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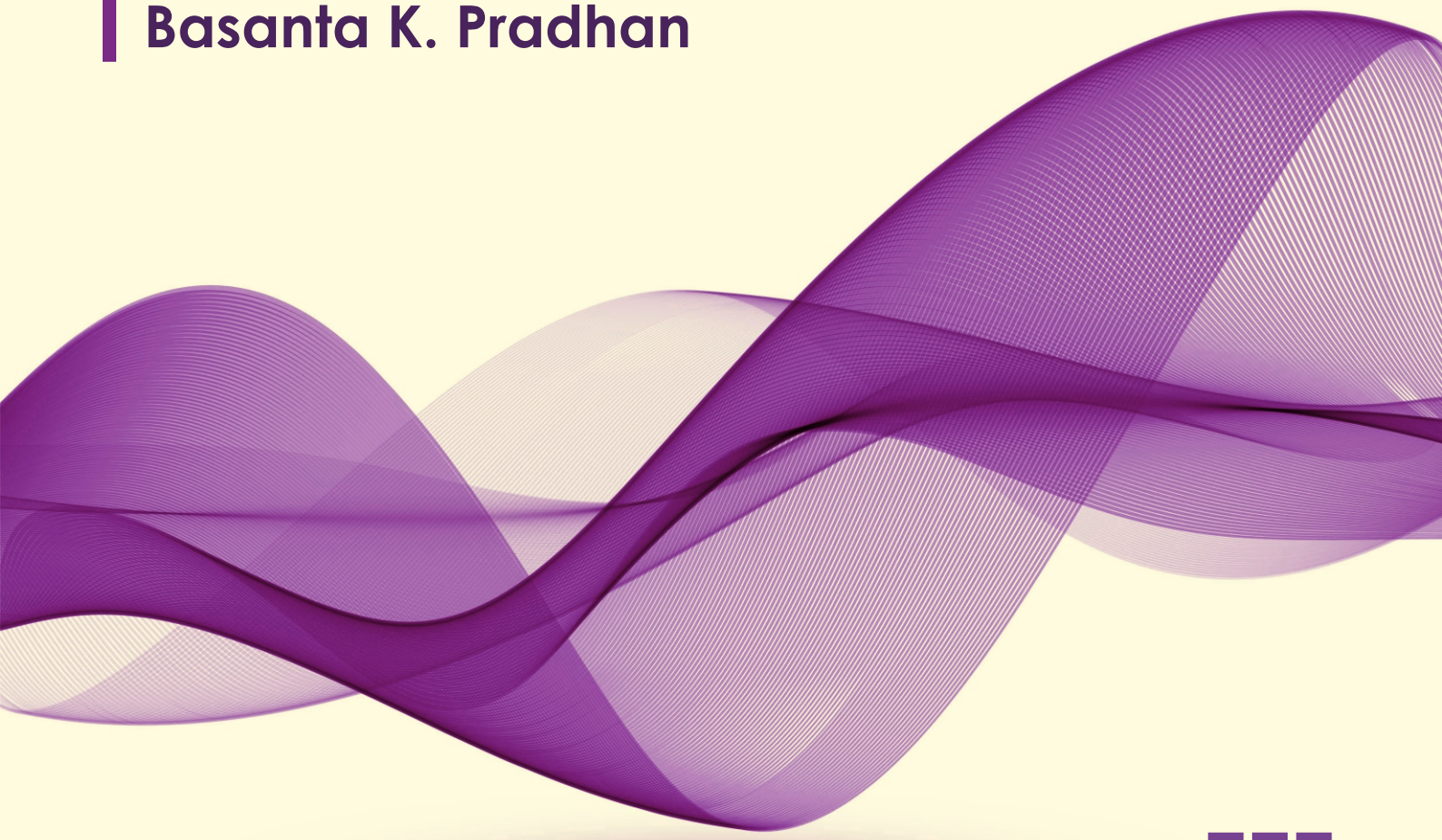

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Rashmi Rastogi,* Sangeeta Chakravarty, Basanta K. Pradhan*****

Abstract

Wagner's law explains the association between economic growth and public expenditure the expenditure increases as the economic grows. This study examines the association between economic growth and state public expenditure in the panel of low-income states in India. We consider the components of total expenditure—expenditure on social sector and economic services. Each of the expenditure is further divided into revenue and capital to find the driving force behind Wagner's law. We have considered annual data for the period from 1980-81 to 2014-15. Using Auto-Regressive Distributed Lag Model (ARDL) and Pedroni's Cointegration Test, we find that Wagner's Law holds for total expenditure and components, social sector and components, and economic services and components for panel of low-income states. Results, however, vary across the states. For Odisha and West Bengal the results are similar to regression results of panel of low-income states. For Madhya Pradesh and Chhattisgarh, Bihar and Jharkhand, economic growth leads to increase in state expenditure in economic services, while economic growth leads to increase in social sector expenditure in Rajasthan. Capital outlay in Rajasthan also tends to increase with economic growth.

Keywords: Wagner's law, Low income states, Panel data, Cointegration, ARDL
JEL lassification:

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1. Introduction

The government incurs expenditure in the economy for the welfare of society. The public expenditure is important for under-developed economies as this is the only way to provide basic infrastructure or amenities in the economy. These economies, therefore, tend to spend a larger share on basic public goods and services than developed economies. For instance, low income states[1] (major) in India have relatively higher public expenditure than high income states and middle income states. During the period 1990-95 to 2005-10, the share of public expenditure in output of low income states grew by 0.68% (CAGR) against 0.06% and 0.28% for high income and middle income states, respectively (Murugan, 2013).

Higher public expenditure in low-income states is encouraging, but these states perform poorly in economic development. The level of poverty and social deprivation is relatively higher in low-income states (Khan et al., 2014). The average growth rate of Net State Domestic Product (NSDP) of low-income states is lower (4.5% during 1990-00 and 4.8% during 2000-05) than high income (5.9% and 5.7%) and middle-income states (6.2% and 6.1%) (Murugan, 2013). The higher public expenditure and poor socio-economic conditions in low-income states raises an important question whether economic growth is accompanied with public expenditure in low-income Indian states, and which component of public expenditure is affected with economic growth in low-income states.

The nexus between economic growth and government expenditure is explained by the German economist Adolf Wagner. As the economy grows the government tends to spend more on public goods and services (Wagner, 1883). He gave three reasons for the rise in government activities- first, industrialisation increases the demand for public services such as education, health, drinking water; second, incapability of private sector in providing important economic services required for increasing industrialisation such as roads and railways, and third, growing requirement of administrative services including law and order in the economy.

Wagner's law has been mostly tested for the aggregate public expenditure incurred in developed countries and developing countries. Analyses of the group of high-income countries for the period 1950 to 2004 (Wu et al., 2010), for Germany for the period 1960-1993 (Hayo, 1996), Japan for the period 1960-2010 (Ono, 2014), Japan and Korea for the

[1] Low Income states include Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Uttarakhand, and Rajasthan.

period 1950-2005 (Mohammadi *et al,* 2008), South Africa for the period 1970-2013 (Odhiambo, 2015)— found significant impact of economic growth on aggregate public expenditure. There is a little support for Wagner's law for Argentina (1913-1971), Brazil (1861-1980), and Chile (1973-1995) (Thornton, 1998), a group of OECD countries (1950 to 2000) (Wahab, 2004), and Turkey for the period from 1965 to 2000 (Bagdigen and Cetintas, 2009).

While the impact of economic growth on aggregate public expenditure was evident in the case of high-income and upper-middle income countries, the results were mixed in the case of developing and least developed countries. The analyses for group of developing countries for the period 1950 to 2004 (Wu et al., 2010), Bangladesh for the period 1976 to 2007 (Kalam and Aziz, 2009), Ethiopia for the period 1950-2007 (Menyah and Wolde-Rufael, 2013), Lesotho for the period 1980 to 2012 (Thabane and Lebina, 2016), Fiji Islands for the period 1970 to 2002 (Narayan et. al, 2008a), and India for the period 1970 to 1999 (Sahoo, 2001)—showed results in favour of Wagner's law. However, the analyses of 41 developing countries for the period 1961-69 (Diamond, 1977), Nigeria (1985-2014) (Ajayi and Aluko, 2016), and India (1960-96 and 1960-00) (Kundrakpam, 2003, and Tulsidharan, 2006), respectively—found no evidence in favour of Wagner's law.

Although the studies using aggregate public expenditure validate Wagner's law, the driving force behind the relationship between economic growth and public sector expenditure is not clear. Therefore, the studies have decomposed aggregate public expenditure and analyses the impact of economic growth on each component of the expenditure. For the developed and upper-middle-income countries, using 1972-91data for the United States (US), Bairam (1995) found that economic growth in the US results in increase in non-defence public expenditure. Another, study by Magazzino (2012) has tested for Wagner's law at disaggregated level for Italy for the period 1960-2008 and found positive and significant results only for passive interest, and dependent labour income.

There are few studies on Wagner's law at disaggregated level for developing countries. A study by Akitoby et al. (2006) has decomposed public expenditure into total spending, current spending, spending on goods and services, wages and salaries, other goods and services, capital spending, non-interest current spending, non-interest total spending. Using the data for 51 developing countries for the period 1970-2002, they found that 70% of countries show long run relation between spending and output in at least one of the

components of public expenditure (except capital spending). For a developing country like Nigeria, the study by Chiawa et al. (2012) found positive and significant impact of national income on total recurrent expenditure and total capital expenditure.

There are hardly any studies that examine Wagner's law within a developing country. Using the data on Chinese provinces for the period between 1952 and 2003, a study by Narayan et al (2008b) supports Wagner's law for the provinces in the early phase of economic development; while there is no evidence for the law in the panel of all Chinese provinces. Another study by Narayan et al. (2012) on India used panel data of 15 major states, and decomposed total public expenditure into consumption and capital expenditure. The study found evidence in favour of Wagner's law for panel of Indian states and the law is dominated by consumption expenditure during the period 1986-87 to 2007-08. While most studies on India analyse aggregate public expenditure at national level and across states, there is no study that analyses the association between economic growth and public expenditure exclusively for low income states and at disaggregate level of state public expenditure. This study tries to fill that gap.

In this study we test whether economic growth is accompanied with public expenditure in low income states in India and whether the association exists at disaggregate level of public expenditure.[2] Low-income states make a perfect case for testing Wagner's law as these states are in the early stages of development and spend relatively large proportion of output on public expenditure. A study by Wahab (2004) suggests that Wagner's law should be tested when the economies are grouped according to their level of development. The states selected in this study were consistently ranked lower on the basis of per capita income for the period from 2011-12 to 2014-15.

We consider the components of total expenditure-—expenditure on social sector as well as economic services. These two expenditures together form development expenditure, which is relatively higher for low-income states in comparison to high-income and middle-income states (Murugan, 2013). Each category of state public expenditure is further divided into revenue and capital outlay to find the driving force behind Wagner's law. We consider annual data for low-income states from 1980-81 to 2014-15. Wagner's law for panel of low-income states is tested using Auto-Regressive Distributed Lag Model (ARDL) and Pedroni's

[2] Wu (2010) found bi-directional relationship between economic growth and public expenditure for high-income and middle-income countries, but the relationship tends to flow from economic growth to public expenditure for the group of low-income countries.

Cointegration technique. We found that Wagner's Law holds for total expenditure, social sector, and expenditure on economic services for panel of low-income states. Results also validate the law for revenue expenditure, capital expenditure, and for each of the expenditure category for panel of states. In the states of Bihar and Jharkhand, Madhya Pradesh and Chhattisgarh, and Uttar Pradesh and Uttarakhand, we find that economic growth in these states results in an increase in revenue expenditure only.

The structure of this paper is as follows. Section 2 describes the pattern of public expenditure in low-income states in India. Section 3 explains the empirical model and data sources. Section 4 discusses the results, and Section 5 concludes the paper.

2. Public Expenditure in Low-income States in India

Public expenditure in low-income states increased from 1980-81 to 2014-15. Similar pattern was observed in their revenue and capital expenditure. In order to discern the pattern of public expenditure at disaggregate level, the study considers only the components of development expenditure, including social sector and economic services, as non-development expenditure is fixed.[3] For the purpose of this section, public expenditure of all low-income states is aggregated and compared with all-India figures. Low-income states considered in the study are Madhya Pradesh, Bihar, Uttar Pradesh, Rajasthan, West Bengal, and Odisha. The three states Chhattisgarh, Jharkhand, and Uttarakhand were part of Madhya Pradesh, Bihar, and Uttar Pradesh, respectively, during the 80s and the 90s so these are added to their original states for the purpose of analysis.

Social sector expenditure is revenue expenditure and capital outlay in low-income states. Similarly, expenditure on economic services is summation of their revenue expenditure and capital outlay. Table 1 shows average public expenditure in net domestic product (NDP) of low-income states over 35 years captured in a block of five-year period from 1980 to 2014.

[3] Public expenditure is divided into two broad categories- development expenditure and non-development expenditure. Since non-development expenditures are fixed in nature, the study considers components of development expenditure including social sector and economic services.

Figure 1 shows three-period moving average of the share of development expenditure, social sector expenditure and economic service expenditure in total expenditure.[4]

The average share of public expenditure at all India level had almost remained same from 1980-81 to 2014-15. The same pattern was observed for all the components of total expenditure except capital expenditure wherein the expenditure had declined due to the cut in public expenditure in response of economic crisis in 1991 (Joshi, 2006).

Table 1: Average share of total public expenditure in net domestic product of low-income states (%)

	Total Expenditure		Revenue Expenditure		Capital Expenditure	
	Low Income States	**India**	Low Income States	India	Low Income States	India
1980-84	**16.60**	**17.81**	11.19	12.31	5.40	5.49
1985-89	**17.78**	**19.18**	13.23	14.5	4.55	4.68
1990-94	**18.53**	**18.87**	14.88	15.11	3.65	3.76
1995-99	**17.85**	**17.47**	14.88	14.49	2.96	2.97
2000-04	**24.03**	**20.03**	18.15	15.75	5.06	4.28
2005-09	**29.68**	**18.55**	17.82	14.41	5.33	4.15
2010-14	**27.52**	**18.36**	18.31	14.76	4.76	3.61
1980-2014 (35 years)	**22.71**	**19.61**	15.49	14.47	4.53	4.13

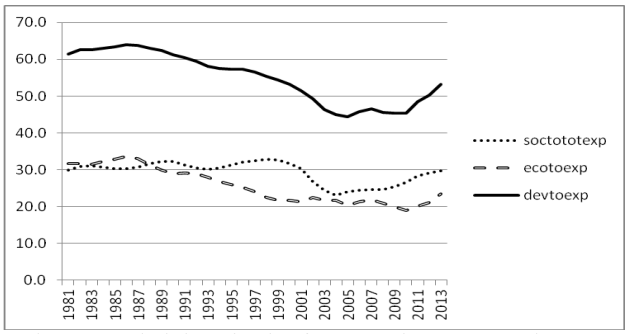
Note: The figures are simple average of five years.
*Total Public Expenditure is the sum of revenue expenditure and capital disbursements (excluding public accounts).
Source: Author's own calculation using data from State Finances, RBI and EPWRF.

The pattern of expenditure is, however, different in low-income states. These states have higher public expenditure compared to national average. In low-income states average share of total expenditure in output was 22.71%, whereas all-India average was 19.61% from 1980-81 to 2014-15. The expenditure had increased specifically during the last three and half decades on account of revenue expenditure. This is due to the increase in pay scales of government employees as per the recommendations of pay commissions, and higher interest payments (Murugan, 2013).[5]

Figure 1: Three-year Moving average of the share of development expenditure, social sector expenditure and economic services in total expenditure (%)

[4] Three-Period moving average is taken remove yearly fluctuations.

[5] Since low income states have higher public debts, the burden of interest payment had increased.



Source: Author's own calculation using data from State Finances, RBI and EPWRF.

From 1980-81 to 2013-14, the low-income states expenditure on development had declined yet these states spent a significant portion, approx. more than 50%, of total expenditure on development (except the period 2003 to 2011) (Figure 1).[6] These states incurred significant expenditure on social sector, but the share of expenditure almost remained same throughout the period, except the decline in social sector expenditure from 2001 to 2010. These states, however, do not spend much on economic services. The rise in expenditure on social services was a result of significant increase in revenue expenditure in Bihar and Jharkhand, Madhya Pradesh and Chhattisgarh, and Uttar Pradesh and Uttarakhand during the last one and half decade. In Bihar and Jharkhand the share of social sector expenditure in NSDP grew from 0.84% (CAGR) during 1980-81 to 1999-00 to 1.07% during 2000-01 to 2014-15. Odisha: the share grew from 0.88% to 1.03%. UP and Uttrakhand: the share increased by 0.79% to 2.80%.

3. Empirical Model and Data Sources

The association between public expenditure and output is explained by Wagner's law. Following Ono (2014) and Narayan et al. (2012), the relationship between government expenditure and Net State Domestic Product (NDP) for the panel of low-income states was estimated for 1980-81 to 2014-15 as follows:

$$\ln(GovExp)_{st} = \alpha_0 + \alpha_1 \ln(NSDP)_{st} + \alpha_2 D_t + \varepsilon_{st} \qquad (1)$$

where dependent variable is the real government expenditure in the low-income state *s* in year *t* and independent variable is real NDP of the low-income state *s* in year *t*. The study

6 The average share of expenditure on social sector and economic services in NSDP is approx 6% during the last three and half decades. The average expenditure by these states on social services is on par with expenditure incurred by many other countries with same level of development. Haile and Nino-Zarazua (2018) pointed out that the average social spending as a per cent of GDP in the group of 55 low income and middle-income countries (including India) were 9.28% during the period 1990 to 2009.

considers total expenditure and the expenditure for development purposes i.e. social sector and economic services. Each of these categories is divided into revenue expenditure and capital expenditure. The study, therefore, considers nine models for all the panel of low-income states and India-model 1 is total expenditure and NDP; model 2 is revenue expenditure and NDP; model 3 is capital disbursements and NDP; model 4 is social sector expenditure and NDP; model 5 is revenue expenditure on social sector and NDP; model 6 is capital outlay on social sector and NDP; model 7 is expenditure on economic services and NDP; model 8 is revenue expenditure on economic services and NDP; and model 9 is capital outlay on economic services to NDP. In all the models, Model 1 to Model 9, the coefficient of NDP of low-income states are expected to be positive indicating that the economic growth in these states results in higher public expenditure. The study also incorporates dummy variable for the year 2004 to represent impact of FRBM Act (2004) on state public expenditure.

The empirical analysis of the study is conducted using the data of six low-income states over the period of time 1980-81 to 2014-15. The data on different components of public expenditure of low income states- Odisha, Bihar and Jharkhand, Madhya Pradesh and Chhattisgarh, Uttar Pradesh and Uttarakhand, Rajasthan and West Bengal, is obtained from EPW Research Foundation.[7] Data on NSDP of these states at current and constant prices is obtained from the *Handbook of Indian Economy*, Reserve Bank of India (RBI). The data on NSDP[8] at current and constant prices of low-income states for the sample period is available at different base years i.e. 1980-81, 1993-94, 1999-00, 2004-05, and 2011-12. Both the series are converted into 2004-05 base year prices and then are used for the computation of implicit deflator to deflate public expenditure.

4. Empirical Results

The public expenditure in low-income states is relatively higher than national averages, and it has increased over the period of time. Average expenditure of low-income states stood around Rs. 1570 billion from 1980 to 2014 (Table 3). These states have higher revenue expenditure than capital expenditure. From the development perspective, these states spend

[7]In case of Jharkhand, the data on public expenditure for the period 1990-91, 2001-02 to 2007-08, and 2009-10 are revised estimates, and in case of Bihar, the data on public expenditure for the year 1994-95 are revised estimates. Accounts figures (Final) of all low-income states are available for 1980-81 to 2014-15. Since accounts estimates for the years 2015-16 and 2016-17 are not available, we have considered the time period from 1980-81 to 2014-15.
The data on public expenditure excludes public accounts.

[8] There is a debate on using Gross State Domestic Product (GSDP) or Net State Domestic Product (NSDP) for testing the determinants of public expenditure. A study, Narayan et. al (2012), on Indian states has used NSDP due to non-availability of data on GSDP.

relatively more on social sector than on economic services. While the social sector expenditure is dominated by revenue expenditure, the expenditure on economic services is driven by both revenue expenditure as well as capital outlay. This implies that expenditure on social sector is mainly to maintain the various services, but expenditure in economic services is incurred to maintain the service as well as creation of new assets.

Table 3: Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
NSDP	35	6122.6	3191.9	2545.0	13520.6
Total Expenditure	35	1570.7	1186.9	441.0	4077.8
Revenue Expenditure	35	1051.1	689.8	268.3	2739.5
Capital Disbursements	35	308.8	204.1	135.8	848.4
Social Sector Expenditure	35	427.9	304.5	115.2	1205.5
Rev-Social Sector Expenditure	35	392.5	270.7	108.8	1067.9
Capital Outlay-Social Sector Expenditure	35	35.4	35.2	6.4	137.6
Economic Services Expenditure	35	380.6	252.0	149.3	1143.4
Rev-Economic Services Expenditure	35	239.4	146.1	81.4	695.4
Capital Outlay-Economic Services Expenditure	35	141.1	110.0	50.1	448.0

Note: All the figures are in INR in billion (constant prices 2004-05 price).

Testing for Panel Unit Roots

Checking for the stationarity is important in time series analysis. The study includes time series data across low-income states on NSDP and various components of public expenditure – total expenditure, revenue expenditure, capital disbursements, total expenditure on social services, and total expenditure on economic services. Total expenditure on social services and economic services is also divided into revenue expenditure and capital outlay. We test for the stationarity in each of panel variables using standardised t-statistic as suggested by Im-Pesaran-Shin (2003).[9] The standardised t-statistic was adjusted cross-sectional dependence across low-income states. The test is performed with constant only and with both constant as well as trend component. All variables are converted to natural log. The results of the panel unit root test at the levels and at first difference of all variables are represented in Table 4.

The results of panel unit root test indicate that p-value of all variables (except 'lnres' revenue expenditure on economic services) is not significant at level, but the variables are significant in first difference in both the cases with constant and with constant as well as trend. This implies variables are stationary at first difference or integrated of order one (*I(1)).* However, the results of panel unit root are different for revenue expenditure on economic services

[9] This is a two step procedure: first, average of the individual ADF t-statistics is calculated for each panel state of a time series; and second, standardised t-statistic is computed by subtracting mean of the statistic from t-statistic and divided the difference by variance of t-statistic.

(lnres) as the p-value is significant at level as well as first difference. The series is, therefore, stationary at level or integrated of order *zero (I(0))*.

Table 4: Panel Unit Root Test- Low Income States

Variables	Level		First Difference	
	Constant	Constant & trend	Constant	Constant & trend
lnNSDP	(-) 0.35 (0.36)	(-) 1.09 (0.86)	(-) 10.40 (0.00)	(-) 9.45 (0.00)
ln(TotExp)	(-) 1.17 (0.12)	(-) 0.18 (0.57)	(-) 9.29 (0.00)	(-) 8.12 (0.00)
ln(RevExp)	(-) 1.95 (0.02)	(-) 1.10 (0.13)	(-) 9.72 (0.00)	(-) 8.55 (0.00)
ln(CapExp)	(-) 0.99 (0.15)	(-) 0.27 (0.61)	(-) 8.57 (0.00)	(-) 7.16 (0.00)
ln(Socexp)	(-) 1.62 (0.05)	(-) 0.83 (0.20)	(-) 8.96 (0.00)	(-) 7.73 (0.00)
ln(RSS)	(-) 1.70 (0.04)	(-) 1.16 (0.12)	(-) 9.19 (0.00)	(-) 7.96 (0.00)
ln(CSS)	(-) 1.92 (0.02)	(-) 0.70 (0.24)	(-) 8.66 (0.00)	(-) 7.39 (0.00)
ln(Ecoser)	(-) 2.28 (0.01)	(-) 0.67 (0.24)	(-) 9.56 (0.00)	(-) 8.15 (0.00)
ln(RES)	(-) 2.63 (0.00)	(-) 1.93 (0.02)	(-) 9.73 (0.00)	(-) 8.28 (0.00)
ln(CES)	(-) 1.32 (0.09)	(-) 0.009 (0.49)	(-) 9.60 (0.00)	(-) 8.21 (0.00)

Note: p-values are in brackets.
Null Hypothesis: all panels have Unit Root. Alternate Hypothesis: some panels are stationary.
**NSDP is Net State Domestic Product, TotExp is total public expenditure, Revexp is revenue expenditure, CapExp is capital expenditure, RSS is revenue expenditure on social services, RES is revenue expenditure on economic services, RAS is revenue expenditure on administrative services, CSS is capital expenditure on social services, CES is capital expenditure on economic services, Socexp is total expenditure (revenue + capital) on social services, and Ecoser is total expenditure (revenue+capital) on economic services.

Overall, we find that NSDP and most of the variables of expenditure are *I(1)*. Only revenue expenditure on economic services (lnres) is *I(0)*. Since NSDP and most of the expenditure variables of panel of low income states are *I(1)*, we test for the existence of long-run relationship between output and expenditure.

Panel Cointegration Test

As most of the variables are non-stationary, it is possible that the linear combination of integrated variables is also stationary; such variables are said to be co-integrated. To find out the cointegrating relationship between *I(1)* variables, we use Pedroni's Cointegration test. Pedroni (2004) proposed several test statistics for testing the null hypothesis of no cointegration in panel data model that allows for heterogeneity across panel. These are residual based test statistics wherein residuals are estimated for each individual member of

the panel. These residuals are, then, pooled in two different ways– first, pooling of residuals of regression are done - within dimension of panel, and, second, pooling of residuals is done between dimensions of the panel. The optimal lag length is selected through Schwarz information criterion (SIC). The tests were performed on all the models of panel of low-income states in India for the period 1980 to 2014 (Table 5). The test statistics representing the pooling of residuals within dimension are V-panel, rho-panel, PP-panel ADF-panel, weighted V-panel, weighted rho-panel, weighted PP-panel, and weighted ADF-panel, while those representing between dimension estimates are rho-Group, PP-Group, and ADF-Group.

Table 5: Pedroni's Co-integration Test Results

	Test Statistic										
	V-Panel	rho-panel	PP-panel	ADF-panel	V-Panel (weighted)	rho-panel (weighted)	PP-panel (weighted)	ADF-panel (weighted)	rho-Group	PP-Group	ADF-Group
Model 1	4.85 (0.00)	(-) 3.97 (0.00)	(-) 4.68 (0.00)	(-) 1.71 (0.04)	4.16 (0.00)	(-) 3.28 (0.00)	(-) 3.87 (0.00)	(-) 1.79 (0.04)	(-) 3.06 (0.00)	(-) 4.65 (0.00)	(-) 1.61 (0.0)
Model 2	3.69 (0.00)	(-) 2.66 (0.00)	(-) 3.72 (0.00)	(-) 1.93 (0.02)	2.84 (0.00)	(-) 2.38 (0.00)	(-) 3.35 (0.00)	(-) 1.74 (0.04)	(-) 1.82 (0.03)	(-) 3.82 (0.00)	(-) 1.31 (0.09)
Model 3	2.53 (0.00)	(-) 2.48 (0.00)	(-) 3.44 (0.00)	(-) 1.08 (0.13)	1.89 (0.02)	(-) 1.81 (0.03)	(-) 3.18 (0.00)	(-) 1.23 (0.11)	(-) 1.76 (0.03)	(-) 4.02 (0.00)	(-) 0.83 (0.20)
Model 4	4.72 (0.00)	(-) 4.88 (0.00)	(-) 5.71 (0.00)	(-) 1.72 (0.04)	2.94 (0.00)	(-) 3.35 (0.00)	(-) 3.98 (0.00)	(-) 1.69 (0.04)	(-) 3.40 (0.00)	(-) 5.41 (0.00)	(-) 0.92 (0.17)
Model 5	4.63 (0.00)	(-) 5.10 (0.00)	(-) 6.17 (0.00)	(-) 1.43 (0.07)	2.52 (0.00)	(-) 3.69 (0.00)	(-) 4.34 (0.00)	(-) 1.56 (0.05)	(-) 3.54 (0.00)	(-) 5.92 (0.00)	(-) 0.72 (0.23)
Model 6	2.11 (0.01)	(-) 2.57 (0.00)	(-) 2.68 (0.00)	(-) 0.66 (0.74)	2.38 (0.00)	(-) 2.64 (0.00)	(-) 2.81 (0.00)	(-) 0.66 (0.74)	(-) 1.57 (0.05)	(-) 2.69 (0.00)	1.48 (0.93)
Model 7	3.37 (0.00)	(-) 2.75 (0.00)	(-) 3.20 (0.00)	(-) 0.06 (0.52)	2.79 (0.00)	(-) 2.60 (0.00)	(-) 3.19 (0.00)	(-) 0.14 (0.44)	(-) 1.54 (0.06)	(-) 2.69 (0.00)	0.54 (0.70)
Model 8	3.47 (0.00)	(-) 2.85 (0.00)	(-) 3.34 (0.00)	(-) 0.28 (0.38)	2.62 (0.004)	(-) 4.06 (0.00)	(-) 4.44 (0.00)	(-) 0.47 (0.32)	(-) 2.49 (0.00)	(-) 3.57 (0.00)	(-) 0.00 (0.49)
Model 9	1.39 (0.08)	(-) 1.21 (0.11)	(-) 2.01 (0.02)	(-) 0.03 (0.48)	0.87 (0.19)	(-) 0.60 (0.27)	(-) 1.95 (0.02)	(-) 0.16 (0.43)	(-) 0.10 (0.45)	(-) 2.32 (0.01)	0.71 (0.76)

Note: All Statistic are distributed N(01), under a null hypothesis of no co-integration in any panel and **Alternate Hypothesis**: some panels are cointegrated.
Model 1 is total expenditure and NDP; model 2 is revenue expenditure and NDP; model 3 is capital disbursements and NDP; model 4 is social sector expenditure and NDP; model 5 is revenue expenditure on social sector and NDP; model 6 is capital outlay on social sector and NDP; model 7 is expenditure on economic services and NDP; and model 8 is revenue expenditure on economic services and NDP; and model 9 is capital outlay on economic services to NDP.

The results indicate that majority of test statistics are significant at 5% level for six models: total expenditure (Model 1), revenue expenditure (Model 2), capital expenditure (Model 3), total expenditure on social services (Model 4), revenue expenditure on social services (Model 5), capital outlay on social services (Model 6), total expenditure on economic services (Model 7), and revenue expenditure on economic services (Model 8). The long run

relationship, however, does not exist for capital outlay on economic services and NSDP (Model 9).

Panel Long Run and Short Run Estimates

Cointegration test indicates existence of long run relationship at disaggregate level of public expenditure and output. The test, however, does not provide estimates of long run relationship. We use auto-regressive distributed lag model (*ARDL)* technique to find estimates of long run and short run relationship between public expenditure and output. The technique can also be used on variables stationary at different orders *I(0)* or *I(1)*, panel unit roots tests indicate that revenue expenditure (total) and revenue expenditure on economic services are stationary at level while output is stationary at first difference.[10] The *ARDL (p,q)* specification is as follows:

$$y_{it} = \sum_{j=1}^{p} \gamma_{ij} y_{i,t-j} + \sum_{j=0}^{q} \beta'_{ij} x_{i,t-j} + dumm_{2004} + u_i + \epsilon_{it} \quad (2)$$

In equation (2) public expenditure (y_{it}) is function of own lagged values, output (x_{it}), lagged values of output, dummy variable for the period prior to the year 2004

$(dumm_{2004})$, state specific unobserved variables (u_i), and error term. The model can be reparameterised into the error correction equation as follows:

$$\Delta y_{it} = \theta_i (y_{i,t-1} \quad \varphi' x_{i,t-1}) + \sum_{j=1}^{p-1} \gamma^*_{ij} y_{i,t-j} + \sum_{j=0}^{q} \beta^{'*}_{ij} x_{i,t-j} + dumm_{2004} + u_i + \epsilon_{it}$$

(3)

The parameter $\theta_i$is the error correcting speed of adjustment term. The vector φ' indicates long run relationship between expenditure and output.

There are several approaches to the estimations of equation (3). The Mean Group (MG) estimations are performed individually for each time period and simple average of the coefficients are calculated to represent the relationship between variables. The Pooled Mean

[10] The *ARDL* technique corrects for endogeneity problem caused by simultaneity or reverse causality.

Group (PMG) approach combined MG and DFE approaches. This approach allows the intercept, short run coefficients, and error correction parameter to vary across panel variable, while the long run coefficient is assumed to be constant across panel variable. We run Hausman test to find the best estimation technique (Appendix 2). The test results indicate PMG technique for the models lntotexp-lnnsdp, lnrevexp-lnnsdp, lncapdis-lnnsdp, lnsocexp-lnnsdp, lnrss-lnnsdp, lncss-lnnsdp, lnecoser-lnnsdp, and lnres-lnnsdp and MG technique for lnces-lnnsdp. Table 6 shows PMG estimates of Model 1-Model 8, and Table 7 shows MG estimates of Model 9.

Table 6: Estimation Results: ARDL Method

(a) Long Run Estimates

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
ln(.lnnsdp)	1.392***	1.214***	0.933***	1.148***	1.141***	1.726***	1.307***	1.158***
	(0.0634)	(0.0363)	(0.0761)	(0.0355)	(0.0345)	(0.157)	(0.118)	(0.0470)
Observations	204	204	204	204	204	204	204	204

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

(b) Error Correction Term

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Panel of Low Income States	-0.203***	-0.201***	-0.343***	-0.287***	-0.305***	-0.263***	-0.228***	-0.374***
	(0.0404)	(0.0566)	(0.0844)	(0.109)	(0.0989)	(0.0719)	(0.0236)	(0.102)
Bihar and Jharkhand	-0.309***	-0.146*	-0.123	-0.131	-0.157	-0.110	-0.274**	-0.336***
	(0.115)	(0.0810)	(0.0796)	(0.101)	(0.105)	(0.0896)	(0.126)	(0.123)
MP and Chhattisgarh	-0.213**	-0.121	-0.132*	-0.0944	-0.129*	-0.317**	-0.273**	-0.844***
	(0.0915)	(0.0939)	(0.0795)	(0.0693)	(0.0753)	(0.137)	(0.123)	(0.209)
Odisha	-0.213**	-0.227**	-0.616***	-0.731***	-0.712***	-0.458***	-0.201***	-0.278***
	(0.0875)	(0.0961)	(0.170)	(0.149)	(0.148)	(0.122)	(0.0668)	(0.0898)
Rajasthan	-0.0615	-0.128	-0.487***	-0.271**	-0.279***	-0.0948	-0.127	-0.144
	(0.0499)	(0.0802)	(0.141)	(0.114)	(0.101)	(0.0812)	(0.0862)	(0.104)
UP and Uttarakhand	-0.304	-0.115	-0.238	-0.0282	-0.0864	-0.127	-0.269	-0.219
	(0.200)	(0.0938)	(0.148)	(0.0628)	(0.0744)	(0.1000)	(0.165)	(0.189)
West Bengal	-0.118	-0.471***	-0.462**	-0.466***	-0.467***	-0.472***	-0.221*	-0.424***
	(0.0891)	(0.154)	(0.197)	(0.135)	(0.138)	(0.144)	(0.122)	(0.148)

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

(c) Short Run Effects

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
				Panel of Low-Income States				
d.lnnsdp	0.189	0.336***	0.000834	0.339**	0.359***	0.347	0.146	-0.196

	(0.152)	(0.127)	(0.327)	(0.141)	(0.131)	(1.095)	(0.392)	(0.292)
dumm04	-0.0260	-0.0395	0.0699	-0.0482	-0.0455	-0.214	-0.0932	0.145
	-0.053	-0.031	(0.166)	-0.035	(0.0346)	(0.154)	(0.119)	(0.182)
Constant	-0.827***	-0.628***	-0.885***	-1.017**	-1.094***	-2.790***	-1.099***	-1.602***
	(0.183)	(0.204)	(0.221)	(0.395)	(0.355)	(0.774)	(0.130)	(0.439)
				Bihar and Jharkhand				
d.lnnsdp	0.198	0.101	0.259	0.232	0.229	0.408	0.415	0.439
	(0.283)	(0.258)	(0.648)	(0.343)	(0.335)	(0.739)	(0.532)	(0.396)
dumm04	0.0831	-0.00100	0.207	-0.0686	-0.0613	-0.121	-0.0128	0.0348
	(0.100)	(0.0920)	(0.225)	(0.117)	(0.115)	(0.256)	(0.184)	(0.140)
Constant	-1.276**	-0.419	-0.310	-0.430	-0.531	-1.119	-1.330*	-1.442**
	(0.515)	(0.278)	(0.235)	(0.388)	(0.405)	(0.963)	(0.687)	(0.569)
				Madhya Pradesh and Chhattisgarh				
d.lnnsdp	0.566***	0.688***	-0.0616	0.334**	0.356**	1.323	0.824**	1.296***
	(0.180)	(0.153)	(0.654)	(0.159)	(0.161)	(0.842)	(0.389)	(0.394)
dumm04	0.133**	-0.0655	0.612***	-0.0272	-0.0205	-0.0381	-0.00178	-0.134
	(0.0564)	(0.0489)	(0.202)	(0.0476)	(0.0491)	(0.251)	(0.123)	(0.142)
Constant	-0.896**	-0.372	-0.320	-0.306	-0.444	-3.388**	-1.314**	-3.583***
	(0.385)	(0.327)	(0.241)	(0.273)	(0.299)	(1.568)	(0.567)	(0.858)
				Odisha				
d.lnnsdp	-0.279	-0.0704	-0.416	0.139	0.0874	0.577	-0.253	0.0637
	(0.208)	(0.169)	(0.509)	(0.266)	(0.276)	(0.687)	(0.235)	(0.228)
dumm04	-0.0155	0.0610	-0.0112	-0.111	-0.0774	-0.895***	-0.0584	-0.183*
	(0.0888)	(0.0694)	(0.227)	(0.113)	(0.117)	(0.309)	(0.109)	(0.104)
Constant	-0.777**	-0.643**	-1.547***	-2.564***	-2.495***	-4.651***	-0.879***	-1.116***
	(0.332)	(0.304)	(0.474)	(0.545)	(0.540)	(1.245)	(0.284)	(0.382)
				Rajasthan				
d.lnnsdp	0.182	0.187*	0.488	0.358***	0.346***	0.289	0.0831	0.0731
	(0.125)	(0.111)	(0.314)	(0.117)	(0.104)	(0.391)	(0.259)	(0.269)
dumm04	-0.00527	-0.0670	0.352*	-0.0726	-0.106*	0.0335	0.00530	0.0625
	(0.0719)	(0.0611)	(0.190)	(0.0633)	(0.0570)	(0.227)	(0.149)	(0.154)
Constant	-0.203	-0.355	-1.259***	-0.931**	-0.986***	-0.847	-0.569	-0.558
	(0.209)	(0.264)	(0.367)	(0.413)	(0.377)	(0.771)	(0.415)	(0.456)
				Uttar Pradesh and Uttarakhand				
d.lnnsdp	0.641	0.659	1.026	0.986***	0.980***	3.880**	1.282	1.282
	(0.548)	(0.402)	(1.424)	(0.359)	(0.366)	(1.597)	(1.235)	(1.137)
dumm04	-0.129	-0.161**	-0.229	0.117**	0.112*	0.124	-0.665***	-0.841***
	(0.118)	(0.0741)	(0.244)	(0.0574)	(0.0586)	(0.262)	(0.236)	(0.256)
Constant	-1.349	-0.359	-0.591	-0.0929	-0.329	-1.509	-1.385	-0.976
	(0.901)	(0.338)	(0.437)	(0.257)	(0.306)	(1.182)	(0.860)	(0.859)
				West Bengal				
d.lnnsdp	-0.172	0.455	-1.290	-0.0146	0.156	-4.394	-1.474	-1.008
	(0.548)	(0.476)	(1.554)	(0.635)	(0.640)	(3.299)	(1.475)	(1.438)
dumm04	-0.222***	-0.00362	-0.511*	-0.126	-0.120	-0.387	0.173	-0.0947
	(0.0802)	(0.0647)	(0.295)	(0.0941)	(0.0946)	(0.482)	(0.218)	(0.212)
Constant	-0.464	-1.623***	-1.280**	-1.778***	-1.781***	-5.229***	-1.119*	-1.939***
	(0.402)	(0.558)	(0.645)	(0.519)	(0.525)	(1.695)	(0.669)	(0.714)

Note: Estimations of panel data are based on 204 observations and 6 groups.
*,**,*** indicates significant at level of 10%,5%,1%, respectively.

The results of long run elasticity (Table 6 (a)) indicates that coefficient of ln(NSDP) is positive and significant in all the specifications (Model 1 – Model 9), indicating the long run

relationship between expenditure (and components) and NSDP. In all the models (except state capital expenditure) the coefficient of ln(nsdp) is greater than unity, indicating that the increase in demand for expenditure is higher than increase in output. For instance, a 1% increase in NSDP leads to 1.39% increase in total expenditure.

The estimates of error correction term signify long run relationship between state public expenditure and NSDP (Table 6(b)). For the panel of low-income states, the coefficient of error correction term is negative and significant for the Model 1- Model 8. The coefficient indicates speed of adjustment, for instance the estimate of (-) 0.20 in case of Model 1 indicates that approximately 20% of disequilibrium, caused by previous year shocks, re-converges to the long run equilibrium.

For individual low-income states, the coefficient of error correction term in all the models is negative and significant for Odisha and West Bengal (except Model 1 and Model 7). For Bihar and Jharkhand, and MP and Chhattisgarh, the long run relationship exists in Model 1 (lntotesp-lnnsdp), Model 7 (lnecoser-lnnsdp), and Model 8 (lnres-lnnsdp). In case of Rajasthan, Wagner's law holds for Model 3 (lncapdis-lnnsdp), Model 4 (lnsocexp-lnnsdp), and Model 5 (lnrss-lnnsdp).

The results of short run elasticity are shown in Table 6 (c). For the panel of low-income states, short run relationship exists for Model 2 (lnrevexp-lnnsdp), Model 4 (lnsocexp-lnnsdp), and Model 5(lnrss-lnnsdp). In MP and Chhattisgarh, the coefficient of lnnsdp is positive and significant for total expenditure (Model 1), revenue expenditure (Model 2), social sector and revenue expenditure on social sector (Model 4 & Model 5), and economic services and revenue expenditure on economic services (Model 7 & Model 8). In Rajasthan, and Uttar Pradesh and Uttarakhand, the short run relationship between expenditure and NSDP exists for social sector expenditure and revenue expenditure on social services.

The results for capital outlay in economic services show that long run relationship exists for low-income states- Rajasthan and West Bengal. The results are confirmed with negative and significant coefficient of error correction term. The short run relationship does not exist for capital outlay on economic services and NSDP.

The dummy variable for the year 2004 is significant and positive for total expenditure (MP and Chhattisgarh), capital expenditure (MP and Chhattisgarh), capital outlay in economic services (MP and Chhattisgarh), social sector expenditure (UP and Uttarakhand) indicating increase in related expenditure in the post FRBM period. The coefficient of dummy variable was significant and negative for total expenditure (West Bengal), revenue expenditure (UP and Uttarakhand), capital outlay in social sector (Odisha), economic services expenditure (UP

and Uttarakhand), and revenue expenditure on economic services (UP and Uttarakhand) indicating decline in expenditure in the post FRBM period.

Table 6: Mean Group Estimations: Capital Outlay in Economic Services (lnCES-lnNSDP)

	Panel of Low Income States	Bihar and Jharkhand	Madhya Pradesh and Chhattisgarh	Odisha	Rajasthan	UP and Uttarakhand	West Bengal
Long Run Estimates							
L.lnnsdp	1.529***	2.280***	1.552**	1.360*	0.885***	2.210**	0.888***
	(0.251)	(0.874)	(0.658)	(0.785)	(0.123)	(1.050)	(0.242)
ECT	-0.296***	-0.230*	-0.133	-0.186	-0.669***	-0.158	-0.400**
	(0.0840)	(0.118)	(0.0932)	(0.141)	(0.183)	(0.121)	(0.166)
Short Run Effect							
D.lnnsdp	-0.196	0.326	-0.825	-0.804	0.622	0.401	-0.896
	(0.292)	(1.346)	(0.740)	(0.500)	(0.504)	(2.142)	(2.314)
D.dumm04	0.145	-0.0876	0.551**	0.183	-0.00778	-0.494	0.725**
	(0.182)	(0.466)	(0.223)	(0.237)	(0.291)	(0.330)	(0.340)
Constant	-1.792***	-2.908*	-0.956	-1.048**	-2.203***	-2.021*	-1.616*
	(0.303)	(1.589)	(0.721)	(0.512)	(0.768)	(1.222)	(0.979)
Observations	204	204	204	204	204	204	204

Overall, we find that long run relationship of expenditure with NSDP exists for total expenditure and the components, social expenditure and components, economic services and components for the panel of low-income states. The findings for panel of low-income states (except capital expenditure) are consistent with Narayan et.al (2012). They pointed out that total expenditure in low-income states had increased after 2000s due to the national policy of balanced regional development and higher transfers by central government for the major programs of poverty alleviation, family planning, health, and education. The pattern, however, differ across individual low-income states. Odisha and West Bengal are the only two low-income states wherein Wagner's law holds for total expenditure and components, social sector and components, and economic services and components (except economic services in case of West Bengal). Wagner's law holds for total expenditure and components for Bihar and Jharkhand. The long run relationship between expenditure on social services and components, and NSDP holds for Rajasthan. For economic services and components, Wagner's law holds for Bihar and Jharkhand, and MP and Chhattisgarh. Short run relationship between expenditure and NSDP exists mainly for revenue expenditure, social expenditure and revenue expenditure on social sector for panel of low-income states, MP and Chhattisgarh, Rajasthan, and UP and Uttarakhand.

5. Conclusion

The government spends a proportion of output for the welfare of society. Low-income states in India spend a significant proportion of output on public goods and services, but the overall development in these states lag behind the other states. This paper addresses the question whether economic growth is associated with public expenditure in low-income states. The study addresses this question by decomposing public expenditure into social sector expenditure and expenditure on economic services. Both categories of expenditure constitute development expenditure. Each category of expenditure is further divided into revenue expenditure and capital expenditure (capital expenditure in case of social sector and economic services represents capital outlay). The time period of the study is 1980-81 to 2014-15. The study tests for Wagner's law for total expenditure and components, social sector and components, and economic services and components for the panel of low-income states in India.

We find that economic growth in low income states leads to increase in public expenditure. In the long run, increase in the income in low-income Indian states results in more than 1% increase in expenditure on social sector and economic services. The results are, however, different for individual low-income states. The two states- Odisha and West Bengal are found to follow Wagner's law as the public expenditure on social sector and economic services had increased with increase in output (except economic services in case of West Bengal). Rajasthan incur public expenditure on social sector as the state GDP increases. In addition, the state also incurs capital expenditure on economic services, particularly, in the energy sector. Bihar and Jharkhand, and Madhya Pradesh and Chhattisgarh incur public expenditure on economic services as the GDP increases. Although states spend on social sector and economic services with economic growth, majority of expenditure is revenue in nature with the exception Rajasthan and West Bengal wherein the government spends on fixed assets economic services. Expenditure on formation of fixed assets is crucial for economic development, therefore, low income states in India should focus on capital expenditure.

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Appendix 1: Ranking of States based on Per Capita Income (in Rs, at 2011-12 prices) for the period 2011-12 to 2014-15

State	Per Capita NSDP for the year 2011-12	**Rank 2011-12**	Per Capita NSDP for the year 2012-13	**Rank 2012-13**	Per Capita NSDP for the year 2013-14	**Rank 2013-14**	Per Capita NSDP for the year 2014-15	**Rank 2014-15**	**Average Per Capita NSDP 2011-12 to 2014-15**	**Rank**
Bihar	21750	1	22201	1	22776	1	23223	1	22488	1
Uttar Pradesh	32002	2	32908	2	34044	2	34583	2	33384	2
Madhya Pradesh	38551	3	41287	4	42778	4	44336	4	41738	4
Manipur	39762	4	38954	3	41441	3	44101	3	41064	3
Assam	**41142**	5	41609	5	43002	5	44809	5	42640	5
Jharkhand	41254	6	44176	6	43779	6	48781	6	44497	6
Tripura	47079	7	50366	7	54429	10	63642	13	53879	10
Odisha	48370	8	50714	8	54109	9	54211	8	51851	7
West Bengal	51543	9	53157	10	53811	7	54520	9	53258	9
Nagaland	53010	10	55482	11	58619	11	60372	11	56871	11
Jammu & Kashmir	53173	11	52406	9	54088	8	50724	7	52598	8
Chhattisgarh	55177	12	56777	12	61409	14	61122	12	58621	13
Rajasthan	57192	13	58441	13	61053	13	64496	14	60295	14
Mizoram	57654	14	60261	15	67592	15	85056	16	67641	15
Meghalaya	60013	15	59703	14	58681	12	55936	10	58584	12
Andhra Pradesh	69000	16	68865	16	72254	16	79174	15	72323	16
Arunachal Pradesh	73068	17	72820	17	77044	17	87973	17	77726	17
Punjab	85577	18	88915	18	93238	18	95807	18	90884	18
Gujarat	87481	19	96683	23	102589	24	111370	24	99531	24
Himachal Pradesh	87721	20	92672	20	98816	21	105241	21	96113	21
Andaman & Nicobar Islands	88177	21	90064	19	94570	19	100754	19	93391	19
Karnataka	90263	22	94375	22	101858	23	105697	22	98048	22
Telangana	91121	23	92732	21	96039	20	101424	20	95329	20
Tamil Nadu	92984	24	96890	24	101559	22	106189	23	99405	23
Kerala	97912	25	103551	25	107846	25	112444	25	105438	25
Maharashtra	99564	26	103904	26	109398	26	114750	26	106904	26
Uttarakhand	100305	27	106318	27	112803	27	118788	28	109553	27
Haryana	106085	28	111648	28	119522	28	124302	29	115389	28
Puducherry	119649	29	119196	29	129127	29	117102	27	121269	29
Sikkim	158667	30	160553	30	168897	30	180675	30	167198	30
Chandigarh	159116	31	169492	31	180779	31	183029	31	173104	31
Delhi	185361	32	193175	32	202216	33	215726	32	199120	32
Goa	259444	33	220019	33	188358	32	241081	33	227226	33

Source: Own Calculation using Data from CSO.

Appendix 2: Hausman Test for PMG *vs* MG

	Lntotexp-nsdp	Lnrevexp-nsdp	Lncapdis-nsdp	Lnsocexp-nsdp	Lnrss-nsdp	Lncss-nsdp	Lnecoser-nsdp	Lnres-nsdp	Lnces-nsdp
Chi-squared	3.24	2.42	3.48	3.44	2.92	0.22	0.01	0.001	5.63
p-val	0.07	0.12	0.06	0.06	0.08	0.64	0.91	0.96	0.01

Note: Null Hypothesis is difference in coefficients is not systematic.

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