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Panel Co-integration between Economic Growth and Non-tax revenue among Indian States

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Abstract

Present study tries to explore the stationarity and co-integration between Non-tax revenue and State Domestic Product of twenty major states of Indian federal system under panel data structure. LLC (2002) and IPS (2003) tests of stationarity have been used to detect unit root in the panel series. Kao (1999) test of panel co-integration shows that the SDP and NTR and NTR and SDP for the twenty states for the period under study are co-integrated. The results of the study suggest that state domestic product of the states are causing the non-tax revenue of the states and the non-tax revenue of the states are also causing state domestic product of the states for Indian federal system.

Keywords: State Domestic Production, Non-tax Revenue, Panel Unit Root, Panel Co-integration.
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1. Introduction

Inadequate revenue sources, uncontrolled growth of current expenditure and failure of central government transfers to grow as fast as the states 'own revenues' have been the major causes of fiscal imbalance at state level. In fact, states' expenditures have been growing which has resulted as shrinking of capital expenditure. Other factors responsible for poor fiscal health of states are up-trend of non-developmental consumption expenditure, high cost of Government employees and implementation of the Sixth Central Pay Commission. From the revenue receipts side, poor tax collections, poorly targeted cost recovery policy and lack of appropriate tax reforms have adversely affected the income buoyancy of the states. Accordingly, states receive revenue from revenue account and capital account. Non-tax revenue of the states comprises interest receipts, receipts from general services like lotteries, fees received for providing various social and economic services etc. But the rates and fees charged for such services are insignificantly low.

Despite marked increase in the absolute level of collection of non-tax revenues, it has remained static at less than one per cent of gross state domestic production. The state government during the period 1995-96 to 2005-06 has surely enhanced their own revenue mobilisation by more than 200 per cent but as their revenue expenditures have gone up simultaneously, their capacity to finance revenue expenditures out of own revenue receipts has declined by more than 16 per cent during the same period. Non-tax revenue grew at a compound annual rate of 7.6 per cent during the period 10 years ending 2009-10 (Economic Survey 2012-13). Further, the states do not have the same ability to finance their growing fiscal imbalance as availed by the Central Government. The states do not have independent power to borrow from open market, nor from Reserve Bank of India because of the regulations of the overdraft facility. Given these constraints on borrowing, the burden of adjusting the imbalances in the state finance has tended to fall mainly on capital account and maintenance of expenditures with adverse implications in terms of infrastructural constraints, declining productivity of state public sector enterprises and ultimately deceleration in the long term growth of economy of the states. These issues have been brought out by several studies like Aiyar and Kurup (1992), Rao and Sen (1993), Srivastava *et al.* (1998), George (2002), Srivastava (2002), Gaur (2002).

It has been found that most of the studies in the field of public finance have concentrated on revenue and expenditure of the state governments by using co-integration and error correction

mechanism like Anderson *et al.* (1986), Artis and Buti (2000), Baghestani and McNown (1994), Chang *et al.* (2002), Garcia and Henin (1999), Hassan and Lincoln (1997), Hondroyiannis and Papapetrou (1996), Joulfaian and Mookerjee (1991), Kollias and Makrydakis (1995), Manage and Marlow (1986), Miller and Russek (1990), Owoye (1995), Gounder *et al.* (2007), Kollias and Paleologous (2007) and Pandey and Dixit (2009).

The relationship between Non-tax revenue (NTR) and State Domestic Production (SDP) has been an important issue of discussion among scholars and economists throughout the world. The existence of nexus in between NTR and SDP can be examined in several ways like growth rate relating to SDP and NTR, proportion of NTR to SDP, several policies relating to accelerate SDP and NTR, etc. So far as inter-state non-tax revenue and state domestic production in India is concerned, limited studies are available. Purohit and Purohit (2009) pointed out the structure of non-tax sources of the states. They presented a detailed analysis of six selected services from social and economic services and concluded that non-tax revenue sources are insignificant sources of revenue in the states' budge. It is important to note that if proper attention is paid in pricing of the government services, non-tax revenue can be the major source of revenue.

Nagpal (2017) in her study analysed the trend of non-tax revenue for the state of Haryana for the period 1980 to 2015. She observed that non-tax revenue has not been able to contribute much to the growing expenditure nor has it been able to keep pace with the other sources of revenue.

Sarma, Pradhan and Bohra (1993) in their study pointed out for many states and many countries in the world, most of the government services are provided free or remain undercharged as these services are regarded 'pure public' goods in character and these are expected to be financed through taxation or borrowings. In case of Rajasthana quarter of the State's own non-tax revenues comprise interest receipts during the period of study i.e. 1974-1993.

Mohanty and Patra (2016) concluded that the per capita non-tax revenue has favorable effect on per capita revenue expenditure of the sub- national governments during the period 2010 to 2014 for the Indian states. But the need is to upgrade the efficiency of revenue collection. As far as policy implications are concerned the government should raise the non-tax revenue by increasing the number of users and the marginal pricing provision of goods. Bagchi (1992)

observed that non-tax revenue has accounted for a small and declining share of total revenue in India.

The review of above literature reveals the fact that no study has been conducted under panel framework for the Indian states for the period 1980-81 to 2011-12. Therefore the present study tries to explore the stationarity and co-integration between Non-tax revenue and State Domestic Product of major states of Indian federal system in time series as well as panel data structure for the period 1980-81 to 2011-12.

Objectives of the Study:

I. To test the panel stationarity of State Domestic Production and Non-tax revenue of the major states of the Indian federal system in terms of total and growth rate.
II. To test the panel co-integration in between SDP and NTR for the Indian federal system of twenty major states in terms of total and growth rate.

Hypothesis of the Study:

To test the first hypothesis we are considering the following AR (1) process for N states and T time periods

$$Y_{it} = \rho_i Y_{it-1} + \varepsilon_{it} \qquad (1)$$

X_{it} , represents the exogenous variables, including any fixed effect or individual trend, ρ_i is the autoregressive coefficient, and the errors ε_{it} are assumed to be mutually IID. The null and alternative hypotheses are

Ho: If $|\rho_i| < 1$**,** Y_i **is said to be trend-stationarity**

Ha: if $|\rho_i| = 1$ **then** Y_i **contains a unit root**

To test the second hypothesis between state domestic production (SDP) and non-tax revenue(NTR) for the twenty major Indian states two variables are integrated of the same order say I(1), estimated with OLS the long run equilibrium equation

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \omega_{it} \qquad (2)$$

From the above equation save the residuals ω_{it}, as are estimates of the equilibrium error, w_{it}.

For the state domestic production and non-tax revenue for the twenty major Indian states to be co-integrated if the equilibrium errors are stationarity at level. Thus the present equation is to be estimated:

$$\Delta\omega_{it} = \delta\omega_{it-1} + \upsilon_{it} \tag{3}$$

And finally the hypothesis to be tested:

H_o: $\delta = 0$, for non-stationarity of ω_{it}, i.e. for non-co-integration, if $t_\delta > \tau$

H_a: $\delta < 0$, for stationarity of ω_{it}, i.e. for co-integration, if $t_\delta > \tau$

Econometric Methodology:

Two types of tests can be distinguished based on the panel unit root test (Kappler 2006). First type of test considers a homogeneous alternative (Levin Lin and Chu 2002, Breitung 2000 and Hadri 2000) and the second type of test considers heterogeneous alternative (Im, Pesaran and Shin 2003, Maddala and Wu 1999 and Choi 2001). In the present study, LLC (2002) and IPS (2003) tests of stationarity have been used.

Panel Unit Root Tests: Levin, Lin, and Chu (2002)

Levin Lin and Chu (LLC) consider the following basic ADF specification:

$$\Delta Y_{it} = \alpha Y_{it-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta Y_{it-j} + X'_{it}\delta + \varepsilon_{it} \tag{4}$$

Where we assume a common $\alpha = \rho - 1$, but allow the lag order for the difference terms, p_i to vary across cross-sections[3].

For a given set of lag orders, we begin by estimating two additional sets of equations, regressing both ΔY_{it} and Y_{it-1} on the lag terms ΔY_{it-j} (for $j = 1, 2, 3, ..., p_i$) and the exogenous variables X_{it}. The estimated coefficients from these two regressions will be denoted $(\hat{\beta}, \hat{\delta})$ and

[3] The hypotheses for the test; $H_0 : \alpha = 0$, i.e., there is a unit root against $H_a : \alpha < 0$, i.e. there is no unit root.

(β, δ), respectively. We define $\Delta\bar{Y}_{it}$ and $\bar{Y}_{it-1}$ by removing the autocorrelations and deterministic components[4] and proxies by standardizing both $\Delta\bar{Y}_{it}$ and $\bar{Y}_{it-1}$, dividing by the regression standard error[5].

An estimate of the coefficient α may be obtained from the pooled proxy equation:

$$\Delta\bar{Y}_{it} = \alpha\bar{Y}_{it-1} + \eta_{it} \tag{5}$$

LLC shows that under the null, a modified *t*-statistic for the resulting $\hat{\alpha}$ is asymptotically normally distributed

$$t^*_{\alpha it} = \frac{t_\alpha - (N\bar{T}S_N\hat{\sigma}^{-2}se(\hat{\alpha})\mu_{m\bar{T}})}{\sigma_{m\bar{T}}} \rightarrow N(0,1) \tag{6}$$

Where t_α is the standard *t*-statistic for $\hat{\alpha} = 0$, $\hat{\sigma}^2$ is the estimated variance of the error term η, $se(\hat{\alpha})$ is the standard error of $\hat{\alpha}$, and

$$\bar{T} = T - (\sum_i p_i / N) - 1 \tag{7}$$

The average standard deviation ratio, S_N, is defined as the mean of the ratios of the long-run standard deviation to the innovation standard deviation for each individual. Its estimate is derived using kernel-based techniques. The remaining two terms, $\mu_{m\bar{T}}$ and $\sigma_{m\bar{T}}$ are adjustment terms for the mean and standard deviation.

The LLC method[6] requires a specification of the number of lags used in each cross-section ADF regression, p_i as well as kernel choices used in the computation of S_N.

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[4] $\Delta\bar{Y}_{it} = \Delta Y_{it-1} - \sum_{j=1}^{p_i}\hat{\beta}_{ij}\Delta Y_{it-j} - X'_{it}\delta$ and $\bar{Y}_{it-1} = Y_{it-1} - \sum_{j=1}^{p_i}\hat{\beta}_{ij}\Delta Y_{it-j} - X'_{it}\delta$

[5] $\Delta\bar{Y}_{it} = (\Delta\bar{Y}_{it}/s_i)$ and $\bar{Y}_{it-1} = (\bar{Y}_{it-1}/s_i)$

[6] LLC test depends upon the assumption of independence of across cross-sections. And this test is not applicable if cross-sectional correlation is present.

Panel Unit Root Tests: Im, Pesaran, and Shin (2003)

Im, Pesaran, and Shin (IPS)[7] begin by specifying a separate ADF regression for each cross section:

$$\Delta Y_{it} = \alpha Y_{it-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta Y_{it-j} + X'_{it}\delta + \varepsilon_{it} \tag{8}$$

After estimating the separate ADF regressions[8], the average of the *t*-statistics for α_i from the individual ADF regressions, $t_{iT_1}(p_i)$:

$$\bar{t}_{NT} = \left(\sum_{i=1}^{N} t_{iT_1}(p_i) \right) \Big/ N \tag{9}$$

The lag order is always zero ($p_i = 0 \; for \; all \; i$), simulated critical values for $\bar{t}_{NT}$ are provided for different numbers of *N* and *T* (equation containing either intercepts, or intercepts and linear trends).

$$W_{\bar{t}_{NT}} = \frac{\sqrt{N}\left\{ \bar{t}_{NT} - N^{-1} \sum_{i=1}^{N} E(t_{iT}(p_i)) \right\}}{\sqrt{N^{-1} \sum_{i=1}^{N} Var(t_{iT}(p_i))}} \rightarrow N(0,1) \tag{10}$$

The expressions for the expected mean and variance of the ADF regression *t*-statistics, $E(t_{iT}(p_i))$ and $Var(t_{iT}(p_i))$, are given by Im, Pesaran, and Shin (IPS) for various values of *T* and *p* and differing test equation assumptions[9].

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[7] IPS suggests an average of the ADF tests when u_{it} are serially correlated with different serial correlation properties across cross-sectional units.

[8] The null hypothesis and alternative hypothesis may be written as, $H_0 : \alpha_i = 0, \; for \; all \; i$ and

$H_a : \begin{cases} \alpha_i = 0 & for \; i = 1, 2, 3 ..... N_1 \\ \alpha_i < 0 & for \; i = N+1, N+2, N+3 ..... N \end{cases}$;(Where i may be reordered as necessary) which may be interpreted as a non-zero fraction of the individual processes is stationarity.

[9] Second generations of panel unit root test are surveyed extensively in Omay (2014). Moreover, the new panel unit root test extending IPS are Çorakçı et. al (2017) Omay et. al.(2017), see also these papers.

Panel Co-integration Tests:

A Panel Residual-based test has been performed for panel co-integration (Kao1999) between state domestic production and non-tax revenue for the twenty major Indian states for the period 1980-81 to 2011-12.

Kao (1999) test specifies cross-section specific intercepts and homogeneous coefficients on the first-stage regressors in the panel co-integration. In the bivariate case for panel SDP & panel NTR the model is of the form

$$Y_{it} = \alpha_i + \beta X_{it} + e_{it} \tag{11}$$

Where $Y_{it} = Y_{it-1} + \varepsilon_{it}$ and $X_{it} = X_{it-1} + \xi_{it}$.

The estimated residuals are

$$e_{it} = Y_{it} - \alpha_i - \beta X_{it} \tag{12}$$

i.e. e_{it} Containing a unit root. For this residual we run an ADF test. (Tests can be calculated from the fixed effects residuals)

$$\hat{e}_{it} = \rho \hat{e}_{it-1} + v_{it} \tag{13}$$

The Kao test used the null hypothesis of no co-integration for the panel[10].

Data for the Study:

In the present study data has been taken from Handbook of Statistics on Indian Economy and State Finance for twenty major states; Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Nagaland, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura and Uttar Pradesh (Handbook of Statistics on Indian Economy 2012-13). For a proper comparison of stationarity over time for the states, the revised series of SDP should be extended backwards. For this

[10] See also Omay et. al. (2017) for nonlinear panel co-integration extension in VECM form.

purpose, first we computed the price correction factor[11]. In the present study, panel stationarity has been tested for State Domestic Product (SDP) and Non-tax revenue (NTR) in panel data (in terms of level and growth rate). A Panel Residual-based test has been performed for panel co-integration (Kao1999) between state domestic production and non-tax revenue for the twenty major Indian states.

Results and Discussion:

In the present study, Levin Lin and Chu (LLC 2002) and Im, Pesaran and Shin (IPS 2003) tests of stationarity have been used. In Table 1, LLC panel unit root test presented for the SDP and NTR.

Table 1: Panel Unit Root -LLC test for SDP and NTR.

Model	At Level	Coefficient	t-value	t-star	P>t
State Domestic Product	No constant and no trend	0.079	12.754	12.296	1.00
	With constant	0.082	9.356	15.056	1.00
	With constant and trend	0.000	0.009	6.632	1.00
	At First Difference				
	No constant and no trend	-0.142*	-2.838	-2.779	0.00
	With constant	-0.564	-7.742	2.560	0.99
	With constant and trend	-1.333	-14.654	2.173	0.99
	At Second Difference				
	No constant and no trend	-2.726*	-21.342	-20.752	0.00
	With constant	-2.797	-22.004	3.396	1.00
	With constant and trend	-2.857	-22.291	9.569	1.00
Non-taxRevenue	**At Level**				
	No constant and no trend	0.157	6.725	6.448	1.00
	With constant	0.137	4.781	15.755	1.00
	With constant and trend	0.010	0.230	14.058	1.00
	At First Difference				
	No constant and no trend	-0.497*	-5.874	-5.752	0.00
	With constant	-0.784	-8.429	8.457	1.00
	With constant and trend	-1.235	-12.177	10.446	1.00
	At Second Difference				
	No constant and no trend	-2.865*	-21.157	-20.620	0.00
	With constant	-2.919	-21.569	13.657	1.00
	With constant and trend	-3.010	-22.254	20.207	1.00

Note: Data has been taken from RBI Handbook of Statistics on Indian Economy 2012-13 and State Finance 12-13. Statistical estimate on the basis of equations 4, 5, 6 and7given in section Econometrics Methodology

[11] Defined as the ratio of implicit deflator for 2004-05 series to 1999-2000 series for the year 2004-05, 1999-2000 series to the 1993-94 series for the year 1999-2000 similarly for 1993-94 series to 1980-81 series for the year 1994.

* Significant at 1 percent level, STATA11.0 used for LLC test

LLC test suggests presence of unit root at level, first difference and second difference in trend and intercept model. For both the series at no constant and no trend LLC test suggests that the series are stationarity at first difference. Table 2 presents LLC test for panel SDP and NTR in terms of growth rate. The result suggests that both the series are stationarity at no constant and no trend

Table 2: Panel Unit Root -LLC test for growth in SDP and growth in NTR.

Model	At Level	Coefficient	t-value	t-star	P>t
Growth in State Domestic Product	No constant and no trend	-1.079*	-13.814	-13.415	0.00
	With constant	-1.380*	-16.736	-2.638	0.00
	With constant and trend	-1.458	-17.310	0.683	0.75
	At First Difference				
	No constant and no trend	-2.730*	-24.711	-24.010	0.00
	With constant	-2.745	-24.820	0.567	0.71
	With constant and trend	-2.779	-25.080	6.370	1.00
	At Second Difference				
	No constant and no trend	-3.740*	-31.417	-30.555	0.00
	With constant	-3.739	-31.419	6.893	1.00
	With constant and trend	-3.743	-31.456	15.482	1.00
Growth in Non-taxRevenue	**At Level**				
	No constant and no trend	-1.269*	-15.080	-14.644	0.00
	With constant	-1.373	-15.929	-1.784	0.04
	With constant and trend	-1.432	-16.380	1.213	0.89
	At First Difference				
	No constant and no trend	-2.752*	-24.488	-23.787	0.00
	With constant	-2.753	-24.508	-0.819	0.21
	With constant and trend	-2.760	-24.571	4.681	1.00
	At Second Difference				
	No constant and no trend	-3.665*	-30.227	-29.378	0.00
	With constant	-3.665	-30.212	2.632	1.00
	With constant and trend	-3.664	-30.225	9.748	1.00

Note: Data has been taken from RBI Handbook of Statistics on Indian Economy 2012-13 and State Finance 12-13. Statistical estimate on the basis of equations 4, 5, 6 and7given in section Econometrics Methodology
* Significant at 1 percent level, STATA11.0 used for LLC test

Table 3 shows that IPS test on panel SDP and NTR for twenty major states in India. Panel SDP for twenty states in India are stationarity at first difference for intercept and trend while for Panel NTR stationarity at first difference for constant and also for intercept and trend.

Table 3: Panel Unit Root -IPS test for SDP and NTR.

Model	At Level	t-bar	W[t-bar]	P-value
State Domestic Product	With constant	1.330	13.776	1.00
	With constant and trend	-0.541	8.430	1.00
	First Difference			
	With constant	-1.875	-1.957	0.03
	With constant and trend	-3.055*	-4.991	0.00
	Second Difference			
	With constant	-4.553*	-14.872	0.00
	With constant and trend	-4.523*	-12.488	0.00
Non-taxRevenue	**At Level**			
	With constant	0.366	9.044	1.00
	With constant and trend	-0.378	9.298	1.00
	First Difference			
	With constant	-2.269*	-3.893	0.00
	With constant and trend	-2.772*	-3.479	0.00
	Second Difference			
	With constant	-4.513*	-14.678	0.00
	With constant and trend	-4.558*	-12.666	0.00

Note: Data has been taken from RBI Handbook of Statistics on Indian Economy 2012-13 and State Finance 2012-13. Statistical estimate on the basis of equations 8, 9 and10 given in section Econometrics Methodology
* Significant at 1 percent level, STATA11.0 used for IPS test

Table 4 presents IPS test for panel SDP and NTR in terms of growth rate. Table 4 shows that SDP and NTR are stationarity at level for constant and also for constant and trend.

From the above we came to know that both the series are stationarity at same order hence panel based co-integration test developed by Kao (1999) can be applied. Kao (1999) test specifies cross-section specific intercepts and homogeneous coefficients on the first-stage regressors in the panel co-integration. In the bivariate case for panel SDP & panel NTR the model is of the form

$$SDP_{it} = \alpha_i + \beta NTR_{it} + e1_{it}$$
$$NTR_{it} = \alpha_i + \beta SDP_{it} + e2_{it}$$
$$SDPG_{it} = \alpha_i + \beta NTRG_{it} + e3_{it}$$
$$NTRG_{it} = \alpha_i + \beta SDPG_{it} + e4_{it}$$

The estimated residuals are

$$e1_{it} = SDP_{it} - \alpha_i - \beta NTR_{it}$$

$$e2_{it} = NTR_{it} - \alpha_i - \beta SDP_{it}$$

$$e3_{it} = SDPG_{it} - \alpha_i - \beta NTRG_{it}$$

$$e4_{it} = NTRG_{it} - \alpha_i - \beta SDPG_{it}$$

Table 4: Panel Unit Root -IPS test for growth in SDP and growth in NTR

Model	At Level	t-bar	W[t-bar]	P-value
Growth in State Domestic Product	With constant	-3.454*	-9.709	0.00
	With constant and trend	-3.487*	-7.298	0.00
	First Difference			
	With constant	-5.217*	-18.067	0.00
	With constant and trend	-5.165*	-15.788	0.00
	Second Difference			
	With constant	-6.605*	-24.741	0.00
	With constant and trend	-6.462*	-22.464	0.00
Growth in Non-taxRevenue	**At Level**			
	With constant	-3.408*	-9.484	0.00
	With constant and trend	-3.432*	-7.002	0.00
	First Difference			
	With constant	-5.103*	-17.519	0.00
	With constant and trend	-5.002*	-14.954	0.00
	Second Difference			
	With constant	-6.213*	-22.854	0.00
	With constant and trend	-6.072*	-20.457	0.00

Note: Data has been taken from RBI Handbook of Statistics on Indian Economy 2012-13 and State Finance 2012-13. Statistical estimate on the basis of equations 8, 9 and10 given in section Econometrics Methodology

* Significant at 1 percent level, STATA11.0 used for IPS test

For this residual we run Dickey Fuller test. The Kao test used the null hypothesis of no co-integration for the panel. The Kao test for panel data of SDP and NTR rejects the null hypothesis of no co-integration.

Our results so far indicate that there is a bi-directional relationship between NTR and states economic growth for the panel data. This means that changes in Non-tax revenue affect State Domestic Product, i.e. efforts made in collection of non-tax revenue of the states may provide returns in terms of higher State Domestic Product. The Kao test for panel data also suggests that State Domestic Product affects the Non-tax revenue for the selected Indian States.

Table 5 : Kao test for panel co-integration: Regression results for SDP and NTR

Model	Constant	Variable	R square	ADJ_ R square	R. MSE	F statistics
$SDP_{it} = \alpha_i + \beta NTR_{it} + e1_{it}$	37543.92 (11.04)	0.135 (22.22)	0.4362	0.4353	68549	493.66
$NTR_{it} = \alpha_i + \beta SDP_{it} + e2_{it}$	69364.57 (3.87)	3.224 (22.22)	0.4362	0.4353	330000	493.66
$SDPG_{it} = \alpha_i + \beta NTRG_{it} + e3_{it}$	5.77 (19.35)	0.001 (0.29)	0.0001	-0.0015	7.0246	0.08
$NTRG_{it} = \alpha_i + \beta SDPG_{it} + e4_{it}$	16.70 (6.43)	0.083 (0.29)	0.0001	-0.0015	49.867	0.08

Note: Data has been taken from RBI Handbook of Statistics on Indian Economy 2012-13 and State Finance 2012-13.; Estimated on the basis of Equation 11.; Software used STATA 11.0

Table 6 : Kao test for panel co-integration: Residual Based

DF Test for Residual	τ- statistics	1% critical value
$e1_{it} = SDP_{it} - \alpha_i - \beta NTR_{it}$	-7.295*	-3.430
$e2_{it} = NTR_{it} - \alpha_i - \beta SDP_{it}$	-10.024*	-3.430
$e3_{it} = SDPG_{it} - \alpha_i - \beta NTRG_{it}$	-31.582*	-3.430
$e4_{it} = NTRG_{it} - \alpha_i - \beta SDPG_{it}$	-28.527*	-3.430

Note: Data has been taken from RBI Handbook of Statistics on Indian Economy 2012-13 and State Finance 2012-13.; Residual calculated on the basis of equation 12.; Software used STATA 11.0

* Significant at 1 percent level.

Conclusion

The present study has focused on the nexus of the non-tax revenue and state domestic product of twenty major Indian states. The study is based on the panel data and panel unit root test has been applied on SDP and NTR in the present study. The LLC and IPS tests show stationarity of the series at first difference for trend and intercept. Kao test of panel co-integration shows that the SDP and NTR and NTR and SDP for the twenty states for the period under study are co-integrated. The results of the study suggest that state domestic product of the states are causing the non-tax revenue of the states and the non-tax revenue of the states are also causing state domestic product of the states for Indian federal system.

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