CHAPTER V
PUBLIC EXPENDITURE DETERMINATION IN INDIAN STATES
- AN APPLICATION OF SUR MODEL

5.1 INTRODUCTION

The causal relationship between expenditure and tax revenue of Indian states shows that tax revenue causes expenditure. In addition, the expenditure is also mounting rapidly owing to the influence of various socio-economic and political factors. Hence, an attempt has been made in this chapter to identify a group of variables influencing State expenditures. The determinant variables considered for this analysis are: 1) Tax revenue, 2) Grants-in-aid, 3) State debt, 4) Primary sector contribution, 5) Literacy rate, 6) Density of population, 7) Percentage of urban in the total population, 8) Percentage of Scheduled caste/ Scheduled tribes in the total population and 9) National income at current prices.

5.1.1 TAX REVENUE

The size of tax revenue of the States significantly influences the growth of public expenditure as tax revenue represents the financial status of the state. Further, it influences the pattern and composition of production by the allocation of resources between different
sectors. Thus taxation through its productive and
distributive effects influences positively the growth of
public expenditure.

5.1.2 GRANTS-IN-AID

Grants-in-aid which constitute the revenue
receipts of the State has a positive influence on public
expenditure. Grants are given to cover the gap between
revenue and expenditure needs of the states. Hence an
increase in grants is always followed by an increase in the
outlay of the state government, thereby influencing the
State government budgets. In addition, when the resources
available with the State governments increase, the budgetary
income effect is created. Therefore, the grants-in-aid
influences positively the revenue expenditure.

5.1.3 STATE DEBT

The States borrow mainly for the purpose of
financing development programmes on capital account such as
the development of agriculture, industries and allied
services owing to the mounting obligations and debt
servicing charges, it influences negatively certain items of
expenditure.

5.1.4 DENSITY OF POPULATION

Demographic factors are an important determinant
of public expenditure. An absolute rise in the size of
population calls for an absolute expansion of basic development services, which will have a positive influence on public expenditure. In addition, it may also have an inverse relationship with public expenditure due to the emergence of economies of scale in public spending.

5.1.5 PERCENTAGE OF SCHEDULED CASTE/ SCHEDULED TRIBES IN THE TOTAL POPULATION

This structural factor in population influences positively the State government expenditure as the government has to spend more on the upliftment of the weaker sections of the society.

5.1.6 PERCENTAGE OF URBAN POPULATION IN TOTAL POPULATION

Increased urbanisation is an important cause of rising public expenditure. The increased demand for economic and social services such as water supply, traffic service and control, public protection, and of health and sanitation results in an increased outlay of state governments.

5.1.7 LITERACY RATE

Literacy rate has a positive relationship with the expenditure as it is correlated with economic development
which in turn results in the demand for higher development expenditure such as health and educational services.

5.1.8 PRIMARY SECTOR CONTRIBUTION

The change in the percentage share of the primary sector in the State Domestic Product (SDP) represents the change in the structure of the economy from agrarian to non-agrarian economy, which calls for higher levels of public expenditure. Hence, this factor has an inverse relationship with public spending.

5.1.9 NATIONAL INCOME AT CURRENT PRICES

One of the important factor on the demand side which explains the relative rise in public expenditure is the increase in national income. An increasing in national income is associated with an increase in demand for social and economic services, and results in the growth of public expenditure.

5.2 MODEL

In order to examine the group of determinants of each item of public expenditure among the explanatory variables and to identify the significant factors associated with each item of expenditure, a Seemingly Unrelated
Regression (SUR) model is proposed and estimated. The states involved in this respect is specified as follows:

\[
\ln Y_{jt} = \beta_{0i} + \sum_{j} \beta_{ij} \ln X_{ijt} + e_{jt}
\]

\[i = 1,2,\ldots,9\]
\[j = 1,2,\ldots,14\]
\[t = \text{sample period.}\]

Where

\[Y_1 = \text{total capital expenditure}\]
\[Y_2 = \text{Development Capital Expenditure}\]
\[Y_3 = \text{Capital expenditure on agriculture}\]
\[Y_4 = \text{Capital expenditure on industry}\]
\[Y_5 = \text{Capital expenditure on public health}\]
\[Y_6 = \text{Non-development capital expenditure}\]
\[Y_7 = \text{Total revenue expenditure}\]
\[Y_8 = \text{Development revenue expenditure}\]
\[Y_9 = \text{Revenue expenditure on agriculture}\]
\[Y_{10} = \text{Revenue expenditure on industry}\]
\[Y_{11} = \text{Revenue expenditure on public health}\]
\[Y_{12} = \text{Revenue expenditure on education}\]
\[Y_{13} = \text{Non-development revenue expenditure}\]
\[Y_{14} = \text{Expenditure on administrative services}\]
\[X_1 = \text{Total tax revenue}\]
\[X_2 = \text{Grants-in-aid}\]
\[X_3 = \text{Total debt of the state}\]
$X_4$ = Primary sectoral contribution
$X_5$ = Literacy rate
$X_6$ = Density of population
$X_7$ = Percentage of urban population in the total population
$X_8$ = Percentage of scheduled caste/scheduled tribe in the total population
$X_9$ = National income at current prices

Since some of the explanatory variables form a sub set of some other explanatory variables, one cannot obtain a more efficient estimator of $\beta_{ij}$ by considering the whole system. Hence, the Zellner's seemingly unrelated regression technique to estimate the coefficients is adopted as follows:

i) Compute $S_{ij}$ from the ordinary least square residuals and obtain $\hat{A}_i^{-*}$

Where

$$S_{ij} = \frac{e_i e_j}{(n-k_i)^{1/2} (n-k_j)^{1/2}}$$

Where $k_i$ denotes the number of columns in $x_i$ and

$q \times q$ =
\[
\begin{pmatrix}
\sigma_{11} & \sigma_{12} & \cdots & \sigma_{1m} \\
\sigma_{21} & \sigma_{22} & \cdots & \sigma_{2m} \\
\vdots & \vdots & \ddots & \vdots \\
\sigma_{m1} & \sigma_{m2} & \cdots & \sigma_{mm}
\end{pmatrix}
\]
ii) Compute the elements of $\mathbf{Z}^{-1}$ and substitute it in the following

\[
\begin{bmatrix}
\sigma_{11}x_1'x_1 & \sigma_{12}x_1'x_2 & \cdots & \sigma_{1m}x_1'x_m \\
\sigma_{21}x_2'x_2 & \sigma_{22}x_2'x_2 & \cdots & \sigma_{2m}x_2'x_m \\
\vdots & \vdots & \ddots & \vdots \\
\sigma_{m1}x_m'x_m & \sigma_{m2}x_m'x_2 & \cdots & \sigma_{mm}x_m'x_m
\end{bmatrix}
\begin{bmatrix}
\mathbf{y} \\
\mathbf{y}
\end{bmatrix}
= 
\begin{bmatrix}
\sigma_{1j}x_1'y_j \\
\sigma_{2j}x_2'y_j \\
\vdots \\
\sigma_{mj}x_m'y_j
\end{bmatrix}
\]

where $x_i$ are the explanatory variables, $y$ is the response variable, and $m$ is the number of equations.

to compute $bx$

iii. Using $bx$, compute a new set of residuals $e_x = y - Xbx$

iv. Partition $e_x$ in the subvectors corresponding to each equation and use these subvectors to compute new $S_{ij}$, thus starting the process all over again.

In the log linear multiple regression results reveal high $R^2$ values that is why most of the regression coefficient are insignificant. This is due to the presence of multicollinearity problem among the explanatory variables. Hence seemingly unrelated regression model has been used to examine the determinants of each item of expenditure. Then, for estimating seemingly unrelated regression model (SUR) an iterative process was adopted for each item of expenditure.
For examining the factors associated with different items of expenditure, each item of expenditure was aggregated at current prices of twenty-two Indian States, viz. Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, and West Bengal. The period selected for the present study was 1969-70 to 1988-89.

5.3 ANALYSIS OF EXPENDITURE DETERMINANTS

Public expenditure of the states is divided into two categories. They are (i) Capital and (ii) Revenue expenditure. Capital expenditure in turn is classified as development and non-development capital expenditure. Development capital expenditure is further divided into expenditure on agriculture, industries, and public health while the revenue expenditure is divided into development and non-development revenue expenditure. Development revenue expenditure consists of expenditure on agriculture, industry, public health, and education. Under non-development revenue expenditure, expenditure on administrative services is also considered.
5.3.1 DETERMINANTS OF TOTAL CAPITAL EXPENDITURE

Equation 1 in Table 5.1 explains the factors influencing the capital Expenditure of Indian states. The $R^2$ and $R^2$ of this equation are 0.9954 and 0.9938 respectively and hence, the model has a good fit. Further, the fitness of the equation is explained by the variables such as tax revenue, grants-in-aid, state debt, percentage of urban population in the total population, and national income at current prices. However, one per cent increase in tax revenue and percentage of urban population to the total population lead to an increase of 0.49 per cent and 4.41 per cent of capital expenditure respectively whereas, the debt of the state is negatively associated with this item of expenditure. The tax revenue constituting the financial position of the states and the urbanisation representing a higher demand for public services influence capital expenditure positively. But the state debt and its services representing the future obligations on the part of the state government influences negatively this item of expenditure.

5.3.2 FACTORS INFLUENCING DEVELOPMENT CAPITAL EXPENDITURE

The determinant factors of development capital expenditure are presented in Equation 2 in Table 5.1. The
### Table 5.1: Determinants of State Expenditure - SUR Model Results

<table>
<thead>
<tr>
<th>Dependent Variables:</th>
<th>Y1</th>
<th>Y2</th>
<th>Y3</th>
<th>Y4</th>
<th>Y5</th>
<th>Y6</th>
<th>Y7</th>
<th>Y8</th>
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<td>X1</td>
<td>0.49028</td>
<td>0.80138</td>
<td>(3.3452)</td>
<td>(3.7409)</td>
<td>0.55418</td>
<td>0.1752</td>
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<td>X2</td>
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<td>(1.6413)</td>
<td>(4.5468)</td>
<td>(1.0068)</td>
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<tr>
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<td>1.54418</td>
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<td>-0.4613</td>
<td>0.1852</td>
<td>0.0385</td>
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<tr>
<td>(4.1900)</td>
<td>(2.7355)</td>
<td>(2.2557)</td>
<td>(1.3734)</td>
<td>(0.1725)</td>
<td>(0.7635)</td>
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<td>X4</td>
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<td>0.4675</td>
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<td>X7</td>
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<td>0.9943</td>
<td>0.9459</td>
<td>0.9140</td>
<td>0.8957</td>
<td>0.5404</td>
<td>0.9986</td>
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<tr>
<td>R²</td>
<td>0.9938</td>
<td>0.9927</td>
<td>0.9266</td>
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<td>0.9982</td>
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**Note:** All values are in logs.

**Figures in parentheses show 't' values**

$\dagger$ Significance at -1 per cent level

$\dagger\dagger$ Significance at 5 per cent level

$\dagger\dagger\dagger$ Significance at 10 per cent level

$\dagger\dagger\dagger\dagger$ Subset regression and logarithmic regression results are presented in Appendix I to IV
<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Y9</th>
<th>Y10</th>
<th>Y11</th>
<th>Y12</th>
<th>Y13</th>
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<td>10</td>
<td>11</td>
<td>12</td>
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<td>Constant</td>
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<td>0.5324**</td>
<td>0.3466*</td>
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<td>(2.5607)</td>
<td>(3.8328)</td>
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<td>-0.0637</td>
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<td>(3.7875)</td>
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<tr>
<td>$I_8$</td>
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<tr>
<td>$I_9$</td>
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<td>0.9991</td>
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<td>0.9793</td>
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<td>0.6683</td>
<td>1.6973</td>
<td>0.9498</td>
<td>1.3404</td>
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</table>

Note: All values are in logs

Figures in parentheses show 't' values

* Significance at 1 per cent level
** Significance at 5 per cent level
*** Significance at 10 per cent level
equation is the best fit since the $R^2$ and $\bar{R}^2$ values are significantly high. The present equation considered the explanatory variables such as tax revenue, grants-in-aid, percentage of Scheduled Caste and Scheduled Tribe in the total population, and density of population. But variables such as tax revenue and percentage of Scheduled Caste and Scheduled Tribes in the total population are significant at one per cent level, and the density of population is significant at five per cent level. One per cent increase in tax revenue and percentage of scheduled caste and scheduled tribes in the total population contribute 0.8 per cent and 3.07 per cent respectively in this item of expenditure. However, an increase of one per cent density of population leads to a decline of 7.09 per cent of development capital expenditure.

Tax revenue, indicating the financial status of the government, is associated positively with development capital expenditure. The recent increase in the provision of economic and welfare services to the vulnerable section of the community, i.e., Scheduled Castes and Scheduled tribe may be stated as the reason for the positive relationship of this variable with development capital expenditure. The density of population influences negatively this item of expenditure due to the presence of economies of scale.
5.3.3 THE DETERMINANTS OF CAPITAL EXPENDITURE ON AGRICULTURE

Equation 3 in Table 5.1 explains the factors influencing the capital expenditure on agriculture. The $R^2$ and $R^2$ values of this equation are 0.9459 and 0.9266 respectively. The explanatory variables considered for this equation are primary sectoral contribution, percentage of scheduled caste and scheduled tribes in the total population and national income at current prices which are significant at one per cent level, and grants-in-aid and total debt of the state are significant at five per cent level. One per cent increase in the total debt of the state, primary sector contribution and the proportion of scheduled caste and scheduled tribes in the total population leads to an increase of 1.54 per cent, 8.86 per cent and 41.08 per cent respectively of capital expenditure on agriculture respectively whereas grants-in-aid and national income at current prices contribute negatively to this item of expenditure.

The total debt of the state represents the financial position of the state and hence it has a positive influence on capital expenditure on agriculture. An increase in the primary sectoral contribution leads to an increase in the demand for agricultural services. Hence, this will have a positive influence on capital expenditure
on agriculture. The percentage of Scheduled caste/ Scheduled tribes in the total population which occupies the major portion of agricultural labourers, is associated positively with the capital expenditure on agriculture. Grants-in-aid, financing mostly the current expenditure of the state government has an inverse relation with this expenditure. A higher national income represents a higher stage of economic development through industrialisation. Hence, this leads to an inverse relationship between national income and capital expenditure on agriculture.

5.3.4 FACTORS INFLUENCING THE CAPITAL EXPENDITURE ON INDUSTRIES

The determinants of capital expenditure on industries is examined with the help of Equation 4 in Table 5.1. The equation is a good fit due to higher $R^2$ and $\bar{R}^2$ value. For estimating this equation the variables such as grants-in-aid, debt of the State, density of population and national income at current prices are selected. While national income at current prices and density of population are significant at one per cent level, the total debt of the state variable is significant at five per cent level. An increase of one per cent each in national income at current prices and total debt of the State leads to an increase of 2.79 per cent and 0.49 per cent of industrial capital
expenditure respectively. However, density of population negatively contributes to this item of expenditure.

An increase in national income as an indicator of economic development may have a higher elasticity of demand for public goods. Therefore, it has a positive influence on this item of expenditure. The state debt, which is utilized for the purpose of creation of capital assets, has a positive relationship with this item of expenditure while the economies of scale arising due to the density of population may be cited as the reason for the negative association of this variable with capital expenditure on industries.

5.3.5 CAPITAL EXPENDITURE ON PUBLIC HEALTH AND ITS DETERMINANTS

Equation 5 in Table 5.1 presents the factors influencing the capital expenditure on public health. The $R^2$ and $\bar{R}^2$ values of this equation are 0.8957 and 0.8584 respectively and they are fitted by taking into account variables such as grants-in-aid, state debt, density of population, percentage of urban population in the total population, and national income at current prices. But, national income at current prices and density of population are only significant at five per cent level in this equation. One per cent increase in the density of
population leads to an increase of 30.71 per cent in capital expenditure on public health, whereas an increase in national income at current prices contributes negatively to this item of expenditure.

The positive association of density of population with capital expenditure on public health may be owing to the increased demand for health services along with a rise in population, while national income contributes negatively to this item of expenditure because a higher income represent the demand for a higher level of medical and health facilities.

5.3.6 DETERMINANTS OF NON-DEVELOPMENT CAPITAL EXPENDITURE

The factors influencing capital expenditure are presented in Equation 6 in Table 5.1. The model is a good fit with $R^2$ and $\bar{R}^2$ values of 0.5041 and 0.3764 respectively. The explanatory variables such as grants-in-aid, state debt, primary sector contribution, percentage of urban population in the total population, and national income at current prices are considered for estimating this model. But only national income at current prices is significant at ten per cent level. An increase of one per cent national income at current prices leads to an increase of 6.68 per cent of non-development capital expenditure. An increase in national
income leads to an increase in economic development, which results in an increase in state activities, law and order problems, and the establishment of various administrative departments in the states. Thus, national income has a positive influence on non-development capital expenditure.

5.3.7 FACTORS INFLUENCING THE REVENUE EXPENDITURE

The estimated equation (Equation 7 in Table 5.1) of revenue expenditure determinants have a good fit with $R^2$ and $R^2$ values of 0.9986 and 0.9982 respectively. Tax revenue, grants-in-aid, density of population, and national income at current prices are considered to fit the revenue expenditure determinants equation. However, all these variables are statistically significant. An addition of one per cent each in tax revenue, grants-in-aid and national income at current prices leads to an increase of 0.55 per cent, 0.27 per cent and 0.49 per cent of revenue expenditure respectively, while density of population contributes negatively in this item of expenditure.

Tax revenue, grants-in-aid and national income the variables reflecting the financial status of the state government may be cited as reason for the positive relationship with revenue expenditure. Owing to the emergence of economies of scale, the density of population contributes negatively to development revenue expenditure.
5.3.8 DEVELOPMENT REVENUE EXPENDITURE AND ITS DETERMINANTS

Equation 8 in Table 5.1 explains the factors influencing development revenue expenditure. The $R^2$ and $\bar{R}^2$ values of this equation are 0.9964 and 0.9951 respectively, and hence it is a good fit. Further, tax revenue, grants-in-aid, state debt, density of population, and national income at current prices are considered to fit this equation. But density of population is significant only at one per cent level. One per cent increase in the density of population leads to an increase of 5.68 per cent in development revenue expenditure. An increase in the density of population is an indicator of economic development which calls for higher levels of economic services. This may be the reason for the positive relationship between density of population and development revenue expenditure.

5.3.9 DETERMINANTS OF REVENUE EXPENDITURE ON AGRICULTURE

The determinants of revenue expenditure on agriculture are examined in Equation 9 in Table 5.1. The equation is a good fit due to the high $R^2$ and $\bar{R}^2$ value. Tax revenue, grants-in-aid, primary sector contribution, percentage of Scheduled Caste and Scheduled Tribes in total population and national income at current prices are considered for estimating this model. However, grants-in-
aid and primary sector contribution are significant at five per cent level and percentage of Scheduled Caste and Scheduled Tribes in the total population is significant at one per cent level. An increase of one per cent in percentage of Scheduled caste and Scheduled tribes in the total population and primary sector contribution leads to an increase of 11.6 per cent and 1.79 per cent of revenue expenditure on agriculture respectively, while grants-in-aid contributes negatively to this item of expenditure. The primary sector contribution reflecting the agrarian structure of the economy and percentage of Schedule Caste and Schedule Tribes in the total population constituting the major portion of agricultural population result in a positive association with this item of expenditure on agriculture.

5.3.10 FACTORS DETERMINING THE REVENUE EXPENDITURE ON INDUSTRY

The estimated equation (Equation 10 in Table 5.1) for examining the factors affecting the revenue expenditure on industry are a good fit with $R^2$ and $R^2$ value of 0.9922 and 0.9901 respectively. To estimate this equation, grants-in-aid, state debt, density of population and national income at current prices are considered. But national income at current prices and density of population have only a significant impact on this item of expenditure and their
coefficient is significant at five per cent level. Further, one per cent increase in national income at current prices and density of population leads to an increase of 0.98 per cent and 6.18 per cent in industrial revenue expenditure respectively. The density of population and the rise in national income result in an increased demand for industrial services. Hence, these two variables influence positively the expenditure on industries.

5.3.11 THE DETERMINANTS OF REVENUE EXPENDITURE ON PUBLIC HEALTH

The factors influencing on revenue expenditure on public health is examined with the help of Equation 11 in Table 5.1. The $R^2$ and $\bar{R}^2$ values of this model are 0.9848 and 0.9793 respectively. Further, this model is fitted by adopting the explanatory variables such as tax revenue, grants-in-aid, state debt, literacy rate and density of population. But tax revenue and density of population are statistically significant. However, these two variables have a positive impact on public health revenue expenditure. Tax revenue reflecting the fiscal resources of the state governments and the density of population leading to an increased demand for better quality of health services are responsible for the positive relationship with the revenue expenditure on health.
5.3.12 REVENUE EXPENDITURE ON EDUCATION AND ITS DETERMINANTS

Equation 12 in Table 5.1 presents the factors influencing educational revenue expenditure. The $R^2$ and $\bar{R}^2$ values of this model are significantly high. The present equation is fitted by considering explanatory variables such as tax revenue, grants-in-aid, literacy rate, percentage of Scheduled Caste and Scheduled Tribes in the total population and national income at current prices, while tax revenue, grants-in-aid and national income at current prices are statistically significant at one per cent level. An increase of one per cent in tax revenue, grants-in-aid and national income at current prices leads to an increase of 0.35 per cent, 0.17 per cent and 0.62 per cent respectively in revenue expenditure on education. A higher national income is an indicator of economic development which results in a higher demand for educational services, tax revenue and grants-in-aid are indication of the financial position of the state which may be the reason for the positive influence of this variable on revenue expenditure on education.

5.3.13 FACTORS INFLUENCING ON NON-DEVELOPMENT REVENUE EXPENDITURE

The determinant factors of non-development revenue expenditure are examined with the help of Equation 13 in
Table 5.1. The $R^2$ and $R^2$ values of this equation are 0.9767 and 0.9705 respectively. To estimate this model, grants-in-aid, state debt, literacy rate and national income at current prices are considered. But the debt of the State and national income at current prices have a significant positive influence on this item of expenditure. The relative importance of non-development expenditure during the process of development results in the expenditure on the maintenance of law and order and establishment of various administrative departments. Hence national income, which is a sign of development, has a positive relationship with this expenditure. A higher state debt shows a higher financial position, in the short-run, to meet the expenditure of the government. This may be the reason for the presence of positive influence on non-development revenue expenditure.

5.3.14 THE DETERMINANTS OF REVENUE EXPENDITURE ON ADMINISTRATIVE SERVICES

Equation 14 in Table 5.1 explains the factors influencing the revenue expenditure on administrative services. The $R^2$ and $R^2$ values of this equation are significantly high and hence it is a good fit. Grants-in-aid, state debt, literacy rate, and national income at current prices are considered for fitting the equation of determinants of revenue expenditure on administrative
services. But national income at current prices is only statistically significant. One per cent increase in national income at current prices leads to an increase of 0.99 per cent in revenue expenditure on administrative services. National income, reflecting the growth of the economy, necessitates the establishment of administrative departments in various sectors. Hence, it has a positive relationship with this item of expenditure.

REFERENCE