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A Causality Analysis on Tax-Growth Nexus in India: 1950-51 to 2011-12

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Abstract:
In the context of taxes-growth nexus, there is a variety of studies to find out the association between economic growth via GDP growth and tax rates. However, theoretical investigation on the effect of fiscal policy on economic growth is till now indecisive, rather debatable. This paper attempts to enquire into the fact econometrically whether taxation revenue collected in different forms is a cause of India's economic growth in the long run. More specifically, the article tries to find the causal relationship between taxation revenue and economic growth in India. Long-run equilibrium relationship between economic growth and taxation can be inferred in the case of India since Johansen cointegration test confirms the existence of long run equilibrium relationship between taxation and economic growth (real GDP growth). Pair-wise granger- causality test confirms that the direction of causality between economic growth (via GDP growth) and total tax revenue, economic growth and indirect tax are generally bidirectional (causality runs in both directions) which implies that higher level of indirect tax revenue as well as total revenue will foster real economic growth but no significant causal relationship exists between economic growth and direct taxes in any direction. Error correction results show that the error correction term has the correct negative sign and is significant for GDP but insignificant for direct taxes, indirect taxes and total tax revenue. This finding is very crucial for Indian economy as India is largely dependent on large indirect tax revenue for implementing different planned welfare activities as well as to finance essential public expenditure and make economic policies successful.

Keywords: Taxation, growth, long-run relationship, granger causality, cointegration, India.

1. Introduction:

In the context of taxes-growth nexus, there is a variety of studies to find out the association between economic growth via GDP growth and tax rates. The liaison between fiscal policy and economic growth has initiated an extensive application area in growth literature. However, theoretical investigation on the effect of fiscal policy on economic growth is till now indecisive, rather debatable. The potential reason of the indecisive empirical evidences could be the choice of inappropriate tax indicators that led the direction of other studies to employ a variety of alternative tax rates like disaggregated average tax rates on indirect and direct taxes, the tax mix ratio of indirect to direct taxes and the effective marginal tax rates that are recently perceived to give a more appropriate measure for investigating how tax incidence affects output dynamics.

Taxation has certain effect on economic decisions that influence the rate of growth. An increase in taxation trims down the returns to investment in both physical and human capital and Research and Development (R&D). The negative aspect of taxation is that it generates lower returns which indicate less accumulation and innovation and hence a lower rate of growth. On the other hand, some public expenditure can enhance productivity, such as the provision of infrastructure, public education, and health care. Taxation provides the means to finance these expenditures and indirectly can contribute to an increase in the growth rate that is indicative of the fact of positive aspect of taxation.

Tax plays a very crucial function in economic planning and development of any country as it is main source of public revenue of government. A rational and competitive tax structure is an essential precondition to attract capitalespecially foreign capital, specialized skill and technology which are essential ingredient for enhancing economic growth. But, taxes –what we pay for civilized society – twist private decisions, create misallocations of resources and cause dead weight losses. One might, therefore, speculate that at least some of these distortions are reflected in aggregate economic performance and that more distortive tax systems are associated with lower economic growth. Tax systems can be more or less distortive because they pull out more or less resources from private agents (the tax level), or because they raise a given amount of revenue in more or less distortive ways (the tax structure).

Several studies have investigated the empirical affiliation between tax and growth. The neo-classical growth models entail that changes in a country's tax structure should have no impact on its long-run growth rate. Such changes allow a country to move towards a higher or lower level of economic activity, but the new long-run growth path converges to the old long-run path. In neoclassical growth models, there are exogenous forces, such as technological progress and population dynamics that cause steady state growth. Taxes may exert only a temporary influence on the growth rate of income in the transition to successive equilibrium growth paths. Therefore, the neoclassical growth model of Solow implies that steady state growth is not affected by tax policy. In other words, tax policy, however distortionary, has no impact on long-term economic growth rates, even if it does reduce the level of economic output in the long-term.

Unlike, the 'new' endogenous growth theory initiated by Romer, presents growth models in which government spending and tax policies can have long-term or permanent growth effects. The endogenous growth models argue that financing through taxes may have an impact on welfare and/or on growth. Tax policy can affect economic growth by depressing new investment and entrepreneurial incentives or by distorting investment decisions since the tax code makes some forms of investment more profitable than others or by discouraging work effort and workers' acquisition of skills. Most of the empirical literature reveals an inverse relationship between tax burdens and rates of growth i.e. a lower tax burden would raise the rate of economic growth. Therefore, future economic output would be higher with the optimal rate of taxation and hence future tax revenues would be higher with a lower rate of taxation. Therefore, a simple way of thinking suggests that taxation always influences economic activity and distorts smooth functioning of market economy. As a result, perception initiates one to affirm that taxation affects negatively growth rates. This claim holds in standard economic theory as well. For instance, taxation lowers steady state level of output in the Solow model. Moreover, as many previously cited scholars demonstrated, taxation in vast majority of cases depresses long-run growth rates in endogenous growth models. In the endogenous growth model, steady state growth is determined by the agencies of the economy. Taxes that affect parameters like the rate of return on capital accumulation or the volume of investments in R&D, influence permanently steady state growth. Therefore, in both theories, there is an implied negative relationship between taxes and growth which has not been conclusively supported from the empirical findings.

Engen and Skinner (1996) recognize different channels through which taxes might cause output growth. First of all, taxes can dampen the investment by taxing away corporate and individual income and capital gains. This means that higher tax rate can discourage the investment rate or the net growth in capital stock through high statutory tax rates on corporate and individual income, high effective capital gain tax and low depreciation allowance. Second, tax policy can affect growth in productivity through its discouraging affect on R&D (research and development) expenditures and the venture capital investments to "hi-tech" industries. Third, taxes may discourage work force participation and hours of work or distort individual choices of acquiring education and skills or it may create biased occupational choice. Fourth, heavy taxation on labour supply can distort the efficient use of human capital by discouraging workers from employment in sectors with high social productivity but a heavy tax burden. Last but not least, taxation can decrease marginal productivity of labour by discouraging workers from working in sectors with high productivity but a heavy tax burden to a lower taxed sector. In public finance, celebrated Wagner's Law which states the opposite direction of the relationship between economic growth and taxation, i.e. the question whether economic growth leads or not to higher tax burden deserves that countries on a higher level of economic development tend to increase the scope of activities of their governments and therefore experience higher tax rates.

Numerous studies have investigated the empirical relationship between tax and growth and several studies provide mixed evidences of the taxes–growth nexus. Plosser (1992), Barro (1991) and King and Rebelo (1990),Engen and Skinner (1992), Kormendi and Meguire (1995), Wright (1996) suggest that a growth in tax volume leads to a reduction in growth. Specifically, Leibfritz et al. (1997), examining the tax burden effects on GDP growth in a sample of OECD countries, concluded that an increase of 10% in the tax/GDP ratio could lead to a reduction of 0.5% in growth, with direct taxation reducing growth marginally more than indirect taxation. Koester and Kormendi (1989), Levine and Renelt (1992), Easterly and Rebelo (1993), Slemrod and Yitzhaki (1995), Mendoza et al. (1997) and Kneller et al. (1999) conclude that there is either a positive or in most cases an insignificant correlation, between the average level of taxation and output dynamics both in the short and the long run. On the other hand, Tosun and Abizadeh (2005) found that economic growth, measured by gross domestic product (GDP) per capita, had significant effect on the tax mix of OECD (Organization for Economic Cooperation and Development) countries. Mendoza *et al.* (1994) conclude that tax mix has no significant effect on growth. Alesina, Ardagna, Perotti and Schiantarelli (1999) show in their model how increases in various kinds of taxes reduce profits and therefore, investments. Perhaps more interestingly, they reach the conclusion that the impact of increases in public spending has even more substantial negative impact on investment than changes in tax rates. Padovano and Galli (2002) empirically justify that average taxation shows no noticeable growth effects, probably because of high correlation with the average fiscal spending and conclude on the negative impact of marginal tax rates and tax progressivity on economic growth. Mamatzakis (2005) in a study with a dynamic impulse response analysis of Greek data sets found that, output growth responds negatively to an increase in the tax burden (given by the ratio of total taxes over GDP) while, there is a positive impact of tax mix (given by the ratio of indirect over direct taxes) on output growth. The impact of growth on the tax burden and the tax mix follows a cyclical pattern with a lag of one year, with a large positive response of the tax mix. The study concludes that indirect taxation benefits in the short term from high growth rates.

In view of the above discussion, this paper attempts to enquire into the fact econometrically whether taxation revenue collected in different form is a cause of India's economic growth in the long run. More specifically, the article tries to find the causal relationship between taxation revenue and economic growth in India.

2. Database and methodology:

The objective of this paper is to investigate the causal linkage between economic growth via GDP growth and different types of tax revenue variables either direct tax or indirect tax or a combination of both [i.e. total tax revenues including direct and indirect taxes] in India using the annual data for the period, 1950-51 to 2011-12 which includes the 62 annual observations. The real Gross Domestic Product (GDP) is used as the proxy for economic growth in India and we represent the economic growth rate by using the constant value of Gross Domestic Product (GDP) measured in Indian rupee.

All necessary data for the sample period are obtained from the Indian Public Finance Statistics, 2011-12 and Handbook of Statistics on Indian Economy, 2011-12 published by Reserve Bank of India. All the variables are taken in their natural logarithms to reduce the problems of heteroscedasticity to a minimum possible level.

2.1. Econometric specification:

2.1.1. Hypothesis:

The paper is based on the following hypotheses for testing the causality and co-integration between GDP and different kinds of tax revenue like direct taxes(DT), indirect taxes(IDT) and total tax revenue(TT) etc. in India (i) whether there is bi-directional causality between GDP growth and DT,IDT and TT, (ii) whether there is unidirectional causality between the variables, (iii) whether there is no causality between GDP and different tax variables in India (iv) whether there exists a long run relationship between GDP and different tax variables in India.

2.1.2.Model Specification:

The link between Economic growth (measured in terms of GDP growth) and taxation in India can be described with a model in linear form. A multiple regression model is designed to test the effects of different types of taxation revenue on economic growth as follows:

$$LnGDP_t = \alpha + \beta_1 Ln\,DT_t + \beta_2 IDT_t + \beta_3 TT_t + \varepsilon_t \quad \text{-------------} \quad (1.1)$$

α and $\beta_i > 0$

Here, GDP_t and DT_t, IDT_t, TT_t show the Gross Domestic Product annual growth rate, direct taxes, indirect taxes and total taxes at a particular time respectively while ε_t represents the "noise" or error term; α and β_i represent the slope and coefficient of regression. The variables remain as previously defined with the exception of being in their natural log form. ε_t is the error term assumed to be normally, identically and independently distributed. The coefficient of regression, β indicates how a unit change in the independent variable (export) affects the dependent variable (gross domestic product). The error, ε_t, is incorporated in the equation to cater for other factors that may influence GDP. The validity or strength of the Ordinary Least Squares method depends on the accuracy of assumptions. In this study, the Gauss-Markov assumptions are used and they include; that the dependent and independent variables (GDP and DT,IDT,TT) are linearly co-related, the estimators (α, β) are unbiased with an expected value of zero i.e., $E(\varepsilon_t) = 0$, which implies that on average the errors cancel out each other. The procedure involves specifying the dependent and independent variables; in this case, GDP is the dependent variable while DT, IDT, TT are the independent variables.

But, it depends on the assumptions that the results of the methods can be adversely affected by outliers. In addition, whereas the Ordinary Least squares regression analysis can establish the dependence of either GDP on DT, IDT, TT or vice versa; this does not necessarily imply direction of causation. Stuart Kendal noted that "a statistical relationship, however, strong and however suggestive, can never establish causal connection." Thus, in this study, another method, the Granger causality test, is used to further test for the direction of causality.

Unit root test:

When dealing with time series data, a number of econometric issues can influence the estimation of parameters using OLS. Regressing a time series variable on another time series variable using the Ordinary Least Squares (OLS) estimation can obtain a very high R^2, although there is no meaningful relationship between the variables. This situation reflects the problem of spurious regression between totally unrelated variables generated by a non-stationary process. Therefore, prior to testing and implementing the Granger Causality test, econometric methodology needs to examine the stationarity; for each individual time series, most macro economic data are non stationary, i.e. they tend to exhibit a deterministic and/or stochastic trend. Therefore, it is recommended that a stationarity (unit root) test be carried out to test for the order of integration. A series is said to be stationary if the mean and variance are time-invariant. A non-stationary time series will have a time dependent mean or make sure that the variables are stationary, because if they are not, the standard assumptions for asymptotic analysis in the Granger test will not be valid. Therefore, a stochastic process that is said to be stationary simply implies that the mean [(E(Y_t)] and the variance [Var (Y_t)] of Y remain constant over time for all t, and the covariance [covar (Y_t, Ys)] and hence the correlation between any two values of Y taken from different time periods depends on the difference apart in time between the two values for all t≠s. Since standard regression analysis requires that data series be stationary, it is obviously important that we first test for this requirement to determine whether the series used in the regression process is a difference stationary or a trend stationary.

We also use a formal test of stationarity, that is, the Augmented Dickey-Fuller (ADF) test and Phillips- Perron (PP) Test. To test the stationary of variables, we use the Augmented Dickey Fuller (ADF) test which is mostly used to test for unit root. Following equation checks the stationarity of time series data used in the study:

$$\Delta y_t = \beta_1 + \beta_1 t + \alpha y_{t-1} + \gamma \sum_{t=1}^{n} \Delta y_{t-1} + \varepsilon_t \text{------(2)}$$

Where ε_t is white nose error term in the model of unit root test, with a null hypothesis that variable has unit root. The ADF regression test for the existence of unit root of y_t that represents all variables at time t. The test for a unit root is conducted on the coefficient of y_{t-1} in the regression. If the coefficient is significantly different from zero (less than zero) then the hypothesis that y contains a unit root is rejected. The null and alternative hypothesis for the existence of unit root in variable y_t is H_0; $\alpha = 0$ versus H1: $\alpha < 0$. Rejection of the null hypothesis denotes stationarity in the series.

If the ADF test-statistic (t-statistic) is less (in the absolute value) than the Mackinnon critical t-values, 0 the null hypothesis of a unit root can not be rejected for the time series and hence, one can conclude that the series is non-stationary at their levels. The unit root test tests for the existence of a unit root in two cases: with intercept only and with intercept and trend to take into the account the impact of the trend on the series.

Phillips–Perron test:

The PP tests are non-parametric unit root tests that are modified so that serial correlation does not affect their asymptotic distribution. PP tests reveal that all variables are integrated of order one with and without linear trends, and with or without intercept terms. Phillips–Perron test (named after Peter C. B. Phillips and Pierre Perron) is a unit root test. That is, it is used in time series analysis to test the null hypothesis that a time series is integrated of order 1. It builds on the Dickey–Fuller test of the null hypothesis $\delta = 0$ in $\Delta y_t = \delta y_{t-1} + u_t$, here Δ is the first difference operator. Like the augmented Dickey–Fuller test, the Phillips–Perron test addresses the issue that the process generating data for y_t might have a higher order of autocorrelation than is admitted in the test equation - making y_{t-1} endogenous and thus invalidating the Dickey–Fuller t-test. Whilst the augmented Dickey–Fuller test addresses this issue by introducing lags of Δy_t as regressors in the test equation, the Phillips–Perron test makes a non-parametric correction to the t-test statistic. The test is robust with respect to unspecified autocorrelation and heteroscedasticity in the disturbance process of the test equation.

Cointegration Test (Johansen Approach):

Cointegration, an econometric property of time series variable, is a precondition for the existence of a long run or equilibrium economic relationship between two or more variables having unit roots (i.e. Integrated of order one). The Johansen approach can determine the number of co-integrated vectors for any given number of non-stationary variables of the same order. Two or more random variables are said to be cointegrated if each of the series are themselves non – stationary. This test may be regarded as a long run equilibrium relationship among the variables. The purpose of the Cointegration tests is to determine whether a group of non – stationary series is cointegrated or not.

Having concluded from the ADF results that each time series is non-stationary, i.e it is integrated of order one I(1), we proceed to the second step, which requires that the two time series be co-integrated. In other words, we have to examine whether or not there exists a long run relationship between variables (stable and non-spurious co-integrated relationship). In our case, the mission is to determine whether or not direct tax (DT), indirect tax (IDT) and total tax revenue (TT) and economic growth (GDP) variables have a long-run relationship in a multivariate framework. Engle and Granger (1987) introduced the concept of co integration, where economic variables might reach a long-run equilibrium that reflects a stable relationship among them. For the variables to be co-integrated, they must be integrated of order one (non-stationary) and the linear combination of them is stationary I(0).

The crucial approach which is used in this study to test r cointegration is called the Johansen cointegration approach. The Johanson approach can determine the number of cointegrated vectors for any given number of non-stationary variables of the same order.

Granger Causality test :

Causality is a kind of statistical feedback concept which is widely used in the building of forecasting models. Historically, Granger (1969) and Sim (1972) were the ones who formalized the application of causality in economics. Granger causality test is a technique for determining whether one time series is significant in forecasting another (Granger. 1969). The standard Granger causality test (Granger, 1988) seeks to determine whether past values of a variable helps to predict changes in another variable. The definition states that in the conditional distribution, lagged values of Y_t add no information to explanation of movements of X_t beyond that provided by lagged values of X_t itself (Greene, 2003). We should take note of the fact that the Granger causality technique measures the information given by one variable in explaining the latest value of another variable. In addition, it also says that variable Y is Granger caused by variable X if variable X assists in predicting the value of variable Y. If this is the case, it means that the lagged values of variable X are statistically significant in explaining variable Y. The null hypothesis (H_0) that we test in this case is that the X variable does not Granger cause variable Y and variable Y does not Granger cause variable X. In summary, one variable (X_t) is said to granger cause another variable (Y_t) if the lagged values of X_t can predict Y_t and vice-versa.

Error Correcting Model (ECM) and Short Term Causality Test :

Error correction mechanism was first used by Saran (1984), later adopted, modified and popularized by Engle and Granger (1987). By definition, error correction mechanism is a means of reconciling the short-run behaviour (or value) of an economic variable with its long-run behaviour (or value). An important theorem in this regard is the Granger Representation Theorem which demonstrates that any set of cointegrated time series has an error correction representation, which reflects the short-run adjustment mechanism.

Co- integration relationships just reflect the long term balanced relations between relevant variables. In order to cover the shortage, correcting mechanism of short term deviation from long term balance could be cited. At the same time, as the limited number of years, the above test result may cause disputes (Christpoulos and Tsionas, 2004). Therefore, under the circumstance of long term causalities, short term causalities should be further tested as well. Empirical works based on time series data assume that the underlying time series is stationary. However, many studies have shown that majority of time series variables are nonstationary or integrated of order 1 (Engle and Granger, 1987). The time series properties of the data at hand are therefore studied in the outset. Formal tests will be carried out to find the time series properties of the variables. If the variables are *I* (1), Engle and Granger (1987) assert that causality must exist in, at least, one direction. The Granger causality test is then augmented with an error correction term (ECT).

3. Analysis of result:

In Ordinary Least Squares (OLS) regression, time series residuals are often found to be serially correlated with their own lagged values. Serial correlation means (a) OLS is no longer an efficient linear estimator, (b) standard errors are incorrect and generally overstated, and (c) OLS estimates are biased and inconsistent .This test is an alternative to the Q-Statistic for testing for serial correlation. It is available for residuals from OLS, and the original regression may include autoregressive (AR) terms. Unlike the Durbin-Watson Test, the Breusch-Godfrey test may be used to test for serial correlation beyond the first order, and is valid in the presence of lagged dependent variables. The null hypothesis of the Breusch-Godfrey test is that there is no serial correlation up to the specified number of lags. The Breusch-Godfrey test regresses the residuals on the original regressors and lagged residuals up to the specified lag order. The number of observations multiplied by R^2 is the Breusch-Godfrey test statistic.

Table-1: Diagnostic Checking: Autocorrelation

Breusch-Godfrey Serial Correlation LM Test:			
F	39.72907	Probability	0.000000
Obs*R-squared	36.36847	Probability	0.000000

Source: Own estimate

The statistic labeled 'Obs*R-squared' is the LM test statistic for the null hypothesis of no serial correlation. The high probability values indicate the absence of serial correlation in the residuals. Therefore, the result from diagnostic checking shows that model suffers from autocorrelation because probability is exactly zero.

The OLS results in Table 2 show that direct tax, indirect Tax and total tax revenue are having insignificant positive/negative impact on economic growth.

Table -2: Regression Results by Ordinary Least Square Technique

Dependent Variable: lnGDP
Method: Least Squares
Sample: 1950 to 2011
Included observations: 62

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.946316	0.499920	-1.892932	0.0634
LnDT	0.329106	0.216693	1.518763	0.1343
LnIDT	-0.167577	0.668079	-0.250835	0.8028
LnTT	0.724083	0.881504	0.821417	0.4148

R-squared	0.998178	Mean dependent var	7.522693
Adjusted R-squared	0.998084	S.D. dependent var	2.101226
S.E. of regression	0.091986	Akaike info criterion	-1.872019
Sum squared resid	0.490763	Schwarz criterion	-1.734785

Log likelihood	62.03259	F-statistic	10590.54
Durbin-Watson stat	0.464598	Prob(F-statistic)	0.000000

Source: Authors' own estimate

Table (3) presents the results of the unit root test byADF for the variables for their levels. The results indicate that the null hypothesis of a unit root can not be rejected for the given variable and, hence, one can conclude that the variables are not stationary at their levels. On the other hand, to determine the stationarity property of the variable, the same test above was applied to the first differences. Results from table (3) revealed that all the ADF values are not smaller than the critical t-value at 1%, 5% and 10%level of significance for all variables. Based on these results, the null hypothesis that the series have unit roots in their differences can not be rejected. Therefore, the augmented Dickey Fuller Test fails to provide result of stationary both at levels and first differences at all lag differences. The results in Table 4 show that variables of our interest, namely LnGDP,LnDT,LnIDT and LnTT attained stationarity after first differencing, I(1), using PP test.

Table-3: Unit Root Test: The Results of the Augmented Dickey Fuller (ADF) Test for Level &First differences with an Intercept and Linear Trend

ADF Test												
variables	Levels						First Differences					
	Intercept			Intercept&Trend			Intercept			Intercept&Trend		
	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2
LnGDP	4.049	2.91	2.39	-3.60	-3.69	-3.12	-5.53	-4.21	-2.67	-6.85	-5.19	-3.36
LnDT	3.80	2.96	2.99	-1.30	-1.38	-1.23	-5.85	-4.50	-3.21	-7.11	-5.88	-4.05
LnIDT	0.663	0.915	-0.202	-2.63	-3.84	-1.89	-6.77	-6.15	-4.73	-6.86	-6.04	-4.65
LnTT	2.06	1.69	1.20	-3.89	-5.96	-3.59	-5.57	-5.92	-4.30	-6.01	-6.07	-4.35
Critical Values												
1%	-3.5398			-4.1135			-3.5417			-4.1162		
5%	-2.9092			-3.4862			-2.9101			-3.4849		
10%	-2.5928			-3.1711			-2.5932			-3.1718		

Source: Authors' own estimate

ADF tests specify the existence of a unit root to be the null hypothesis.

Ho: series has unit root; H_1: series is trend stationary.

Table-4 : Unit Root Test: The Results of the Phillips-Perron (PP) Test for Level &First differences with an Intercept and Linear Trend

PP Test												
variables	Levels						First Differences					
	Intercept			Intercept&Trend			Intercept			Intercept&Trend		
	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2
LnGDP	4.04	3.80	3.69	-3.60	-3.62	-3.69	-5.52	-5.45	-5.45	-6.85	-6.84	-6.83
LnDT	3.80	3.66	3.78	-1.30	-1.32	-1.31	-5.85	-5.83	-5.79	-7.11	-7.12	-7.09
LnIDT	0.663	0.614	0.618	-2.63	-2.69	-2.70	-6.77	-6.83	-6.84	-6.86	-6.92	-6.93
LnTT	2.06	1.83	1.82	-3.89	-3.85	-3.87	-5.57	-5.66	-5.59	-6.01	-6.1	-6.05
1%	-3.5398			-4.1135			-3.5417			-4.1162		
5%	-2.9092			-3.4836			-2.9101			-3.4849		
10%	-2.5919			-3.1696			-2.5923			-3.1703		

Source: Author's own estimate

PP tests specify the existence of a unit root to be the null hypothesis.

Ho: series has unit root; H_1: series is trend stationary.

Table- 5: Johansen Cointegration Tests:

Hypothesized N0. Of CE (s)	Eigen value	Likelihood Ratio	5% critical value	1% critical value
None **	0.428903	58.19005	47.21	54.46
At most 1	0.265338	25.13848	29.68	35.65
At most 2	0.110960	6.946162	15.41	20.04
At most 3	0.000119	0.007012	3.76	6.65

Ho: has no co-integration; H_1: has co-integration.

Test assumption: Linear deterministic trend in the data.

*(**) denotes rejection of the hypothesis at 5 %(1%) significance level.

L.R. test indicates 1 cointegrating equation(s) at 5% significance level.

Source: Authors' own estimate

Since the principal variables are stationary and integrated of order I(1), we apply now the Johansen cointegration test to see whether the variables are cointegrated or not suggesting long-run relationship. The Johansen approach can determine the number of cointegrated vectors for any given number of non-stationary variables of the same order. The test for presence of long-run relationship between the variables using the Johansen and Juselius

(1992) LR statistic for cointegration was conducted. The results reported in table (5) suggest that the null hypothesis of no cointegrating vectors can be rejected at the 1% level of significance. It can be seen from the Likelihood Ratio (L.R.) that we have a single co-integration equations. In other words, there exists one linear combination of the variables. It can be seen from the Likelihood Ratio (L.R.) that we have one co-integration equation. In other words, there exist one linear combinations of the variables. The Johansen cointegration test results declared that there is cointegration and hence, confirmed the existence of long run equilibrium relationship between economic growth and all right hand side variables.

The acceptance of cointegration between series implies that there exists a long run relationship between them and this means that an error-correction model (ECM) exists which combines the long-run relationship with the short-run dynamics of the model. The existence of cointegration implies that unidirectional or bidirectional Granger causality must exist.

The results of pair wise granger causality between economic growth via GDP growth and direct tax, indirect tax and total tax revenue are contained in Table 6. We have found that causality between economic growth(via GDP growth) and total tax revenue(TT) , economic growth(via GDP growth) and indirect tax(IDT) are bidirectional because null hypotheses of no granger causality can be rejected at 5 or 10 percent level of significance but no causality exist between economic growth and direct taxes and vice versa.

Table-6: Granger Causality test

Pairwise Granger Causality Tests				
Lags: 2				
	Obs.	F-Statistic	Probability	
LnDT does not Granger Cause LnGDP	60#	1.22424	0.30187	Accept
LnGDP does not Granger Cause LnDT		2.39687	0.10045	Accept
LnIDT does not Granger Cause LnGDP	60	6.82031	0.00226*	Reject
LnGDP does not Granger Cause LnIDT		3.73282	0.03019*	Reject
LnTT does not Granger Cause LnGDP	60	9.62495	0.00026*	Reject
LnGDP does not Granger Cause LnTT		2.72798	0.07420**	Reject

Source: Author's own estimate

Observations after lag.

*(**) Indicates significant causal relationship at 5 (10) significance level.

Lagged explanatory variables represent short- run impact and the long-run impact and are given by the error correction term. Error correction results show that the error correction term ECT_{t-1} has the correct negative sign and is significant for GDP but insignificant for direct taxes, indirect taxes and total tax revenue. An estimate of -0.31 for GDP indicates that 31% of the preceding year disequilibrium is eliminated in the current year.

Table- 7: Error-correction Results

Sample(adjusted): 1953 2011

Included observations: 59 after adjusting endpoints

Standard errors & t-statistics in parentheses

Cointegrating Eq:	CointEq1
LnGDP(-1)	1.000000
LnDT(-1)	-0.006006
	(0.24830)
	(-0.02419)
LnIDT(-1)	0.898186
	(0.78025)
	(1.15116)
LnTT(-1)	-1.819798
	(1.02697)
	(-1.77200)
C	2.051442

Error Correction:	D(LnGDP)	D(LnDT)	D(LnIDT)	D(LnTT)
CointEq1	-0.310555*	-0.043883	-0.071036	-0.077234
	(0.05696)	(0.13800)	(0.07215)	(0.07207)
	(-5.45185)	(-0.31800)	(-0.98453)	(-1.07168)
D(LnGDP(-1))	0.138152	0.557172	0.439116	0.441353
	(0.10582)	(0.25635)	(0.13403)	(0.13388)
	(1.30558)	(2.17352)	(3.27622)	(3.29673)
D(LnGDP(-2))	-0.202568	0.058844	-0.275403	-0.201145
	(0.10734)	(0.26004)	(0.13596)	(0.13581)
	(-1.88712)	(0.22629)	(-2.02555)	(-1.48111)
D(LnDT(-1))	0.183362	-0.540523	-0.353666	-0.378945
	(0.21388)	(0.51813)	(0.27090)	(0.27059)
	(0.85733)	(-1.04323)	(-1.30550)	(-1.40044)

D(LnDT(-2))	0.703935	0.756295	0.206480	0.316652
	(0.21105)	(0.51127)	(0.26732)	(0.26701)
	(3.33546)	(1.47924)	(0.77241)	(1.18592)
D(LnIDT(-1))	0.534937	-1.582683	-0.583862	-0.744296
	(0.63726)	(1.54380)	(0.80718)	(0.80625)
	(0.83943)	(-1.02519)	(-0.72334)	(-0.92316)
D(LnIDT(-2))	2.438318	1.815951	0.965612	1.103235
	(0.61772)	(1.49647)	(0.78243)	(0.78153)
	(3.94727)	(1.21349)	(1.23411)	(1.41164)
D(LnTT(-1))	-0.745571	2.670744	1.189881	1.462456
	(0.88108)	(2.13447)	(1.11601)	(1.11472)
	(-0.84620)	(1.25125)	(1.06619)	(1.31195)
D(LnTT(-2))	-3.151405	-3.128059	-1.475901	-1.763343
	(0.85891)	(2.08076)	(1.08793)	(1.08667)
	(-3.66907)	(-1.50332)	(-1.35661)	(-1.62270)
C	0.124775	0.062167	0.118550	0.103837
	(0.02172)	(0.05261)	(0.02751)	(0.02748)
	(5.74553)	(1.18166)	(4.30974)	(3.77924)
R-squared	0.582251	0.286655	0.367999	0.402430
Adj. R-squared	0.505522	0.155632	0.251917	0.292672
Sum sq. resids	0.056781	0.333234	0.091098	0.090887
S.E. equation	0.034041	0.082466	0.043118	0.043068
F-statistic	7.588370	2.187826	3.170167	3.666526
Log likelihood	121.1925	68.98785	107.2467	107.3151
Akaike AIC	-3.769239	-1.999588	-3.296499	-3.298816
Schwarz SC	-3.417114	-1.647463	-2.944374	-2.946691
Mean dependent	0.113040	0.129938	0.130788	0.130477
S.D. dependent	0.048409	0.089745	0.049852	0.051209
Determinant Residual Covariance		1.77E-13		
Log Likelihood		531.2893		
Akaike Information Criteria		-16.51828		
Schwarz Criteria		-14.96893		

Source: Own estimate.

4. Conclusion:

This empirical article explores whether there is any short run as well as long-run causal equilibrium relationship between economic growth via GDP growth and tax revenues in India by using granger causality test and Johansen technique for cointegration during the period 1950-51 to 2011-12.

The regression results show that that direct tax, indirect tax and total tax revenue are having insignificant positive/negative impact on economic growth. Cointegration results suggest that long-run equilibrium relationship between economic growth and taxation can be inferred in the case of India since Johansen cointegration test confirms the existence of any long run equilibrium relationship between taxation and economic growth (real GDP growth). We observe from pair-wise granger causality test that the direction of causality between economic growth (via GDP growth) and total tax revenue, economic growth and indirect tax are generally bidirectional (causality runs in both directions) which implies that higher level of indirect tax revenue as well as total revenue will foster real economic growth but no significant causal relationship exists between economic growth and direct taxes in any direction. Error correction results show that the error correction term has the correct negative sign and is significant for GDP but insignificant for direct taxes, indirect taxes and total tax revenue.

This finding is very crucial for Indian economy as India is largely dependent on large indirect tax revenue for implementing different planned welfare activities as well as to finance essential public expenditure and make economic policies successful.

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Appendix:

Relevant Data set for the study

Year	GDP	Direct Tax	Indirect tax	Total tax
1950-51	100.36	231	396	627
51-52	105.96	244	495	739
52-53	104.49	252	426	678
53-54	113.78	242	430	672
54-55	106.89	240	480	720
55-56	108.61	259	509	768
56-57	129.65	288	602	890
57-58	132.55	327	718	1045
58-59	148.27	344	745	1089
59-60	155.74	378	838	1216
60-61	170.49	402	948	1350
61-62	179.92	449	1094	1543
62-63	192.38	560	1305	1865
63-64	219.86	693	1632	2325
64-65	256.86	743	1856	2599
65-66	268.95	734	2188	2922
66-67	306.13	767	2494	3261
67-68	359.76	780	2676	3456
68-69	379.38	840	2919	3759
69-70	417.22	963	3237	4200
70-71	443.82	1009	3743	4752
71-72	472.21	1171	4404	5575
72-73	519.43	1346	5090	6436
73-74	636.58	1552	5837	7389
74-75	749.3	1834	7389	9223
75-76	795.82	2493	8689	11182
76-77	855.45	2585	9747	12332
77-78	976.33	2680	10557	13237
78-79	1049.3	2851	12677	15528
79-80	1145	3096	14587	17683
80-81	1368.38	3268	16576	19844
81-82	1602.13	4133	20009	24142
82-83	1789.85	4492	22750	27242
83-84	2093.56	4907	26618	31525
84-85	2351.13	5330	30484	35814
85-86	2627.17	6252	37015	43267
86-87	2929.24	6889	42650	49539
87-88	3320.68	7483	49493	56976
88-89	3962.95	9758	57168	66926
89-90	4565.4	11165	66528	77693
90-91	5318.13	12260	75462	87722
91-92	6135.28	16657	86541	103198

92-93	7037.23	19387	94779	114166
93-94	8179.61	21713	100248	121961
94-95	9553.85	28878	118971	147849
95-96	11185.86	35777	139482	175259
96-97	13017.88	41061	159995	201056
97-98	14476.13	50538	170121	220659
98-99	16687.39	49119	183898	233017
99-2000	18472.73	60864	213719	274583
2000-01	19919.82	71762	233558	305322
2001-02	21677.45	73109	241426	314535
2002-03	23382	87365	268912	356277
2003-04	26222.16	109546	304538	414084
2004-05	29714.64	137093	357277	494370
2005-06	33905.03	167635	420053	587688
2006-07	39532.76	231376	505331	736708
2007-08	45820.86	318839	551490	870329
2008-09	53035.67	327981	587469	915450
2009-10	60914.85	376995	623849	1000844
2010-11	71574.12	450093	813175	1263268
2011-12	82326.52	538083	956415	1494498

Source: Obtained from the Indian Public Finance Statistics, 2011-12 and Handbook of Statistics on Indian Economy, 2011-12(compiled).