CHAPTER VI

SAVING - INVESTMENT GAP AND PATTERN OF GROWTH: EMPIRICAL EVIDENCE.
6.1 In this chapter we intend to analyse some implications of additional resource mobilisation, external assistance and deficit financing as saving-investment gap filling instruments on the growth of Indian Economy. We study the implications of these three saving-investment gap filling instruments on our economy with the help of simple as well as multiple linear regression models. Prior to the discussion on our empirical work done we theoretically discuss the implications of each of the saving-investment gap filling instruments on the growth of an economy.

6.2 Additional Resource Mobilisation : Impact on Growth

Under additional resource mobilisation there are two sources of raising funds for development. The first is additional taxation which is collected in two ways: (a) by increasing the rates or reducing the rebates, of taxes, and (b) by imposing new taxes and duties and the second is the additional resource mobilisation through public sector enterprises by raising their administered prices. Here we shall discuss the implications of the first source on growth which has been the most important source in all the plans.

Additional taxation as a source of financing development has gained more and more importance continuously and resources raised from this source have increased from Rs. 255 crores in the First Plan period to Rs. 25,023 crores in the Seventh Plan period i.e., nearly 98 times increase. This trend was inevitable because of uncertain amount of ‘balance from current revenues’ and
disappointing condition of the surplus from the public enterprises. Many of the public enterprises involving huge investment are incurring heavy losses. The burden of such losses is borne mainly by the taxpayers. Thus, during the planning period, reliance on the taxation for raising additional resources has made it the main source of financing economic development.

The major objectives of India's taxation policy, as mentioned in the plan documents and various Budget speeches, may be stated as (i) to raise sufficient revenue to finance the public sector projects without severely affecting saving and investment of the private sector, (ii) to spread the tax burden on the different sections of the society so as to reduce the income and wealth inequalities, (iii) to restrain conspicuous consumption by the affluent section of the society as an anti-inflationary measure and to generate exportable surplus, (iv) to divert investment from capital intensive and luxury goods industries to labour intensive and essential industries, and (v) to mop up excess profits.

If the insufficient growth and poverty are on account of lack of resources then it is argued that the resources for public sector should be increased through additional taxation even at the cost of worsening its disincentive effects. "If, however, insufficient investment and low growth are attributed to a lack of resources, then the tax system should be designed to increase resources available for investment through additional taxation". [Meier, 1990, p.179].
The importance of public revenue from the point of view of accelerated economic development could hardly be exaggerated. Irrespective of the prevailing ideology or the political color of particular governments, the economic and cultural development of a country requires the efficient and steadily expanding provision of a whole post of non-revenue-yielding services—education, health, communication systems, and so on, commonly known as "infrastructure"—which requires to be financed out of government revenue. Besides meeting these needs taxes or other compulsory levies provide the most appropriate instrument for increasing savings for capital formation out of domestic sources. By reducing the volume of spending by consumers, they make it possible for the resources of the country to be devoted to building up capital assets.

Taxation, by diverting funds from private to public sector reduces the amount available for private consumption and investment. The effect of such diversion on investment and output depends on the employment of the funds by the government which could be either on current goods and services or investment. To the extent that public consumption goes up at the expense of private savings and investment it will have an adverse effect on total output and therefore on growth. On the other hand, the diversion of funds from private consumption to public investment would have a beneficial effect on total output and therefore on growth.

Through taxation resources can be transferred from private hands to government. Taxes curtail consumption and thereby leads to forced savings and releases resources from consumption goods
sector to the government and if the later, instead of increasing public consumption with these resources, resort to investment then it will lead to the growth of output. However, it should be noted that taxes should not amount to reduce output in the consumption sector to the extent of creating scarcity of wage goods, otherwise, it would mean an inflationary impact.

Government can impose direct taxes progressively to curb high income slabs and thereby reduce inequalities of income and wealth. But, very steep tax rates may adversely affect capacity and desire to work, save and invest which create a negative impact on private sector's economic activity. Therefore, a rational judgement in this regard is very essential. For this purpose, in taxation, the exemption limit for savings should be made flexible and investment rebates may also be offered. Considering the implications of high tax rates on household savings and investment in the private sector it is apprehended that the tax rates in India have reached almost the saturation point. That the Government of India is also aware of it can be understood from the following excerpt of the Sixth Plan document: "The traditional mechanism for mobilising additional resources has been to rely on additional taxation. As a result of progressive increase in tax rates in the past, the ratio of tax revenue to countries national income has now reached the level of 20 percent. The scope for raising additional revenues, therefore, through more changes in tax rates is rather limited". [Sixth Five Year Plan, Govt. of India, 1985–90 P. 66].
The exception is taxes in agricultural sector. Due to political and administrative reasons agricultural sector has paid a much lower share of total taxes as compared to non-agricultural sector. The result has been lower tax revenue to the States and higher tax burden on urban sector. In other words, it has created inter-sectoral and inter-class inequalities in taxation. The taxation of agriculture has a critical role to play in the acceleration of economic development since it is only the imposition of compulsory levies in the agricultural sector itself which enlarges the supply of saving for economic development. In the beginning of economic development in India it was justified to impose less taxes on agricultural sector because of very low incomes of the cultivators. But during the plan period there has been a significant increase in incomes of rural households because of heavy plan investments in agricultural sector, improvements in the technique of production and heavy tax rebates and subsides to farmers. The incomes in agricultural sector have increased but not the burden. Hence there is ample scope for the government of India to tap resources from the agricultural sector in the form of additional taxation and invest the same for augmenting national output and growth.

6.3. External Assistance - Impact on Growth:

The various sources of domestic financial resources usually fail to meet the entire needs of a development plan. The inflow of external assistance can, however, provide additional
financial resource to fill up the gap between plan investment and domestic savings. Where there is a shortage of foreign exchange the inflow of foreign capital can make a significant contribution towards meeting the external costs of development expenditure. External assistance, if available would thus serve two functions simultaneously: it would make available additional supplies of foreign exchange and also supplement the investible resources in the country.

Sources of international capital inflows are classified into official and private sources. Official sources are government and government agencies (also called bilateral lenders) and international organisations (called multilateral lenders). Private sources are commercial suppliers and manufacturers, commercial banks, other private investors which invest in foreign enterprises (direct investment) and charitable organisations which provide financial aids, goods and services and grants.

The implication of foreign assistance on growth of the recipient country depends on the extent to which aid is successfully integrated by the recipient country into its development efforts. "If financial assistance from abroad is to result in a higher rate of domestic investment leading to higher growth, it must be prevented from simply replacing domestic sources of financing investment or from supporting higher personal consumption or an increase in non-developmental current expenditures by the government" [Meier, 1990,P.234]
When foreign aid is available on a general purpose basis, the allocation of the foreign capital is decisive in determining whether it contributes as much as possible to raising the growth potential of the recipient country. The efficient allocation of investment resources then depends on the application of investment criteria in terms of the country's entire development programme, and domestic policy measures must be adopted to supplement the use of foreign assistance. Regardless of the amount of aid received, the formation of capital depends, in the last resort, on domestic action. We fully agree with the following view of Professor Meier: "It is appropriate therefore to emphasize the necessity of self help measures: unless recipient governments adopt policies to mobilise fully their own resources and to implement their plans, the maximum potential benefit from aid will not be realised. As record of foreign assistance in several countries shows, external aid may be incapable of yielding significant results unless it is accompanied by complementary domestic measures, such as basic reforms in land tenure systems, additional taxation, investment in human capital, and more efficient government administration." [Meier, 1940, P. 235]

There is considerable controversy over the contribution that aid makes to development. There has arisen a body of "radical" economic school which is questioning the very basis of foreign aid. According to this school, foreign aid by the developed countries to less developed nations is nothing but a "sophisticated instrument of control." [Weissman (ed), 1974, P.11] According to Griffin and Enos (1970) "it enables those in power to evade and avoid fundamental reforms; it does little more than
"patch plaster on the deteriorating social edifice." Drawing mostly from the experience of Latin American Countries, Griffin and Enos (1970) have tried to paint a very dismal account of foreign aid. Regressing the average growth rates of 12 Latin American countries on the ratio of aid to GNP for the period 1957-64, they found that the coefficient of regression was negative. Their regression equation was:

\[ Y = 42.97 - 6.78 \frac{Y}{A}; \quad R^2 = 0.13 \]

where \( y = \) average rate of growth of GNP, and \( A/Y = \) ratio of foreign aid to GNP. In a study by Gulati (1976), it was shown that the same 12 Latin American countries, as those chosen by Griffin and Enos, but for the period 1966-69, there was no significant correlation between growth and aid. The regression equation was

\[ Y = 0.29 \frac{A}{C}; \quad R^2 = 0.06 \]

where \( Y = \) rate of growth of GNP, \( A/C = \) ratio of aid to GNP.
The sign of the regression coefficient was positive though not different from zero; the 't' value of the regression coefficient was not significant at 5% level. Thus the hypothesis that foreign aid promotes growth cannot be accepted. The same conclusion followed when the size of the sample was increased to 38 by including some other developing countries of Asia, Africa and Latin America. In this case also the regression coefficient for aid was positive but not significant at 5 per cent level. However, analysing the impact of foreign aid on Growth, Gulati (1976) concludes, "........... foreign aid has no adverse effect on the growth rate of gross domestic product of the less developed countries during the last decade. The statistically weak but positive correlation between aid and growth can be explained by the failure of the donors to follow the strict economic criteria for disbursement among the less developed countries. The policies of the aid recipients also were responsible for this weak relation."[P. 160].

The radical attack on foreign aid is based on the laxity in government efforts in less developed countries to introduce necessary institutional changes for greater accumulation, and saving. In fact, the domestic saving rate might decline as a result of an inflow of foreign capital. As Griffin and Enos (1970) have put it, "as long as the cost of aid (e.g., the rate of interest on foreign loans) is less than the incremental output capital ratio, it will 'pay' a country to borrow as much as possible and substitute foreign capital for domestic savings."[P.320].

Contrary to the view that foreign assistance only has the effect of supplementing domestic saving in the recipient country,
Suggestions for a strategy for more rapid development utilizing substantial amounts of external assistance have been set out in several papers (e.g. Chenery and Bruno, 1962; Mckinon, 1964). These studies suggest that a moderate volume of external resources may make possible a substantial increase in the rate of growth of a developing economy through financing additional investment as well as through providing the additional imports required to sustain higher levels of income. The key elements in this process are the response of the country to the availability of external resources and its ability to replace these resources over time by changes in the structure of its production and its use of income. In the context of foreign aid and development policy of the recipient country, Irma Adelman and Hollis Chenery (1966) observe that "A transfer of external resources enables the recipient to raise the level of investment and to increase the supply of commodities that are not domestically produced. The first requirement of development policy under these circumstances is to allocate a sufficient portion of the import surplus to increased investment and to the import of commodities needed to prevent bottlenecks in production. Continuation of a substantial resource transfer implies adjustments in the structure of domestic production and income use to accommodate this element in total supply. Once a growth process is established, changes in the economic structure in the direction of increased savings, import substitution and increased exports are required in order to reduce the dependence on external resources. The development policies which were appropriate to the earlier period of maximizing growth with a large volume of foreign aid will then have to be modified in order to bring about the structural changes required." (P.183)

As in case of inflation the impact of EA (External
Assistance on growth cannot be ascertained if the purpose for which EA is used is not known. However, we could not obtain detailed data of EA relating to purpose for which it is used. If EA is used for unproductive purposes then its impact on growth will be negative. On the basis of the aggregate data of EA we could find the aggregate effect of EA on growth which may fail to reveal the actual situation.

6.4. Deficit Financing & Impact on Growth

Deficit financing, for economic development of India, was first recommended by the framers of the Bombay Plan in 1948. This method, however, was put into practice for the first time in India while implementing the First Five Year Plan. A continuous increase in development expenditure in the public sector brought about a change in the budgetary trend. Even to attend the modest outlay targets in the plans, total resources always fell short of requirements. The inevitable result was increasing recourse to deficit financing.

Some official as well as non-official views on the experiment of deficit financing for economic development were advanced during the very First Plan period. The International Monetary Fund Mission visited India in 1953 and presented its report on 'Economic Development with Stability' to the Government of India. In this report the Mission observed that as the Indian economy developed, more money would be needed for increase in production also for increasing monetisation. Such increase in money supply would be necessary for maintenance of stability in the economy. The Mission experts were of the opinion that "Deficit financing which is used to secure appropriate money
supply and to direct real resources to the government for its investment is clearly essential to the success of the plan. If deficit financing is undertaken without regard to its effects on money supply and the availability of resources, it will inevitably lead to inflation and hamper the achievement of the plan."

Many economists have assumed deficit financing as an effective means for financing development plans of less developed countries. They argue that when deficit financing is meant for financing development expenditure which is allocated for those projects which yield quick returns then with full increasing supply of real goods, inflationary pressure will be nullified. Again with the rising income then, more savings will be generated which will make it possible to have further investment on a larger scale. Prof. Hirschman's theory of unbalanced growth advocates a continuous dose of deficit financing for accelerated economic growth. Dr. V.K.R.V. Rao (1953) was ready to accept deficit financing for economic development from the very beginning for economic planning in India. He pointed out both its uses and abuses and he wanted that the safe limit of deficit financing should not be crossed because it will then lead to hyper inflation and no growth. Dr. R.N. Bhargava another eminent Indian economist, was also in favour of the use of deficit financing because through deficit financing the government could use resources much earlier than would otherwise be possible. It thus accelerates the pace of development.

Deficit financing can give a boost to development process. It makes optimum use of unutilised resources possible through effective mobilisation in the country’s economy. Again, deficit
financing may cause a price rise and reduction in consumption. Thus, it implies a forced saving. When this forced saving leads to capital formation, productivity and output increase, which in turn brings down the price level. Thus, inflation for the purpose of capital formation is in due course self-destructive. However, the very purpose of deficit financing for economic development will be served provided that the following points are taken care of:

1. It should be used only moderately.
2. A constant vigil must be fixed on price indices while resorting to deficit financing.
3. The prices of essential goods should be controlled. Food supplies should be adequately arranged to stabilise food prices.
4. Cost push inflation should be checked by checking a rise in wages and salaries.
5. Public administration should be efficient and honest.


In this section we proceed to analyse empirically the impact of the three S-I gap-filling instruments, namely, ARM, EA and DF on the growth of Indian Economy. Here also we shall make two empirical studies as in case of inflation: one on the basis of the planwise annual average figures of the explanatory and the explained variables for the entire period under study, viz; 1951-52 to 1989-90 and the other on the basis of the yearly figures of the same variables for the period 1980-81 to 1989-90. Our study
relate to both at constant prices (1980-81 prices) and at current price values of the variables. Tables 6.1, 6.2, 6.3 and 6.4 below incorporate the values of the variables needed for our empirical study. As in case of inflation, in case of growth too we study the impact of additional direct taxes (ADT) and additional indirect taxes (AIT) (resulting from both the horizontal and vertical expansion of tax base) on growth together with EA and DF. In this case the multiple regression model will consist of four explanatory variables. The figures for ADT and AIT are embodied in table 5.11 of chapter V.

Table 6.1

Planwise Annual Average of Gross National Income (Y), Additional Resource Mobilisation (ARM), External Assistance (EA) and Deficit Financing (DF) at 1980-81 Prices.

<table>
<thead>
<tr>
<th>Plan Period</th>
<th>Y</th>
<th>ARM</th>
<th>EA</th>
<th>DF</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Plan</td>
<td>47447</td>
<td>276</td>
<td>238</td>
<td>360</td>
</tr>
<tr>
<td>Second Plan</td>
<td>57117</td>
<td>1327</td>
<td>1161</td>
<td>1203</td>
</tr>
<tr>
<td>Third Plan</td>
<td>68896</td>
<td>2501</td>
<td>1834</td>
<td>1058</td>
</tr>
<tr>
<td>Annual Plans</td>
<td>76627</td>
<td>1074</td>
<td>2749</td>
<td>798</td>
</tr>
<tr>
<td>(1966-69)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fourth Plan</td>
<td>89857</td>
<td>2412</td>
<td>2119</td>
<td>1161</td>
</tr>
<tr>
<td>Fifth Plan</td>
<td>108149</td>
<td>3794</td>
<td>2145</td>
<td>1311</td>
</tr>
<tr>
<td>Annual Plan</td>
<td>114379</td>
<td>2089</td>
<td>1577</td>
<td>1876</td>
</tr>
<tr>
<td>(1979-80)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sixth Plan</td>
<td>135827</td>
<td>7792</td>
<td>1902</td>
<td>2732</td>
</tr>
<tr>
<td>Seventh Plan</td>
<td>173473</td>
<td>3805</td>
<td>2827</td>
<td>5861</td>
</tr>
</tbody>
</table>

(ii) ARM, EA an DF: As in table 5.4

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### Table 6.2

Planwise Annual Average of GNP, Additional Resource Mobilisation (ARM), External Assistance (EA) and Deficit Financing At Current Prices.

<table>
<thead>
<tr>
<th>Plan Period</th>
<th>GNP</th>
<th>ARM</th>
<th>EA</th>
<th>DF</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Plan (1951-56)</td>
<td>9,634.2</td>
<td>51.0</td>
<td>44.4</td>
<td>66.6</td>
</tr>
<tr>
<td>Second Plan (1956-61)</td>
<td>13,142.4</td>
<td>210.4</td>
<td>184.2</td>
<td>190.8</td>
</tr>
<tr>
<td>Third Plan (1961-66)</td>
<td>19,879.4</td>
<td>578.4</td>
<td>392.6</td>
<td>226.6</td>
</tr>
<tr>
<td>Annual Plans (1966-69)</td>
<td>30,925.3</td>
<td>303.3</td>
<td>776.7</td>
<td>225.3</td>
</tr>
<tr>
<td>Fourth Plan (1969-74)</td>
<td>44,247.6</td>
<td>856.0</td>
<td>752.0</td>
<td>412.0</td>
</tr>
<tr>
<td>Fifth Plan (1974-79)</td>
<td>78,967.8</td>
<td>2060.0</td>
<td>1164.4</td>
<td>712.0</td>
</tr>
<tr>
<td>Annual Plan (1979-80)</td>
<td>102,595.0</td>
<td>1509.0</td>
<td>1139.0</td>
<td>1355.0</td>
</tr>
<tr>
<td>Sixth Plan (1980-85)</td>
<td>163,535.4</td>
<td>6594.0</td>
<td>2180.8</td>
<td>2567.0</td>
</tr>
<tr>
<td>Seventh Plan (1985-90)</td>
<td>305,542.0</td>
<td>5004.6</td>
<td>4540.0</td>
<td>7709.0</td>
</tr>
</tbody>
</table>

Source: (i) GNP figures are obtained from Basic Statistics Relating to Indian Economy, CMIE, Vol I, August, 1992

(ii)Figures for ARM, EA and DF are derived from table 5.4. Reference: "Note" below table 5.4
### Yearwise GNP, Additional Resource Mobilisation (ARM), External Assistance (EA) and Deficit Financing (DF) at Prices from 1980-81 to 1989-90.

<table>
<thead>
<tr>
<th>Year</th>
<th>GNP</th>
<th>ARM</th>
<th>EA</th>
<th>DF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980-81</td>
<td>1,22,722</td>
<td>926</td>
<td>2161</td>
<td>4081</td>
</tr>
<tr>
<td>1981-82</td>
<td>1,29,928</td>
<td>3814</td>
<td>1706</td>
<td>2987</td>
</tr>
<tr>
<td>1982-83</td>
<td>1,33,299</td>
<td>5996</td>
<td>2007</td>
<td>2776</td>
</tr>
<tr>
<td>1983-84</td>
<td>1,42,861</td>
<td>785?</td>
<td>1845</td>
<td>2807</td>
</tr>
<tr>
<td>1984-85</td>
<td>1,49,256</td>
<td>9312</td>
<td>1793</td>
<td>2367</td>
</tr>
<tr>
<td>1985-86</td>
<td>1,55,365</td>
<td>1066</td>
<td>2112</td>
<td>3414</td>
</tr>
<tr>
<td>1986-87</td>
<td>1,61,535</td>
<td>1885</td>
<td>2462</td>
<td>6299</td>
</tr>
<tr>
<td>1987-88</td>
<td>1,68,004</td>
<td>2368</td>
<td>3206</td>
<td>4624</td>
</tr>
<tr>
<td>1988-89</td>
<td>1,85,616</td>
<td>4083</td>
<td>3134</td>
<td>6036</td>
</tr>
<tr>
<td>1989-90</td>
<td>1,96,874</td>
<td>4865</td>
<td>4366</td>
<td>8933</td>
</tr>
</tbody>
</table>

Source: (i) GNP: Basic Statistics relating to Indian Economy, CMIE, August 1992, Vol I.

(ii) ARM, EA and DF: Same as in Table 5.9
### Table 6.4


<table>
<thead>
<tr>
<th>Year</th>
<th>GNP</th>
<th>ARM</th>
<th>EA</th>
<th>DF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980-81</td>
<td>1,22,722</td>
<td>726</td>
<td>2,162</td>
<td>4,061</td>
</tr>
<tr>
<td>1981-82</td>
<td>1,43,256</td>
<td>1,170</td>
<td>1,865</td>
<td>2,256</td>
</tr>
<tr>
<td>1982-83</td>
<td>1,58,761</td>
<td>6,728</td>
<td>2,252</td>
<td>3,114</td>
</tr>
<tr>
<td>1983-84</td>
<td>1,85,779</td>
<td>9,652</td>
<td>2,266</td>
<td>3,448</td>
</tr>
<tr>
<td>1984-85</td>
<td>2,07,109</td>
<td>12,247</td>
<td>2,359</td>
<td>3,115</td>
</tr>
<tr>
<td>1985-86</td>
<td>2,32,370</td>
<td>1,482</td>
<td>2,936</td>
<td>4,747</td>
</tr>
<tr>
<td>1986-87</td>
<td>2,58,225</td>
<td>2,761</td>
<td>3,605</td>
<td>9,225</td>
</tr>
<tr>
<td>1987-88</td>
<td>2,92,146</td>
<td>4,904</td>
<td>5,052</td>
<td>7,284</td>
</tr>
<tr>
<td>1988-89</td>
<td>3,47,573</td>
<td>6,908</td>
<td>5,304</td>
<td>10,214</td>
</tr>
<tr>
<td>1989-90</td>
<td>3,97,396</td>
<td>8,766</td>
<td>5,803</td>
<td>16,486</td>
</tr>
</tbody>
</table>

Source: (i) GNP: as in table 6.3
(ii) ARM, EA and DF: Same as in table 5.9 in chapter V.

#### 6.5.1. Econometric Tools for Analysing the Implications of S-I Gap on Growth

We present below the various regression results when our regression models are fitted with the data embodied in the tables 6.1, 6.2, 6.3, and 6.4. In order to find the impact of additional direct tax (ADT) and additional indirect tax (AIT) on growth together with EA and DF at constant prices we make use of the table 5.11 of chapter V along with the tables 6.1 and 6.3 above.
A. Multiple Linear Regression Model: In order to study the impact of Additional Resource Mobilisation (ARM), External Assistance (EA) and Deficit Financing (DF) as S-I gap filling instruments on growth we use the following multiple linear regression model:

\[ Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + u_i \quad \cdots (1) \]

Where \( Y \) = GNP (Gross National Product)

\[ X_1 = \text{Investment financed through additional resource mobilisation} \]

\[ X_2 = \text{Investment financed through external assistance} \]

\[ X_3 = \text{Investment financed through deficit financing} \]

\( U \) = Stochastic disturbance term

\( \beta_0, \beta_1, \beta_2 \) and \( \beta_3 \) are parameters to be determined

The equations (1) for \( i = 1, 2, \ldots, n \) can be put in the following matrix form

\[ Y = \hat{\beta} X + U \quad \cdots \cdots \quad (2) \]

The least squares solution yields \( R^2, \text{Var} (\hat{\beta}) \) which are given by

\[ \hat{\beta} = (X'X)^{-1} X'Y \quad \cdots \cdots \quad (3) \]

\[ R^2 = \frac{\hat{\beta}'Y - n\bar{Y}^2}{\bar{Y}^2 - n\bar{Y}^2} \quad \cdots \cdots \quad (4) \]

\[ \text{Var} (\hat{\beta}) = \sigma^2_u (X'X)^{-1} \quad \cdots \cdots \quad (5) \]
where an unbiased estimator of \( \sigma^2 \) of \( \sigma^2 \) is given by
\[
\hat{\sigma}^2 = \frac{\sum e_i^2}{n-k} \quad \text{........... (6)}
\]
\[e_i = y_i - \hat{y}_i\]

\( K \) = Number of parameters to be estimated.

\[
\text{S.E. (} \hat{\beta} \text{) =} \sqrt{\text{Var (} \hat{\beta} \text{)}} \quad \text{........... (7)}
\]

The \( t \) - statistic is defined by
\[
t^* = \frac{\hat{\beta}_i}{\text{S.E. (} \hat{\beta}_i \text{)}} \quad \text{........... (8)}
\]

Which follows \( t \) - distribution with \( (n-k) \) degrees of freedom.

B. Simple Regression Model: In order to study the individual impact of each of the S-I gap filling instruments, i.e; ARM, EA and DF on growth we use the following simple linear regression model:

\[
y_i = \beta_0 + \beta_1 x_i + u_i \quad (i=1, 2, \ldots, n) \quad \text{........... (9)}
\]

Where \( Y = \text{GNP} \)

\[x = \text{I or I FARM or I FEA or I FDF}\]

\( U = \text{Stochastic disturbance term} \)

\( i = i \text{th observation} \)

\( \beta_0, \beta_1 \) are parameters to be estimated.

The least squares solution yields:
\[
\hat{\beta}_i = \frac{\sum x_i y_i}{\sum x_i^2} \quad \text{........... (10)}
\]
Where \( x_i = x_i - \bar{x} \), \( y_i = y_i - \bar{y} \)

\[
\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x} \quad \ldots \quad (11)
\]

S.E. (\( \hat{\beta}_1 \)) = \sqrt{\text{Var} (\hat{\beta}_1)} = \frac{s_u}{\sqrt{n}} \frac{1}{\sum x_i^2} \quad \ldots \quad (12)

Where \( s_u = \sqrt{\frac{\sum e_i^2}{n-2}} \), \( e_i = y_i - \hat{y}_i \)

\[
R^2 = \frac{\sum (\hat{y}_i - \bar{y})^2}{\sum (y_i - \bar{y})^2} \quad \ldots \quad (13)
\]

The t-statistic is defined by

\[
t^* = \frac{\hat{\beta}_1}{\text{S.E.}(\hat{\beta}_1)} \quad \ldots \quad (14)
\]

Which follows t-distribution with (n-2) degrees of freedom.

6.6.2. Regression Results and Their Interpretations

A. Multiple Regression Results:

Below we present the various regression results when our model (I) of 6.5.1.A is fitted with the data embodied in tables 6.1, 6.2, 6.3 and 6.4. and the table 5.11 of chapter V.

At Constant Prices (1930-81 Prices)

(a) Impact of ARM(\( X_1 \)), EA(\( X_2 \)) and DF(\( X_3 \)) on Growth Planwise

[Table 6.13]

\[
Y = 35788.58 + 8.461878X + 9.129042X^2 + 15.99275X^3
\]

S.E. (\( \hat{\beta}_i \)):

\[
(2.819762) \quad (7.921405) \quad (4.109251)
\]

\[
t^* : \quad (3.001) \quad (1.152) \quad (3.892)
\]

R = 0.91

No. of observations = 9

Degrees of Freedom = 5

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(b) Impact of ARM($X_1$), EA($X_2$), and DF($X_3$) on Growth Yearwise for the period 1980-81 to 1989-90 (Table 6.3)

\[ Y = 85509.90 + 3.800467 X + 39.44837 X^2 + 6.035832 X^3 \]

S.E.($\beta_i$): \( \begin{array}{cccc} 1 & 2 & 3 & 4 \\ (1.422723) & (12.94103) & (2.347898) & (2.671) \end{array} \)

\[ t^* : \begin{array}{cccc} 2 & 3 & 4 \\ (2.671) & (3.048) & (2.571) \end{array} \]

\[ R^2 = 0.93 \]

No. of observations = 10

Degrees of Freedom = 6

(c) Impact of EA($X_1$), DF($X_2$), ADT($X_3$) and ALT($X_4$) on Growth Planwise.

\[ Y = 62518.19 + 14.30185 X + 24.49171 X^2 + 126.133 X^3 + 47.80901 X^4 \]

S.E.$(\beta_i)$: \( \begin{array}{cccc} 1 & 2 & 3 & 4 \\ (5.366554) & (8.333663) & (133.8669) & (16.60162) \end{array} \)

\[ t^* : \begin{array}{cccc} 2 & 3 & 4 \\ (2.665) & (2.938) & (0.942) \end{array} \]

\[ R^2 = 0.94 \]

No. of observations = 9

Degrees of Freedom = 4

(d) Impact of EA($X_1$), DF($X_2$), ADT($X_3$) and ALT($X_4$) on Growth Yearwise for the Period 1980-81 to 1989-90.

\[ Y = 77158.25 + 12.27932 X + 0.619822X^2 + 6.749793X^3 + 11.25970X^4 \]

S.E.$(\beta_i)$: \( \begin{array}{cccc} 1 & 2 & 3 & 4 \\ (4.288727) & (3.844461) & (12.35846) & (4.365549) \end{array} \)

\[ t^* : \begin{array}{cccc} 2 & 3 & 4 \\ (2.863) & (0.121) & (2.579) \end{array} \]

\[ R^2 = 0.91 \]

No. of observations = 10

Degrees of Freedom = 5
N.B. (i) + implies significant at 1% level of significance (i.e.; highly significant)

(ii) ++ implies significant at 5% level of significance.

(iii) N.S. implies not significant.

At Current Prices

(a) Effect of ARM(X), EA(X), and DF(X) on Growth Planwise

[Table 6.2]

\[ Y = 2,915.386 + 10.05579X + 38.97112X^2 + 14.27271X^3 \]

S.E. (\(\beta\)): \[(2.600161) (13.37824) (5.384372)\]

\(t^*\): \[+ + + + + +\]

\(R^2 = 0.99\)

No. of observations = 9

Degrees of Freedom = 5

(b) Effect of ARM(X), EA(X), and DF(X) on Growth Yearwise

for the Period 1980-81 to 1989-90 [Table 6.4]

\[ Y = 24067.04 + 6.386236X + 36.83838X^2 + 16.07127X^3 \]

S.E. (\(\beta\)): \[(2.279569) (11.65268) (5.45887)\]

\(t^*\): \[+ + + +\]

\(R^2 = 0.96\)

No. of observations = 10

Degrees of Freedom = 6
B. Simple Regression Results:

We present below the various regression results when our model (9) of 6.5.1 B is fitted with the data embodied in tables 6.1, 6.2, 6.3 and 6.4.

At Constant Prices (1980-81 Prices)

(i) Effect of $\text{ARMC}_1$ on Growth $\&$ Planwise

$Y = 61348.68 + 12.74965 \times_1$

S.E.($\beta_1$): (4.948015)  

$t^* : (2.577)$

$R^2 = 0.49$

No. of observations $= 9$

Degrees of Freedom $= 7$

(ii) Effect of $\text{EA}_2$ on Growth $\&$ Planwise

$Y = 37816.82 + 32.10612 \times_2$

S.E. ($\beta_2$): (14.87532)  

$t^* : (2.158)$

$R^2 = 0.40$

No. of observations $= 9$

Degrees of Freedom $= 7$
(iii) Impact of DF($X_3$) on Growth Planwise

\[ Y = 56894.29 + 21.98798X_3 \]

S.E.($\beta_i$) = (3.988878)

\[ t = 5.512 \]

\[ R^2 = 0.81 \]

No. of observations = 9

Degrees of Freedom = 7

(iv) Impact of ARM($X_1$) on Growth Yearwise from 1980-81 to 1989-90

\[ Y = 156939.6 + 0.55329X \]

S.E.($\beta_i$) = (1.295335)

\[ t = 2.743 \]

\[ R^2 = 0.51 \]

No. of observations = 10

Degrees of Freedom = 8

(v) Impact of EA($X_2$) on Growth Yearwise from 1980-81 to 1989-90

\[ Y = 93439.87 + 24.68785X_2 \]

S.E.($\beta_i$) = (4.962877)

\[ t = 4.975 \]

\[ R^2 = 0.76 \]

No. of observations = 10

Degrees of Freedom = 8

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(vi) Impact of DF\((X_2)\) on Growth Yearwise from 1980-81 to 1989-90

\[
Y = 113384.9 + 9.308958 X
\]

S.E. (\(\beta_1\)): \((2.393453)\)

\(t^*\): \(3.889\)

\(R^2 = 0.65\)

No. of observations = 10

Degrees of Freedom = 8

At Current Prices

(i) Effect of ARM\((X_1)\) on Growth Planwise

\[
Y = 18701.22 + 34.69181 X
\]

S.E. (\(\beta_1\)): \((8.429876)\)

\(t^*\): \(4.147\)

\(R^2 = 0.71\)

No. of observations = 9

Degrees of Freedom = 7

(ii) Effect of EA\((X_2)\) on Growth Planwise

\[
Y = 7878.61 + 85.81968 X
\]

S.E. (\(\beta_1\)): \((6.223196)\)

\(t^*\): \(13.790\)

\(R^2 = 0.96\)

No. of observations = 9

Degrees of Freedom = 7
(iii) **Impact of DF(X_3) on Growth Planwise.**

\[ Y = 29392.88 + 38.16721 X^3 \]

\[ \text{S.E.}(\beta_i): (3.797956) \]

\[ t: (10.049) \]

\[ R^2 = 0.94 \]

No. of observations = 9

Degree of Freedom = 8

(iv) **Impact of ARM(X_1) on Growth Yearwise from 1980-81 to 1989-90.**

\[ Y = 223466.1 + 2.001041 X \]

\[ \text{S.E.}(\beta_i): (8.954205) \]

\[ t: (0.223) \]

\[ R^2 = 0.006 \]

No. of observations = 10

Degrees of Freedom = 8

(v) **Impact of EA(X_2) on Growth Yearwise from 1980-81 to 1989-90.**

\[ Y = 39619.35 + 58.00331 X^2 \]

\[ \text{S.E.}(\beta_i): (6.019787) \]

\[ t: (9.635) \]

\[ R^2 = 0.92 \]

No. of observations = 10

Degrees of Freedom = 8
(vi) **Impact of DF\((X_3)\) on Growth Yearwise from 1980-81 to 1989-90.**

\[
Y = 108616.9 + 24.50696 X^3
\]

S.E.(\(\beta_3\)) = (4.344510)

\[t^* = 5.641\]

No. of observations = 10

Degrees of Freedom = 8.

**N.B.** (i) + implies significant at 1% level of significance (i.e.; highly significant).

(ii) + + implies significant at 5% level of significance.

(iii) N.S. implies not significant.

**6.6.3. Interpretation of Regression Results:**

The estimated multiple as well as simple linear regression models based on the values of the variables at 1980-81 prices can be interpreted as below:

(a) So far as the entire period under study is concerned, ARM, EA and DF account for 91 percent of the total variations in GNP and the impact of each of them on growth of GNP is positive. Again, the partial regression coefficients of \(X_1\) (ARM) and \(X_3\) (DF) are significant at 5% level while the partial regression coefficient of \(X_2\) (EA) is not significant. These observations have also been supported by the corresponding estimated simple linear regression equations. From the estimated simple linear regression equations also, we find that the impact
of each of the explanatory variables on the growth of GNP is positive. Again, while the coefficients of \( X_1 \) (ARM) and \( X_2 \) (DF) are significant at 5% and 1% level respectively, that of \( X_3 \) (EA) is not significant. Moreover, coming to the individual impact of ARM, EA and DF on GNP, we find that ARM accounts for 49 percent of variations in GNP, EA accounts for 40 percent of variations in GNP and DF accounts for 81 percent of variations in GNP.

When we incorporate additional direct taxes (ADT) and additional indirect taxes (AIT) (arising out of both horizontal and vertical expansion of tax base) in our multiple regression model in lieu of ARM, then we find that EA, DF, ADT and AIT together account for 94 percent of variations in GNP. Also we observe that while the impact of additional indirect taxes (AIT) on the growth of GNP is positive and significant, that of additional direct taxes (ADT) on the growth of GNP is although positive, yet it is insignificant.

The estimated multiple as well as simple linear regression models based on the yearly data at 1980-81 prices for the period 1980-81 to 1989-90 yield the following informations:

The three explanatory variables \( X_1 \) (ARM), \( X_2 \) (EA) and \( X_3 \) (DF) in unison account for 93 percent of the total variations in GNP and the impact of each of them on the growth of GNP is positive. Again, all the partial regression coefficients of \( X_1 \) (ARM), \( X_2 \) (EA) and \( X_3 \) (DF) are significant at 5% level. The corresponding simple linear regression results also support the observations made on the estimated multiple linear regression model. We find from the simple linear regression results that
each of $X^1$ (ARM), $X^2$ (EA) and $X^3$ (DF) is having positive impact on the growth of GNP and while the coefficients of $X^2$ (EA) and $X^3$ (DF) are significant at one percent level, that of $X^1$ (ARM) is significant at 5% level of significance. Again, while $X^1$ and $X^2$ individually account for 76 percent and 65 percent of the total variations in GNP, ARM accounts for 51 percent of the total variations in GNP.

When we incorporate additional direct taxes (ADT) and additional indirect taxes (IDT) arising out of horizontal and vertical expansion of tax base in our multiple regression model in lieu of ARM, then we find that EA, DF, ADT and AIT together explain 91 percent of variations in GNP. Again, while the impact of AIT on the growth of GNP is positive and significant, that of ADT is although positive yet it is insignificant. We have already mentioned earlier that although ARM consists of three components, viz; additional direct tax, additional indirect tax and additional contribution from public sector enterprises resulting from the revision of administered prices, yet we could not incorporate the third component in our multiple regression model in lieu of ARM due to the non-availability of such data. Again additional taxes usually imply additional direct tax (ADT) and additional indirect tax (AIT) arising out of vertical expansion of tax base only. However, we could not find such figures yearwise. As such we have calculated ADT and AIT corresponding to a particular year by subtracting the immediately previous year figures of direct tax and indirect tax from the corresponding figures of that year. These figures obviously consist of two components: one due to horizontal expansion and the other due to vertical expansion of tax base.
On the basis of our estimated multiple regression models incorporating the three explanatory variables, viz; ARM, EA and DF [Ref : A: (a), (b)] we observe that ARM and DF are having positive significant bearing upon the growth of GNF whether we consider the entire period of our study or the period 1980-81 to 1989-90. However, on the basis of the entire period of our study we find that although the influence of EA on the growth of GNP is positive yet it is not significant while its impact on growth is found to be positive and significant on the basis of the data pertaining to the eighties. This is due to the reason that while GNP is increasing continuously both in terms of planwise annual average figures and yearwise figures for the eighties, the inflow of external assistance in terms of planwise annual average figures is more erratic in nature in comparison to the yearwise figures for the eighties.

We have also estimated our multiple as well as simple linear regression models on the basis of the values of the variables at current prices [Tables 6.2 and 6.4] and the results have been displayed above. Since the analysis on the basis of constant prices is more meaningful as such we are not giving the analysis of the estimated regression models based on current prices.
REFERENCES


