy with the United States during the period covered under the study, the United States has been selected as a base country. The MI_t index can obtain any value between zero and one; a value near to one will ensure high level of monetary policy independence and value near to zero will reflect a lower degree of monetary policy independence.

Further, the monthly data on the ER has been used for the construction of ERS index. Thereafter, annual standard deviation of this monthly exchange rate has been calculated in order to construct an index of Exchange Rate Stability.

$$ERS_t = \frac{0.01}{0.01 + \sigma_{mt}\left(\Delta\varepsilon_{mt}\right)} \Bigg\}; \begin{matrix} m = 1,2\ldots,12\ months \\ t = 1,2\ldots,T\ years \end{matrix}$$

Where Δ is the first order difference operator, ε_{mt} reflects the log of exchange of Indian rupee *vis-à-vis* United States dollar (USD), and σ_{mt} indicates monthly standard deviation in t^{th} year. The value of this index will also lie between 0 and 1. Aizenman *et al.* (2008) said that there is need of some adjustments in this index series as the mere application of this index can lead to a downward bias i.e., in case the exchange rate following a narrow

band is facing frequent devaluation or revaluation, it could exaggerate exchange rate flexibility. It is necessary to apply a threshold limit to exchange rate fluctuations in order to avoid the above mentioned downward bias. Therefore, the value of one has been assigned when the monthly rate of change of exchange rate remained within the band of +/-0.33. A higher value of ERS_t index will indicate more exchange rate stability and *vice versa*.

However, the formation of the index of Capital Openness (CO) is done with the application of the formula given by Gupta and Manjhi (2011) while using the annual data on Net Capital Inflows and GDP at factor cost. For the construction of this index methodology given by Gupta and Manjhi (2011) has been made use of. According to Gupta and Manjhi (2011) de facto measure is more suitable for Indian economy as against the de jure measure. This index is equivalent to the ratio of the absolute value of net capital flows to Gross Domestic Product (GDP) of India. Net capital flows are focused because for international trinity capital account balance is the most crucial parameter. This index has been normalized between zero and one in order to make it comparable to ERS and MI index.

$$CO_t = \frac{|NetFlows_t|}{GDP_t}; t = 1, 2 \ldots, T \text{ years}$$

As the proposed empirical analysis is based upon time series data, it is mandatory to conduct the preliminary analysis comprises of Unit Root Analysis and Structural Break identification before the major analysis to understand the relationship between endogenous and exogenous variables. In the case of annual data series, the order of integration could be confirmed with the execution of Augmented Dickey-Fuller (ADF) test statistics. The integration order provides the information regarding the number of unit roots in the data series. It is not plausible to apply basic inference models in case of integrated variables. Thus, check of stationarity of the series is must in advance of application of the regression analysis and the most popular method is ADF unit root test. In this procedure, null hypothesis of the presence of unit root has been tested against the alternative of no unit root. Further, the identification of structural break is also a must step in case of time series data as the accurate conclusions are possible only if all the properties of data are properly verified and required adjustments are made. The ADF-break test statistics have been applied in order to identify the structural break in the dependent variables.

After checking the basic properties of the used time series data, the next step is the selection of the best method to run the regression analysis. The basic ordinary Least Square(OLS) Method will depict the correct relationship amongst the data variables only if all the series are level stationery i.e. I(0). The application of OLS model provides the misleading results in case a data series exhibits I(1) order of integration. On the other hand, it is advisable to use the Johansen Cointegration model in the case where all the variables are I(1). Here, the question arises which model is the desired one in situations where the regression models constitute the I(0) as well as I(1) variables. The answer has been provided by Pesaran *et al.* (2001) in the form of Autoregressive Distributed Lag (ARDL) technique. This method is the best suitable in case of the data having a mixture of the series with zero and one order of integration. Even in case of all I(1) variables, if the Eigenvalues or Trace-Statistics have shown the existence of single cointegration relationship/one vector, then also ARDL modeling will be applicable. The empirical economic analysis has also supported the existence of the long run relationship amongst the variables as postulated by the economic theory. In ARDL, the endogenous variable is dependent upon the present and past values of the exogenous variables as well as on its own lagged values. In this statistical procedure, F-statistics given by the application of Wald Test has been used to detect the long term affiliation of the concerned variables. This model is based upon certain assumptions:

- The error terms should not be correlated with each other.
- All the data series must be free from the problem of heteroscedasticity.
- This model will not work if the order of integration of any variable is greater than I(0).

The model specifications of the ARDL Co integration technique is given below:

$$Y_t = \delta + \sum_{i=1}^{\nu} \psi_i Y_{t-1} + \sum_{j=1}^{k} \sum_{i=0}^{\lambda_j} X_{j,t-i}' \gamma_{j,i} + \varepsilon_t \quad (1)$$

- Y is the dependent variable in the t time period and X_j represents the list of independent variables.
- δ Will give the co-efficient of the constant term included in the model.
- $\sum_{i=1}^{\nu}$ and $\sum_{i=0}^{\lambda_j}$ are the lag operators of dependent and independent variables, respectively, whereas ν refers to the number of lags present in the dependent variable and $\lambda_1 \ldots\ldots\ldots\ldots \lambda_k$ provide the information regarding the lag structure of the all the k independent variables, respectively.
- ε_t indicates the value of error term in the t time period.

The first step is the selection of appropriate lags of the model as the inclusion of the correct number of lags is always important to reach the accurate results. Thus, the lag length selection criterion must be applied. The two most important criterions namely Akaike information criterion (AIC), Schwarz information criterion (SC) are widely used. The basic formula for the AIC is given below:

$$AIC = 2(no.\ of\ \ parameters) + 2\log(\max imum\ likelihood\ \ function)$$

In the case of data having less than 40 observations i.e. small sample data, there is a big probability of wrong selection of model by AIC by choosing the overfit model. Thus, a new variant to this criterion has been developed known as AICc:

$$AICc = AIC + \frac{2(no.\ of\ \ parameters)^2 + 2(no.\ of\ \ parameters)}{n - no.\ of\ \ parameters - 1}$$

This new version of AIC is a second order estimate as it takes into account the square term of the number of parameters, whereas the original AIC is a first order estimate.

The second famous method to check the lag length is of Schwarz information criterion (SC) also known as Bayesian Information criterion:

$$SIC = 2\ln(\max imum\ \text{likelihood}) + (\log(\text{no. of observations})\ (\text{no. of observed parameters}))$$

For the models with very large size samples, SIC criterion is a better choice as compared to AIC because former gives more penalty to the 2 log(maximum likelihood). The ARDL model should be re-estimated by altering the number of lags in the model and the best model should be selected. A model with the smallest AIC and SIC etimates, or with the more value of R-Square and small value of standard errors, is considered as the best model, (Nkoro and Uko, 2016). As the ARDL estimation is a dynamic estimation, the long-run transformation of this model is verily possible. This long term representation provides information about the change in the dependent variable due to the change in the independent variables. This long run coefficient estimation will be done as follows:

$$\varphi_j = \frac{\sum_{i=1}^{k} \gamma_{j,i}}{1 - \sum_{i=1}^{\nu} \psi_i} \quad (2)$$

Note: With the help of standard errors of Equation 1 the standard errors of Equation 2 could be calculated through the Delta Method.

The Error Correction Form of ARDL Model

The Cointegartion Form or Error Correction Form can be computed by estimating the Equation 1 in the differenced transformation and then substituting the value of Equation 2 into Equation 1. After the estimation final Error Correction Form will come as:

$$\Delta Y_t = -\sum_{i=1}^{\nu-1} \psi_i * \Delta Y_{t-1} + \sum_{i=1}^{k} \sum_{i=0}^{\lambda_i - 1} \Delta X_{j,t-i}' \gamma_{j,i} * - \theta EC_{t-1} + \varepsilon_t \quad (3)$$

Where,

$$EC_t = Y_t - \delta - \sum_{j=1} X_{j,t}' \hat{\varphi}_j \quad (3.1)$$

In Equation 3 and Equation 3.1, the term EC_t refers to the speed of the adjustment (corrcetion) parameter. It is the coefficient of EC_t which is going to provide the information about the extent of correction of the disequilibrium in the current period. This co-efficient must be negative and significant in order to ensure convergence towards the equilibrium point. Whereas the positive value of this will be a sign of the divergence from the equilibrium point. If EC_t is equal to unity then it applies that the model is able to restore its equilibrium.

$$\hat{\theta} = 1 - \sum_{i-1}^{\nu} \hat{\psi}_i \quad (3.2)$$

$$\psi_i * = \sum_{m=i+1}^{\nu} \hat{\psi}_m \quad (3.3)$$

$$\gamma_{j.i} * = \sum^{qi} \gamma_{\lambda,m} \quad (3.4)$$

The Equation 3.1, 3.2 and 3.3 are explaining the summation form of the variables of $\hat{\theta}$, $\psi_i *$ and $\gamma_{j.i} *$.

The bound test procedure has been developed by Pesaran *et al.* (2001) in order to understand the fact that whether there exists the level relationship or the long run relationship between the dependent and independent variables under consideration. Thus, it is ultimately the bound test which is going to confirm the exact form of cointegration relationship.

$$\Delta Y_t = -\sum_{i=1}^{\nu-1} \psi_i * \Delta Y_{t-1} + \sum_{i=1}^{k} \sum_{i=0}^{\lambda_i - 1} \Delta X_{j,t-i}' \gamma_{j,i} * - \nu Y_{t-1} \delta - \sum_{j=1} X_{j,t}' \hat{\varphi}_j + \varepsilon_t \quad (3.5)$$

In Equation 3.5, X represents independent variable and Y represents dependent variable, ε_t refers to the error term.

In this bound test, null hypothesis is of no long run relationship/existence of level relationship is tested against the alternative of the existence of long-run relationship:

$H_0 = \nu = 0$ and $\hat{\varphi}_1 = \hat{\varphi}_2 = ... = \hat{\varphi}_k = 0$, the co-efficients of lagged variables are zero.

$H_1 = \nu \neq 0$ and $\hat{\varphi}_1 \neq \hat{\varphi}_2 \neq ..... \neq \hat{\varphi}_k \neq 0$, the co-efficients of lagged variables are non-zero.

This hypothesis is tested with the application of Wald test on Equation 4. Pesaran *et al.* (2001) have provided two sets of critical values for the F-statistics of Wald test i.e. Lower Bound Values (I_0) and Upper Bound Values (I_1). The (I_0) and (I_1) are for the set of variables which are I(0) and I(1), respectively. Therefore, lower Bound confirms the absence of cointegration relation, whereas upper bound values apply that long run cointegration relationship is there. If the value bound test F-statistics is greater than (I_1), then null hypothesis of no cointegration will be rejected. On the other hand, null hypothesis will be accepted in case F-statistics co-efficient is less than the (I_0) .When the Bound test application favours the cointegration then long run coefficients as well as Error Correction Form will be estimated by making use of the above-mentioned procedure.

ARDL Model Descriptions with respect to the present Study:

The description of the model is in the reference of the basic equation of ARDL model i.e. Equation 1. For more clarity the (1) equation has been rewritten first and then the details of the used model are given accordingly:

$$Y_t = \delta + \sum_{i=1}^{\nu} \psi_i Y_{t-1} + \sum_{j=1}^{k} \sum_{i=0}^{\lambda_j} X_{j,t-i}{}' \gamma_{j,i} + \varepsilon_t \qquad (4)$$

Where,

Y_t is the dependent variable in the time period t and in this study it is the parameter of the macroeconomic performance of the Indian economy and the total number of dependent variables are four in this case namely Inflation Rate, Inflation Volatility, Growth Rate, Output Volatility.

- Inflation Rate is nothing but the annual growth rate of Wholesale Price Index (WPI) of the Indian economy.
- Inflation Volatility refers to the five year standard deviation of the inflation rate.
- Growth Rate is the annual growth rate of the Gross Domestic Product (GDP).
- Output Volatility represents the five-year standard deviation of the growth rate of GDP.

It is worth mentioning that the regression models in the framework of ARDL are applied with taking into account these dependent variables one by one. Further, the term $\sum_{j=1}^{k} \sum_{i=0}^{\lambda_j} X_{j,t-i}{}' \gamma_{j,i}$ of the Equation 1 comprises of all the independent variables used in the model. Thus, according to all the independent models of the present study, this term will be equal to:

$$\sum_{j=1}^{k} \sum_{i=0}^{\lambda_j} X_{j,t-i}{}' \gamma_{j,i} = \sum_{i=0}^{\lambda_j} TRC_{t-i}{}' \gamma_1 + \sum_{i=0}^{\lambda_j} IR' \gamma_2 + \sum_{i=0}^{\lambda_j} (TRC * IR_{t-i})' \gamma_3 + \sum_{i=0}^{\lambda_j} Z_{t-i}{}' B$$

Here,

- i refers to the number of lags of all the independent variables.
- TRC is the vector of any two of the three trinity choices.
- IR indicates the international reserve hoardings.
- $TRC * IR_{t-i}$ represents the vector of the interaction variable of any of the two trinity indicators with international reserves.

- Z_{t-i} is the vector of all the macroeconomic control variables which comprises of a number of variables as listed below:
    1) Gross Fiscal Deficit(GFD): RBI has a belief that there is a negative relationship between the level of fiscal deficit and macroeconomic stability. In addition, it represents the fiscal policy stance.
    2) Broad Money (M3): It is the parameter of the monetary policy stance which a very important macroeconomic policy.
    3) Bank credit(BC): this is also an indicator of monetary policy but it will provide a clear picture of the effects of food credit and non food credit on economic stability.
    4) Inflation Rate of United States of America: as the Indian economy is mostly linked with the USA economy, thus it is expected that inflation rate of USA is going to make changes in the macroeconomic performance indicator of the Indian economy as well.
    5) Crude Oil Price (COP): the link between COP with inflation as well as growth variables is very important and it cannot be ignored.

After making all the required adjustments and including all the data series in the model, the final ARDL model used in this present study is following as:

$$Y_t = \delta + \sum_{i=1}^{\nu} \psi_i Y_{t-1} + \sum_{i=0}^{\lambda_i} TRC_{t-i}{}'\gamma_1 + \sum_{i=0}^{\lambda_i} IR'\gamma_2 + \sum_{i=0}^{\lambda_i} (TRC * IR_{t-i})'\gamma_3 + \sum_{i=0}^{\lambda_i} Z_{t-i}{}'B + \varepsilon_t \quad (5)$$

Here, in Equation 5, δ refers to the intersect term, ψ_i gives the value of lagged variables, all other terms are explained in a text earlier. In equation 5, there are four dependent variables and three possible trinity choice alternatives, thus ARDL modelling has been performed 24 times in total i.e. 6 times for each dependent variable, as ARDL model has been performed twice for each of the three trinity choice combinations i.e. with the inclusion of $\sum_{i=0}^{\lambda_i} (TRC * IR_{t-i})'\gamma_3$ term and without including this, for every dependent variable. In simple words, analysis has been performed in the trilemma as well as quadrelimma framework.

4. EMPIRICAL ANALYSIS

As per the above mentioned methodological framework, the first step in the empirical analysis of the present study has been taken by executing the ADF-unit root test, PP test, KPSS test and DF-GLS test. Here, the test statistics have been computed by applying the ADF procedure and PP test three times i.e. with drift, with drift and trend, and without drift and trend. On the other hand, the KPSS test and DF-GLS test statistics are applied twice, i.e. with drift, with drift and trend. It is worth mentioning here that in case a series is stationary at levels, then unit root analysis for the first difference is not executed as it is not required. Otherwise, tests at first difference have also been applied for the data series which have accepted the null hypothesis of the presence of unit root at levels. Another important thing is that in the case of KPSS test the null hypothesis is of stationarity as against the null of the unit rate in case of all other three test statistics. The results of summary of all the four used unit root test statistics are reported in Table 1.

The majority of test statistics reveal that the data series of the Inflation rate, Inflation Volatility (IV), Growth Rate, Output Volatility (OV), USA Inflation and Terms of Trade (TOT) are level stationary as they are integrated at I(0). The remaining set of variables namely Monetary Independence Index (MI), Exchange Rate Stability Index (ERS), Capital Openness Index (CO), Crude Oil Price (COP), Bank Credit (BC), International Reserve-GDP ratio

(IR/GDP), Gross Fiscal Deficit (GFD) and Broad Money (M3) are integrated at order one as all these have accepted the null hypothesis at levels but have rejected the null at first difference.

Table-1. Summary of Unit Root Analysis.

Unit Root test name	ER	CO	MI	IR/GDP	GFD	TOT	M3	USA_inf	COP
ADF	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(0)	I(1)
PP	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(0)	I(1)
DF-GLS	I(1)	I(1)	I(1)	I(1)	I(1)	I(0)	I(1)	I(0)	I(1)
KPSS	I(0)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(0)	I(1)

Note: I(0) and I(1) represent the order of integration at level and first difference, respectively.
Source: Authors' Calculations.

The next step is to identify the possible structural break of the used variables. However, it ADF-Break test has been applied only to the four dependent variables i.e. inflation rate, growth rate, IV and OV, as it is the dependent variable break which is going to matter the most. Table 2 represents the structural break analysis results. The identified structural breaks are of 2011, 2006 and 2012 for Inflation Rate, Inflation Volatility and Growth Rate, respectively. However, there is no significant break has been found in case of the variable of output volatility. The respective break dummies are included in the ARDL model while conducting empirical analysis.

Table-2. ADF-Break test Structural Break Analysis Results.

Name of the Variable	Break Date
Inflation Rate	2011
Inflation Volatility	2006
Growth Rate	2012
Output Volatility	N.A.

Note: N.A. represents not available.
Source: Authors' Calculations.

The unit root analysis has revealed that the variables under consideration are a mixture of I(0) and I(1) order of integration. Therefore, in this case, the most suitable econometric tool in the kit of time series analysis is of Autoregressive Distributed Lag (ARDL) model developed by Pesaran *et al.* (2001). This cointegration technique has been applied six times for each dependent variable and there are total four dependent variables, thus total of 24 regressions have been run under the framework of ARDL procedure. The first step in the ARDL model is to determine the length of the lags of the model. Hence, AIC and SIC criterions have been applied to determine the appropriate lag length. In all the cases, both these criterions have supported the inclusion of two lags; accordingly all the models have executed with two lags. After the selection of suitable lag length, the next move is to execute the Bound Test in order to confirm the cointegration relationship among the variables. The Wald test F-statistics values of the Bound test reported in Table 3, validate the existence of cointegration in case of all the regression models as the test statistics in all the cases lies above the upper bound (I_1) at 5 per cent level of significance.

The price control is always a desirable goal of every economy as an increase in inflation rate at a very high rate can disturb the functioning of the whole economy. Here, an effort has been made to evaluate the impact of different combinations of trilemma policy goals on the level of inflation rate in the Indian economy during the period of 1980-2016. The six ARDL models have run with the inflation rate as the dependent variable. The control variables remain same while the second, fourth and sixth regression equations include the interaction variable of all the three trinity choices with international reserves and the remaining three equations are without the inclusion of these interaction variables.

Table-3. ARDL Bound Test Results.

Model No.	Degree of Freedom	Wald Test F-statistics Values			
		Inflation Rate	Inflation Volatility	Growth Rate	Output Gap
1	10	4.652*	9.816*	4.608*	4.880*
2	12	14.296*	8.377*	5.378*	7.014*
3	10	6.142*	8.244*	3.659*	6.501*
4	12	9.247*	20.490*	5.793*	6.534*
5	10	5.656*	13.523*	3.376*	5.839*
6	12	15.403*	14.278*	3.504*	8.734*

Notes: (i) (I_0) = 2.06 and (I_1) =3.24 at 5 percent level of significance for 10 degree of freedom, and (I_0) = 5.73 and (I_1) =5.77 at 5 percent level of significance for 12 degree of freedom. (ii) * represents that series are significant at 5 per cent.
Source: Authors' Calculations

Table-4. Long Run Coefficients of Inflation Rate as dependent variable.

Variables	Model1	Model2	Model3	Model4	Model5	Model6
Growth Rate	0.970***	0.928***	0.814***	1.034***	0.925***	0.857***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
COP	-1.507	-0.141	0.422	1.656	-0.887	0.456
	(0.105)	(0.810)	(0.563)	(0.105)	(0.279)	(0.505)
GFD	0.184	0.004	0.282	1.684**	-0.050	0.061
	(0.395)	(0.981)	(0.324)	(0.033)	(0.836)	(0.715)
BC	2.217**	0.767	1.193	1.058	0.875	0.217
	(0.015)	(0.146)	(0.123)	(0.131)	(0.208)	(0.685)
IR_GDP	-0.312***	-0.452***	-0.268**	-0.772**	-0.397***	-0.352***
	(0.004)	(0.000)	(0.021)	(0.009)	(0.000)	(0.000)
M3	-1.684	0.042	-1.069	1.310	-0.119	0.371
	(0.112)	(0.949)	(0.237)	(0.243)	(0.882)	(0.587)
TOT	1.069*	0.557	1.753***	0.451***	0.833	0.561
	(0.082)	(0.192)	(0.002)	(0.005)	(0.137)	(0.159)
USA_Inf	0.225*	-0.039	0.076	0.595*	-0.117	-0.046
	(0.059)	(0.416)	(0.528)	(0.074)	(0.150)	(0.399)
MI	-0.516*	0.221	0.735**	2.382**	-	-
	(0.078)	(0.461)	(0.036)	(0.031)		
ERS	0.249*	2.236***	-	-	0.139	2.273***
	(0.062)	(0.004)			(0.239)	(0.000)
CO	-	-	0.810**	1.450***	7.657	3.939
			(0.037)	(0.013)	(0.111)	(0.206)
MI*res	-	0.102	-	-0.126	-	-
		(0.345)		(0.422)		
ERS*res	-	0.323**	-	-	-	0.344***
		(0.013)				(0.000)
CO*res	-	-	-	0.891**	-	-0.508
				(0.024)		(0.776)
Break_2011	-2.747***	-2.464***	-2.304***	-3.457***	-2.617	-2.366***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
cons	-6.606*	-8.297**	-9.476**	-2.284***	-8.248	-8.280**
	(0.08)	(0.020)	(0.030)	(0.007)	(0.071)	(0.019)

Note: *,**, and *** reflects that the coefficient is significant at 10, 5 and 1 percent levels of significance, respectively.

Table 4 reports the long run coefficients of all the six ARDL cointegration procedures with the inflation rate as a dependent variable. The first policy combination considered in model 1 and model 2 is of MI and ERS. It is found that if the Indian economy chooses the policy of an independent monetary policy with a stable exchange rate system then both the indices are significantly affecting the level of the inflation rate. The effect of ERS is positive while MI is bringing negative change in the inflation rate. Here, this kind of negative relation between MI and inflation rate is not justifiable as these two are positively related to each other according to the economic theory. However, when policy combination of MI and ERS interacts with the international reserves as shown in the model2, then it increases the effectiveness of ERS, but completely vanishes the impact of MI on price changes. This kind of

relationship emphasizes that if Indian economy has decided to pursue the policy mix of MI with ERS, then it is beyond the reach of Reserve Bank of India (RBI) to make required changes in the inflation rate. The better option could be the selection of MI with CO and the empirical results of Model3 and Model4 of Table 4 are providing clear support to this combination. In this case, there is a positive and significant link between an independent monetary policy and the inflation rate in the Indian economy. This relationship becomes even stronger with the entry of the interaction variable of international reserves with both the policy choices.

Table-5. Error Correction Form of Inflation Rate as the dependent variable.

Variables	Model1	Model2	Model3	Model4	Model5	Model6
∂ (inflation Rate(-1))	0.704*** (0.001)	0.884*** (0.000)	0.016*** (0.000)	0.396*** (0.010)	0.740*** (0.000)	1.032*** (0.000)
∂ (Growth Rate)	1.306*** (0.000)	1.500*** (0.000)	1.292*** (0.000)	1.099*** (0.000)	1.270*** (0.000)	1.467*** (0.000)
∂ (COP)	-3.319* (0.085)	-0.359 (0.808)	1.039 (0.577)	3.002 (0.130)	-1.851 (0.257)	-0.034 (0.979)
∂ (GFD)	0.406 (0.400)	0.568 (0.150)	-0.199 (0.706)	0.170 (0.714)	-0.105 (0.834)	0.162 (0.716)
∂ (BC)	1.033 (0.651)	1.947 (0.134)	1.039 (0.577)	-1.723 (0.328)	1.825 (0.188)	0.579 (0.681)
∂ (IR_GDP)	0.791** (0.051)	0.847** (0.028)	0.721** (0.053)	-0.307 (0.378)	0.838*** (0.018)	0.873*** (0.013)
∂ (M3)	-2.065*** (0.008)	-7.979** (0.028)	-4.060*** (0.002)	-2.476*** (0.007)	-0.326*** (0.006)	-1.192*** (0.005)
∂ (TOT)	2.353 (0.100)	1.415 (0.192)	4.320*** (0.004)	1.339*** (0.000)	0.738 (0.138)	1.496 (0.164)
∂ (USA_Inf)	0.264 (0.164)	-0.100 (0.410)	-0.135 (0.492)	0.074 (0.762)	-0.245 (0.139)	-0.122 (0.387)
∂ (MI)	-1.137* (0.087)	0.561 (0.459)	-1.021 (0.088)	-2.599* (0.068)	-	-
∂ (ERS)	0.548* (0.064)	2.345 (0.137)	-	-	0.290 (0.246)	0.289*** (0.006)
∂ (CO)	-	-	1.870 (0.794)	4.002*** (0.014)	-0.969 (0.881)	0.234 (0.963)
∂ (MI*res)	-	0.259 (0.338)	-	-0.229 (0.410)	-	-
∂ (ERS*res)	-	0.278 (0.299)	-	-	-	0.397*** (0.017)
∂ (CO*res)	-	-	-	2.817** (0.020)	-	0.134 (0.765)
∂ (Break_2011)	-6.049 (0.000)	-6.257*** (0.000)	-5.678*** (0.000)	-6.269*** (0.000)	-5.461*** (0.000)	-6.309*** (0.000)
CointEq(-1)	-2.201 (0.000)	-2.538*** (0.000)	-2.463*** (0.000)	-1.813*** (0.000)	-2.086*** (0.000)	-2.666*** (0.000)

Note: *,**, and *** reflects that the coefficient is significant at 10, 5 and 1 percent levels of significance, respectively.

The next possible choice could be of selecting the remaining two corners of trinity triangle i.e. ERS and CO. This choice with and without international reserve interaction has been incorporated in the regression equations depicted by Model5 and Model6, respectively. Out of two policy goal, it is the ERS which is affecting the dependent variable of the inflation rate, the intensity of which declines when ERS interacts with reserves. Talking about the role of macroeconomic control variables, it is the variables of Growth rate and IR/GDP which are significantly impacting the inflation rate in all the six models, however, the former's affect is always positive and latter's is negative throughout.

The Error Correction form of all models with the inflation rate as a dependent variable is depicted by Table 5. The Error Correction term (CointEq(-1)) is negative and significant in all regression equations ensuring the

stability of every model. However, the speed of adjustment in the quadrilemma models is more than the trilemma models implying that former models could achieve their equilibrium at a fast speed.

Table-6. Long Run Coefficients of Inflation Volatility as dependent variable.

Variables	Model1	Model2	Model3	Model4	Model5	Model6
Growth Rate	0.506 (0.566)	2.232*** (0.016)	-0.112 (0.850)	4.287 (0.108)	-0.643 (0.276)	-0.419 (0.441)
COP	-24.798 (0.132)	0.128** (0.027)	-0.085** (0.025)	-1.023 (0.435)	-1.731 (0.132)	-16.906 (0.162)
GFD	-2.804 (0.411)	-0.795** (0.050)	3.072 (0.123)	2.823 (0.366)	0.539 (0.817)	1.042 (0.619)
BC	11.068 (0.231)	0.731*** (0.020)	11.805 (0.141)	8.929 (0.350)	4.899 (0.350)	4.173 (0.385)
IR_GDP	-1.739 (0.246)	-0.603** (0.034)	-1.259 (0.147)	-0.467 (0.774)	-1.282 (0.247)	-1.289 (0.219)
M3	-8.124 (0.469)	-4.543*** (0.017)	-9.110 (0.335)	-1.032 (0.348)	0.132 (0.985)	0.517 (0.937)
TOT	7.209 (0.241)	0.0901*** (0.011)	-2.096 (0.598)	9.738 (0.197)	-2.881 (0.553)	-1.679 (0.700)
USA_Inf	-0.099* (0.078)	-0.094** (0.026)	-0.047** (0.023)	-0.076* (0.092)	-0.064* (0.055)	-0.094* (0.056)
MI	-2.217 (0.093)	2.196 (0.451)	-1.416** (0.030)	-1.272* (0.091)	-	-
ERS	-1.124* (0.082)	-1.527** (0.031)	-	-	-0.506 (0.491)	-3.124 (0.530)
CO	-	-	3.073** (0.024)	0.286* (0.068)	1.023** (0.035)	1.192** (0.032)
MI*res	-	0.383** (0.026)	-	-4.795* (0.070)	-	-
ERS*res	-	-0.442** (0.039)	-	-	-	0.733 (0.387)
CO*res	-	-	-	4.305** (0.0204)	-	-2.903 (0.118)
Break_2006	9.015* (0.034)	7.499** (0.020)	2.234*** (0.005)	6.076 (0.196)	-0.682* (0.056)	-1.025* (0.056)
cons	1.323 (0.977)	5.598 (0.468)	7.364 (0.853)	-8.474 (0.880)	-12.336 (0.697)	-2.873* (0.093)

Note: *,**, and *** reflects that the coefficient is significant at 10, 5 and 1 percent levels of significance, respectively.

In addition, it is always recommended to test the volatility of inflation with respect to different policies as it is necessary to reduce this to make the macroeconomic system more stable. Thus, the required effect of the policy choices is negative. The results reported in Table 6 show that the two policy combinations (MI with ERS, MI with CO) are outperforming the third one (ERS with CO) from the point of view of price stability. This conclusion is true for both the cases of trilemma and quadrilemma. However, being an open economy, it is not possible to completely give away the corner of CO. thus, it is recommended that India should focus upon the second combo i.e. MI with CO. A striking observation from the control variables is that the inflation rate of the USA economy is helping in price stability of the Indian economy as it is negatively related to the variable of Inflation Volatility.

Another important observation is that MI and ERS are negatively related to the inflation volatility, satisfying the stability requirement. On the other hand, inflation volatility will increase with the increasing degree of capital account convertibility, although negative coefficient of MI is greater than the positive coefficient of CO. Thus, increasing the autonomy of central bank will create more stabilizing effects for inflation as compared to the destabilizing effects of CO. Table 7 provides the Error correction forms of all the models with dependent of inflation volatility. The negative and significant CointEQ(-1) term confirms the stability of all the regressions.

Table-7. Error Correction Form of Inflation Volatility as dependent variable.

Variables	Model1	Model2	Model3	Model4	Model5	Model6
∂ (inflation Volatility(-1))	1.090*** (0.000)	-0.488*** (0.002)	1.103*** (0.000)	0.834*** (0.003)	1.203*** (0.000)	1.234*** (0.000)
∂ (Growth Rate)	0.398*** (0.009)	0.470*** (0.000)	0.255** (0.032)	1.006** (0.019)	0.181 (0.105)	0.213* (0.077)
∂ (COP)	-0.790 (0.661)	0.750*** (0.000)	-2.345 (0.184)	2.283 (0.446)	-2.726 (0.149)	-2.897 (0.155)
∂ (GFD)	-0.093 (0.837)	-1.372*** (0.008)	0.846 (0.109)	2.139** (0.038)	0.687 (0.242)	1.000 (0.127)
∂ (BC)	2.472 (0.205)	-1.855*** (0.009)	-0.923 (0.687)	-4.520 (0.169)	1.560 (0.326)	1.475 (0.364)
∂ (IR_GDP)	0.272 (0.508)	-1.905*** (0.002)	0.188 (0.626)	0.377 (0.386)	0.335 (0.392)	0.381 (0.334)
∂ (M3)	-1.814 (0.474)	-1.452** (0.035)	-2.510 (0.334)	-2.857 (0.349)	-3.557 (0.354)	-4.211 (0.307)
∂ (TOT)	1.610 (0.246)	0.271*** (0.003)	-0.557 (0.581)	0.570 (0.654)	-0.918 (0.504)	-0.593 (0.680)
∂ (USA_Inf)	-0.426*** (0.013)	-0.645*** (0.000)	-0.481*** (0.008)	-0.897*** (0.011)	-0.070*** (0.004)	-0.661*** (0.007)
∂ (MI)	-0.893* (0.067)	0.443 (0.435)	-1.210** (0.046)	-0.720 (0.513)	-	-
∂ (ERS)	-0.638** (0.022)	1.145 (0.314)	-	-	-0.161 (0.500)	-0.494 (0.670)
∂ (CO)	-	-	1.457*** (0.007)	3.105** (0.028)	0.449** (0.027)	0.160*** (0.017)
∂ (MI*res)	-	0.781** (0.016)	-	0.370 (0.293)	-	-
∂ (ERS*res)	-	0.506** (0.034)	-	-	-	-0.060 (0.769)
∂ (CO*res)	-	-	-	1.727** (0.053)	-	-0.015* (0.079)
c (Break_2006)	2.013*** (0.001)	3.535*** (0.0000	0.615* (0.087)	1.573** (0.023)	-0.217 (0.076)	-0.362*** (0.006)
CointEq(-1)	-0.223*** (0.005)	-0.202*** (0.012)	-0.275*** (0.000)	-0.259*** (0.041)	-0.318*** (0.005)	-0.353*** (0.008)

Note: *, **, and *** reflects that the coefficient is significant at 10, 5 and 1 percent levels of significance, respectively.

Along with the price stability, another important goal of every economy is of achieving a high growth rate of Gross Domestic Product (GDP) and ensuring more degree of output stability. The increasing level of GDP is a sign of improving economic performance, while less output volatility ensures more macroeconomic stability. Due to the significant role of output indicators, it is quite necessary to check the relationship of these variables with the trilemma indices of MI, ERS, and CO. The long run coefficients of the six regression models with Growth Rate as dependent variables are represented in Table 8. The most interesting finding is that an independent monetary policy is affecting the output growth neither with ERS nor with CO, and the international reserves are not able to alter this impact. Nevertheless, the growth rate is positively related to the CO index. Moreover, this relationship is stronger in the case of a combination of CO and ERS.

Another inference is that Gross Fiscal Deficit (GFD) came out as a significant variable in all the models and its relation with growth rate is positive except one case i.e. CO and ERS combo in the framework of quadrilemma. Moreover, Indian growth is reacting positively to the changes in the USA inflation rate, but negatively to the Indian inflation rate changes. A very high volume of import from the USA could be a possible reason behind this kind of scenario. Table 9 represents the error correction form of Table 8. This term is again negative and significant confirming the stability of the models.

Table-8. Long Run Coefficients of Growth Rate as dependent variable.

Variables	Model1	Model2	Model3	Model4	Model5	Model6
Inflation Rate	-0.257	-0.170	-0.391***	-0.284**	-0.232	-0.674***
	(0.166)	(0.248)	(0.004)	(0.055)	(0.108)	(0.000)
COP	0.025	-0.457	0.313	-1.128	1.577*	-0.261
	(0.979)	(0.554)	(0.676)	(0.298)	(0.092)	(0.117)
GFD	0.571*	0.942***	0.713**	0.927**	0.629**	-0.772***
	(0.081)	(0.006)	(0.019)	(0.020)	(0.040)	(0.000)
BC	-0.592	1.095	-0.815	1.028	-1.559**	-0.254***
	(0.388)	(0.171)	(0.181)	(0.356)	(0.038)	(0.000)
IR_GDP	0.195	0.302	0.134	0.321*	0.164	1.674***
	(0.190)	(0.055)	(0.252)	(0.089)	(0.144)	(0.000)
M3	0.322	-0.984**	0.534	-0.645	0.157	-0.192***
	(0.741)	(0.076)	(0.504)	(0.225)	(0.227)	(0.000)
TOT	-0.063*	-0.034	-0.029**	-0.061*	-0.005	-0.094***
	(0.071)	(0.333)	(0.039)	(0.058)	(0.124)	(0.000)
USA_Inf	0.078**	0.079***	0.024***	0.009***	0.068**	0.086***
	(0.013)	(0.001)	(0.007)	(0.005)	(0.020)	(0.000)
MI	0.308	0.538	0.103	0.599	-	-
	(0.285)	(0.200)	(0.683)	(0.390)		
ERS	-0.021	-1.022	-	-	-0.152	-0.455***
	(0.925)	(0.184)			(0.162)	(0.000)
CO	-	-	0.535**	-5.583	0.495**	0.752**
			(0.048)	(0.613)	(0.051)	(0.016)
MI*res	-	0.059	-	0.005	-	-
		(0.658)		(0.967)		
ERS*res	-	-0.140	-	-	-	-0.092***
		(0.297)				(0.012)
CO*res	-	-	-	-1.614	-	-0.403***
				(0.542)		(0.000)
Break_2006	0.636*	0.611*	0.611**	0.357*	0.966***	-4.489***
	(0.097)	(0.067)	(0.048)	(0.076)	(0.009)	(0.003)
cons	5.923**	6.919***	3.367*	8.637*	0.897*	-7.361**
	(0.033)	(0.007)	(0.098)	(0.064)	(0.087)	(0.045)

Note: *, **, and *** reflects that the coefficient is significant at 10, 5 and 1 percent levels of significance, respectively.

The comparison of Table 8 with Table 9 brings this to the attention that in the short run GFD was significant only in Model1 and Model6, but in the long run, it has started significantly affecting the growth rate in all the models with all the alternative choices of trinity indices (with and without international reserves). This implies that it takes some time to the gross fiscal deficit to negatively and significantly change the volume of GDP growth rate in India and during that time the government can correct its deficit if it does not want it to negatively hit the growth of the economy.

Moreover, it is always recommended in the economic theory that deficit is beneficial only within certain limits. Thus, the government should always keep a check on its fiscal deficit so that it could not cross the prescribed limit. Another important finding is regarding the effect of money supply (M3) on output growth and it is clear from the findings that in most of the cases, money supply fails to bring changes in the growth rate. It seems that a link is absent between the monetary policy and the real sector. This kind of relationship is there due to the fact that monetary policy authority is not focusing upon the quantitative measures rather upon the interest rate measures. Another reason behind this absent link of money and output growth could be the presence of black money. It refers that the whole amount of money pumped in the system by the central bank is not getting converted into economic growth, rather a major chunk of the supplied money is being hoarded in the form of black money.

Further, in order to ensure that the changes in the output growth are stable over the period of time, another empirical exercise has been performed by considering the output volatility as the dependent variable. The impacts of three trinity choice combinations (with and without international reserves) have been checked on the level of

output volatility in order to infer the best trilemma goals. When MI and ERS are two corners of the trinity triangle adopted by India, then both of the policies are not contributing to bringing any stability in the output level.

Table-9. Error Correction Form of Growth Rate as dependent variable.

Variables	Model1	Model2	Model3	Model4	Model5	Model6
∂ (Growth Rate(-1))	1.388**	1.1841***	1.709***	1.138**	1.741***	0.674***
	(0.010)	(0.004)	(0.002)	(0.025)	(0.001)	(0.000)
D ∂ (Inflation Rate)	-1.009*	-0.731	-1.432**	-0.810	-1.225**	-0.261
	(0.088)	(0.114)	(0.024)	(0.131)	(0.032)	(0.117)
∂ (COP)	0.084*	-1.433	1.146	-3.215	4.011	0.155**
	(0.060)	(0.546)	(0.680)	(0.240)	(0.154)	(0.026)
∂ (GFD)	-1.331*	-0.469	-0.112	0.123	-0.785	-0.072***
	(0.060)	(0.392)	(0.887)	(0.892)	(0.379)	(0.000)
∂ (BC)	-1.976	3.431	-2.982	2.930	-0.195**	-0.025***
	(0.393)	(0.141)	(0.200)	(0.290)	(0.041)	(0.000)
∂ (IR_GDP)	-1.492*	-0.257	-0.479***	-0.032	-0.007***	0.674***
	(0.010)	(0.624)	(0.006)	(0.957)	(0.002)	(0.000)
∂ (M3)	5.307	-2.351	6.036	-1.875	9.301	-0.094***
	(0.356)	(0.596)	(0.254)	(0.692)	(0.106)	(0.000)
∂ (TOT)	-1.061	-0.467	-1.999	-0.017*	-0.529	0.686***
	(0.635)	(0.780)	(0.247)	(0.088)	(0.787)	(0.000)
∂ (USA_Inf)	0.064**	0.075***	0.061**	0.014**	0.050*	-0.055**
	(0.040)	(0.001)	(0.030)	(0.037)	(0.088)	(0.029)
∂ (MI)	-0.182	-0.140**	-0.317	-0.165	-	-
	(0.794)	(0.024)	(0.637)	(0.893)		
∂ (ERS)	-0.463	-3.204	-	-	-0.604	0.075**
	(0.352)	(0.175)			(0.173)	(0.016)
∂ (CO)	-	-	0.571*	-3.083	0.052**	-0.092**
			(0.071)	(0.893)	(0.054)	(0.012)
∂ (MI*res)	-	-0.500	-	-0.685*	-	-
		(0.189)		(0.057)		
∂ (ERS*res)	-	-0.439	-	-	-	-0.096*
		(0.289)				(0.056)
∂ (CO*res)	-	-	-	-4.597	-	0.094
				(0.517)		(0.291)
∂ (Break_2012)	2.124*	1.915*	2.237**	1.018*	3.838**	-0.403***
	(0.066)	(0.089)	(0.059)	(0.077)	(0.024)	(0.000)
CointEq(-1)	-3.336***	-3.133***	-3.656***	-2.848**	-3.972***	-4.489***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)

Note: *, **, and *** reflects that the coefficient is significant at 10, 5 and 1 percent levels of significance, respectively.

However, when Indian economy chooses to fully open up its capital account along with the full monetary policy autonomy by sacrificing the third corner of stable exchange rate system, then it is the CO index which will start positively attributing towards the volatility of output growth. Meaning thereby that financial integration is acting here as an anti-growth stability policy and the fluctuations in the capital inflows and outflows could be a possible reason behind this. A solution is provided in the Model4 itself that when CO and MI indices are interacting with the international reserves then these are not only changing the sign of CO index but also making the MI index effective in achieving the output stability. Therefore, the combination of an autonomous monetary policy with full capital account convertibility will ensure the stable growth rate of the Indian economy while working in the quadrilemma framework. On the other hand, as India tries to achieve the corner of full financial integration with fully stable exchange rate system by choosing a dependent monetary policy, the stability of the economy is negatively hit by the CO index.

Here, reserves are not able to convert the sign of this index. The only possible solution in this case could be the development of the domestic financial system as it will help in reducing the fluctuations in the capital inflows as well as outflows, in turn, stabilize the growth rate of the economy (Aizenman, 2013).

Table-10. Long Run Coefficients of Output Volatility as the dependent variable.

Variables	Model1	Model2	Model3	Model4	Model5	Model6
Inflation Rate	0.038 (0.106)	0.014* (0.074)	0.027 (0.145)	0.038** (0.030)	0.028* (0.081)	0.0284* (0.083)
Crude Oil Price	0.299* (0.095)	0.008 (0.963)	0.219** (0.029)	0.417* (0.056)	0.306*** (0.017)	0.612*** (0.018)
GFD	0.121** (0.020)	0.059** (0.012)	0.079** (0.059)	0.169*** (0.008)	0.118*** (0.014)	0.127** (0.039)
BC	-0.339** (0.035)	-0.104 0.533	-0.427*** (0.003)	- 0.665*** (0.004)	-0.467*** (0.000)	- 0.506*** (0.005)
IR_GDP	0.001 (0.968)	0.002 (0.921)	-0.004 (0.801)	0.030 (0.127)	-0.017 (0.256)	-0.050 (0.127)
M3	0.377* (0.066)	0.112 (0.607)	0.450*** (0.012)	0.758*** (0.006)	0.518*** (0.001)	0.604*** (0.010)
TOT	0.014 (0.912)	-0.145 (0.330)	-0.110 (0.283)	-0.190** (0.052)	-0.060 (0.486)	0.264 (0.141)
USA Inflation Rate	-0.003 (0.862)	0.016 (0.544)	-0.028 (0.193)	- 0.062*** (0.013)	-0.055*** (0.000)	- 0.054*** (0.015)
MI	0.006 (0.870)	0.148 (0.229)	-0.010 (0.755)	-0.177 (0.109)	-	-
ERS	-0.042 (0.111)	0.134 (0.400)	-	-	-0.037** (0.053)	-0.049 (0.774)
CO	-	-	0.2504*** (0.008)	0.1022 (0.516)	0.248*** (0.001)	3.023 (0.195)
MI*res	-	0.004 (0.866)	-	-0.047** (0.043)	-	-
ERS*res	-	0.026 (0.266)	-	-	-	0.003 (0.914)
CO*res	-	-	-	-0.084** (0.042)	-	0.338 (0.718)
cons	-0.278 (0.783)	0.790 (0.463)	0.145* (0.082)	0.193* (0.070)	-0.234* (0.065)	-2.732 (0.065)

Note: *, **, and *** reflects that the coefficient is significant at 10, 5 and 1 percent levels of significance, respectively.
Source: Author's Calculations.

Except for the trinity variables, some macroeconomic control variables have also come out as the important ones in changing the output variability. The output volatility exhibits a positive and significant relationship with M3 as well as BC, implying that these two are helping the economy in increasing its macroeconomic stability. However, the parameters of GFD, COP and Inflation Rate are showing a positive link with the level of output volatility. Thus, it is recommended that the Indian policy makers must try to control these three in order to attain a more stable growth rate of the economy.

Lastly, the error correction form of Table 10 has been depicted in Table 11. It is clear that the all the six models executed with the dependent variable of output volatility are stable over the period of time as the coefficient of error correction term (CointEQ(-1)) is negative and significant in each case. Hence, all the models will definitely regain equilibrium

Level and the speed of adjustment per year of every model will depend upon the respective coefficient of the error correction term.

Table-11. Error Correction Form of Output Volatility as dependent variable.

Variables	Model1	Model2	Model3	Model4	Model5	Model6
∂ (Output Volatility(-1))	0.235** (0.025)	0.431** (0.016)	0.321** (0.025)	0.876** (0.043)	0.712* (0.065)	0.125** (0.024)
∂ (Inflation Rate)	0.014 (0.313)	0.010 (0.433)	0.007 (0.570)	0.004 (0.732	0.004 (0.705)	-0.007 (0.567)
∂ (COP)	0.091* (0.094)	0.009 (0.963)	0.022** (0.020)	0.246 (0.181)	0.035** (0.020)	0.047*** (0.016)
∂ (GFD)	-0.117** (0.019)	-0.098** (0.021)	-0.082* (0.068)	-0.018*** (0.011)	-0.092* (0.087)	-0.021*** (0.016)
∂ (BC)	-0.039** (0.031)	0.220 (0.280)	-0.044*** (0.003)	-0.074*** (0.004)	-0.238 (0.146)	-0.150 (0.423)
∂ (IR_GDP)	-0.086*** (0.013)	0.002 (0.920)	-0.083*** (0.009)	-0.080* (0.067)	-0.070** (0.017)	-0.063 (0.117)
∂ (M3)	0.818** (0.019)	0.408 (0.335)	0.081*** (0.010)	0.085*** (0.007)	0.079*** (0.002)	0.126*** (0.008)
∂ (TOT)	0.013 (0.912)	-0.161 (0.326)	-0.113 (0.274)	-0.024** (0.050)	-0.069 (0.477)	0.075 (0.670)
∂ (USAInflation Rate)	-0.025 (0.101)	0.001 (0.952)	-0.040** (0.025)	-0.070*** (0.025)	-0.043** (0.041)	-0.084*** (0.001)
∂ (MI)	0.006 (0.869)	- 0.025*** (0.006)	-0.010 0.756	-0.015 (0.838)	-	-
∂ (ERS)	-0.041 (0.110)	-0.062 (0.605)	-	-	-0.043* (0.062)	-0.266 (0.154)
∂ (CO)	-	-	0.111*** (0.000)	-1.100 (0.414)	0.015** (0.041)	-0.124* (0.094)
∂ (MI*res)	-	-0.043** (0.020)	-	-0.015 (0.290)	-	-
∂ (ERS*res)	-	-0.005 (0.765)	-	-	-	0.170*** (0.002)
∂ (CO*res)	-	-	-	-0.099** (0.041)	-	-1.248*** (0.000)
CointEq(-1)	-0.971*** (0.000)	- 1.108*** (0.000)	-1.029*** (0.000)	-1.121 (0.000)	- 1.148*** (0.000)	1.045*** (0.000)

Note: *, **, and *** reflects that the coefficient is significant at 10, 5 and 1 percent levels of significance, respectively.
Source: Author's Calculations.

5. SUMMARY OF CONCLUSIONS

The measurement of the affects of different policies on macroeconomic stability is a requirement as the final target of the policy makers as always to achieve a stable economic system. The three policy choices explained by the international trinity hypothesis are also of great importance in this aspect. As per this hypothesis, an economy can simultaneously achieve only two policy goals out of the three namely an independent monetary policy, exchange rate stability, and capital account convertibility. Thus, there are three possible pairs of these policy choices and all the three pairs may have different affects upon the level of stability parameters. It is pertinent to empirically estimate the best combination of the trinity choices. Therefore, in this study, a similar kind of effort has been made for the Indian economy. All the three combos of trilemma triangle have been put into an empirical framework in order to check their affect upon the inflation rate, growth rate, inflation volatility, and output volatility. The role played by the international reserve hoarding has also been taken into account as the many studies have proved that trilemma framework is converting into the quadrilemma due to the increasing amount of reserves as well as due to the decisive role played by these reserves in the effectiveness of trinity choices upon the macroeconomic stability.

Accordingly, six ARDL models have been applied to each dependent variable. Thus the total of 24 models have been executed as there were four dependent variables, namely inflation rate, inflation volatility, growth rate, and output volatility. It can be concluded that trinity choices can successfully affect the macroeconomic stability of the

Indian economy. Overall, the combination of an independent monetary policy with full capital account convertibility has been come out as the best one in both the cases of inflation variables as well as of output variables. It has been empirically proved that when the Indian economy has chosen the indices of MI and CO, then these are creating stabilizing effects upon the inflation rate as well as on the output growth rate, in turn ensuring the overall macroeconomic stability.

Another important conclusion is that the quadrilemma framework choices are better than the trilemma as the presence of interaction variable of the trinity indices and international reserves have altered the policy effects in an efficient manner and made these policy choices more stabilizing, especially the combination of monetary independence and capital account openness. In sum, it may be concluded that the Indian economy may go ahead with the capital account convertibility coupled with monetary independence. However, the sacrifice of exchange rate stability is inevitable that too can be avoided up to a certain extent with the policy of acquiring higher levels of international reserves.

Funding: This study received no specific financial support.
Competing Interests: The author declares that there are no conflicts of interests regarding the publication of this paper.

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