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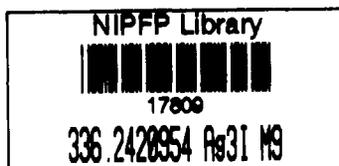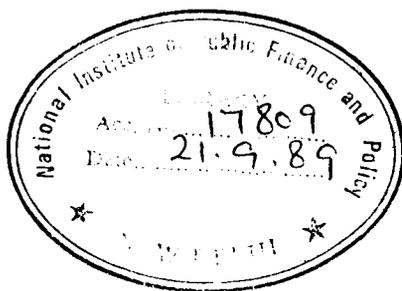
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ABSTRACT

This paper suggests modification of the constant rate-base method of estimating elasticity based on data grouped by income classes, and quantifies the effect of a change in inequality in the distribution of income on the yield of personal income tax. The suggested modification allows to account for variation, over time, in the distribution of income among taxpayers within the income classes. The study reveals that during 1966-67 to 1983-84 inequality in taxable income was marked by a declining trend, and this had substantial negative impact on elasticity of the tax. Had the inequality remained unchanged, elasticity of the tax with respect to gross domestic product would have been around 1.33 instead of 1.04.

Government policies directed at mitigating inequality in the distribution of income seem to dampen growth of yield of the personal income tax. This perhaps is an important factor in forecasting the tax yield, that has so far been ignored. This effect should be explicitly taken into account in the tax revenue forecasting exercises. If the inequality is expected to decline at a rate lower than that in the reference period, then the effective elasticity would be in the range of 1.04 to 1.33, and if it is expected to decline at a rate higher than that in the reference period, then the effective elasticity may be well below 1.04.

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1. Introduction

Mitigating inequality in the distribution of income and imparting built-in flexibility to the tax system have been among the main objectives of the Government of India. These objectives may, however, come into conflict. A declining (rising) trend in inequality in the distribution of income may have a negative (positive) impact on built-in flexibility or elasticity[1] of the personal income tax. In estimating elasticity of the tax, no attention has generally been paid to the trends in inequality in the distribution of income. The results of select studies on income elasticity of the Indian personal income tax by Sahota (1961), Gulati (1962), Cutt (1969), Jain (1969), Nambiar and Joshi (1974), Srivastava (1975), Gupta (1975), Rao (1979), Khadye (1981), Gupta and Aggarwal (1982), Bagchi and Rao (1982), Aggarwal (1984), Rao (1987), and Bagchi (1988) are given in Table 1 by

metholodogies adopted. None of these studies quantifies the impact of inequality on elasticity of the tax. The purpose of this paper is to fill this gap.

The study reveals that during 1966-67 to 1983-84, inequality in taxable income was marked by a declining trend and this had substantial negative impact on elasticity of the personal income tax.

The study calls for estimation of income inequality and elasticity of the tax. Methods of estimation of elasticity are reviewed in Section 2. The constant rate-base method of estimating elasticity that has been adopted in this study has been modified to account for variation, over time, in the distribution of income within the income classes. The modified method is described in section 3. Section 4 indicates data limitations and suggests remedies. Choice of reference period, coverage and choice of rate structure are indicated in Section 5. Working of the series of hypothetical tax revenue at the rate structure of 1983-84 is presented in Section 6. Estimates of elasticity are presented and discussed in Section 7. Section 8 contains conclusions of the study.

2. Methods of Estimation of Elasticity : A Review

Estimation of elasticity involves capturing/isolating that component of the tax yield which can be considered as automatic growth at a constant tax structure. Historical tax yield comprises the tax yield at a constant tax structure and the effect, on tax yield, of the disrectionary changes brought about in the tax structure during the reference period. Various methods of estimating elasticity of a tax have been discussed in the literature. These are based on capturing the automatic growth in tax yield at a constant tax structure from the historical tax yield, or estimating the hypothetical tax yield at a constant tax structure, or adjusting the estimate of buoyancy[2] of the tax. All these methods can be said to have a common conceptual framework.

In general, tax yield (T) can be said to depend mainly on the tax base (B), index of inequality (II) in the distribution of tax base, and the tax rate structure (R). Further, the tax base can be said to depend on the national income (Y) and the tax structure. Tax structure can affect the tax base mainly through the level of exemptions and deductions and of the marginal tax rates. Exemptions and deductions are inversely related to the tax base. With a higher exemption limit, lesser number of persons fall within the purview of the tax and a lower proportion of total income of different taxpayers is subject to the

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marginal rate schedule. Secondly, level of marginal tax rates may affect work effort of individuals and the incidence of evasion, which may then affect the tax base. Therefore, tax yield model can be written as:

$$T = f (B, II, R) \qquad \ldots(1)$$
$$B = f (Y, R) \qquad \ldots(2)$$

In the reduced form, the tax yield can be expressed as:

$$T = f (Y, II, R) \qquad \ldots(3)$$

Inequality in the distribution of tax base may be measured in terms of Gini index or by any other measure of inequality. However, specifying by a single variable, a tax structure with many marginal tax rates, exemptions, deductions and credits etc., is a difficult task. To overcome this complex problem, a number of techniques have been used in the literature which give rise to different methods of estimation of elasticity of a personal income tax. Various methods of estimation of elasticity of a tax can be classified into the following three broad categories:

i.   Those based on direct estimation of elasticity.

ii.   Those involving estimation of hypothetical series of tax revenue at a constant tax structure.

iii.   Those based on adjustment of estimate of buoyancy of the tax.

Methods based on direct estimation of elasticity of a tax use relation (3) with observed series of tax revenue. However, it has generally been estimated by excluding the inequality variable. This category of methods includes those based on (a) the use of tax rate and base variables, persued by Wilford (1965), Ray (1966), Legler and Shapiro (1968), Muskin and Lupo (1967), and Srivastava (1975); (b) use of dummy variables for the years of major discretionary changes, developed by Singer (1970), Chelliah and Chand (1974) and Wasylenko (1975); and (c) cross-section of groups of taxpayers by income as proposed by Mishan and Dicks-Mireaux (1958), Blackburn (1967), and Pechman (1973); and by region as advocated by Tanzi (1969) and subsequently applied in various studies including Anderson (1973), Tanzi (1980) and Rao (1987). The methods based on tax rate and base variables may not be thought appropriate for two reasons. First, representing a multi-rate tax structure by a single adequate tax rate is not an easy task. Second, while the use of base variable captures the effects of

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the discretionary changes, it also includes effects of non-discretionary changes as the base may change inspite of an unchanged tax structure. Srivastava (1975) suggests use of two parameters instead of a single tax rate variable, one parameter representing initial rate and the other representing incremental factor in the tax rate as one moves from a low-rate bracket to a high-rate bracket. However, interpretation of two-parameter representation of the multi-rate personal income tax is not unambiguous. The technique of dummy variables allows capturing generally the constant shifts in tax revenue and is beset with problems of potential multicollinearity. The methods based on cross-section data assume that the relationship between average tax liability and average taxable income across income classes or regions is the same as the relationship for the country as a whole at those levels of taxable income. This assumption does not seem to hold good in reality.

Methods involving estimation of series of hypothetical tax revenue at a constant tax structure use relation (3) with series of hypothetical tax revenue instead of observed revenue and with exclusion of tax rate variable. This, however, has also been generally estimated without the inequality variable. Methods in this category differ with respect to the process of obtaining series of hypothetical tax revenue. Various methods developed for obtaining the hypothetical series include (a) proportional adjustment method developed by Sahota (1961) and Prest (1962), the characteristics of which have been studied in detail

subsequently by Chelliah and Chand (1974); and   (b) the constant rate-base methods.

The proportional adjustment method assumes that the revenue effect of a discretionary change and the tax yield exclusive of the effect of the discretionary change grow at the same rate. If this assumption is not satisfied with respect to a major component of resource mobilisation, then application of proportional adjustment method may give a distorted series of hypothetical tax revenue.   Further, the quality of the series of hypothetical tax revenue would greatly depend on the quality of the estimates of revenue effects of the discretionary changes brought about during the reference period.

The constant rate-base methods differ with respect to the degree of disaggregation of the data. These include those suggested by Auld (1971), Lewis (1962), Pearse (1962) and Wasylenko (1975). The methods used by Lewis and Auld are based on highly aggregated data. The method used by the former is based on the application of a single tax rate in the previous year to the tax base in the current year and that used by the latter is based on the application of a single effective marginal tax rate in the previous year to the change in the tax base in the current year. Methods advocated by Pearse and Wasylenko are based on data grouped by income classes. In estimating hypothetical tax revenue with the tax structure of a reference year, the former lays emphasis on

imposing the distribution of income of the reference year in all the years in the reference period while the latter stresses imposing the ratios of deductions to incomes by income classes in the reference year, in each of the years in the reference period. The method based on highly disaggregative data applies legal tax structure of the reference year to the incomes of each of the taxpayers in each of the years in the reference period. It is implicitly assumed in the constant rate-base methods that the distribution of income within an income class remains unchanged over time. If this assumption is violated then these methods may give a misleading estimate of elasticity.

The method based on adjustment of estimate of buoyancy was proposed by Choudhry (1979). It derives a `divisia index´ on the basis of historical data on the tax yield. This index is used to adjust buoyancy of the tax to obtain an estimate of elasticity. This method can be said to suffer from two major limitations. First, it can underestimate the positive revenue effects and overestimate the negative revenue effects. Second, it may not give satisfactory results when the effects of the discretionary changes are of large magnitude.

3. Proposed Modification in the Constant
Rate-Base Method

Depending on the available data, the constant rate-base method based on data grouped by income classes is applied in this study for estimating series of hypothetical tax revenue at a constant rate structure. However, the method based on grouped data, as generally applied, ignores changes, over time, in the distribution of income within the income classes. We have modified it to account for these changes. The changes in per capita income of the taxpayers in a given income class, over time, are taken to reflect changes in the distribution of income among the taxpayers within the income class. Therefore, even the modified method would not correct for a change in the distribution of income that would not change per capita income of the taxpayers. But such a change is unlikely to have a significant impact on the tax yield. The modified rate-base method as applied in the current study is briefly described here. This method involves the following four steps in estimating a series of hypothetical tax revenue at a given rate structure:

i.   Obtaining average tax rates and average incomes by income classes in different years,

ii.   Estimation of hypothetical average tax rates by income classes in different years at the rate structure of the reference year,

iii.   Estimation of hypothetical tax revenue by income classes in different years at the rate structure of the reference year, and

iv.   Obtaining the time series of hypothetical tax revenue at the rate structure of the reference year.

The following notations are used in describing these steps:

n = number of years in the reference period

k = number of income classes

N = number of taxpayers

TI = taxable income

ATI = average taxable income

ATL = average tax liability

ATR = average tax rate

ATR^*= estimated hypothetical tax rate at the rate structure of a reference year

TR^* = estimated hypothetical tax revenue at the rate structure of a reference year.

Scripts i (=1,2,3,.........,n) and j (=1,2,3,............,k) would be used for ith year and jth income class respectively, e.g., TI_{ij} would denote taxable income of the jth income class in the ith year.

(i) Steps 1 & 2:

Average tax rate and average taxable income of different income classes can be obtained for each of the years in the reference period, as follows:

$$ATR_{ij} = TR_{ij}/TI_{ij} \qquad ...(4)$$
$$ATI_{ij} = TI_{ij}/N_{ij} \qquad ...(5)$$

If, over time, distribution of taxable income within each income class remains unchanged, then the average tax rates corresponding to a reference year as given by equation (4) can be taken as the average tax rates applicable to the other years at the rate structure of the reference year. However, if distribution of taxable income within each income class does not remain unchanged, then the average tax rates at the rate structure of the reference year, applicable to an income class in different years need be estimated by accounting for the changed distribution of taxable income within an income class in each year. For estimating such hypothetical average tax rates, we assume that for fixed

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income brackets, change in the distribution of taxable income within an income class is appropriately reflected in change[3] in the average income of the income class. So the average tax rates, at the rate structure of a reference year, applicable to an income class in different years can be estimated by accounting for the change in average taxable income of the income class.

The hypothetical average tax rates can be estimated on the basis of a relationship between the average tax rate and **average taxable income** at the rate structure of the reference year. For rth year as the reference year, this relationship may be estimated by fitting the following specifications of an average tax rate function:

$$ATR_{rj} = \alpha_1 + \beta_1 \, ATI_{rj} + \gamma_1 \, (1/ATI_{rj}) \quad \ldots (6)$$

$$LogATR_{rj} = \alpha_2 + \beta_2 \, LogATI_{rj} + \gamma_2 \, (1/ATI_{rj}) \quad \ldots (7)$$

These specifications allow the average tax rate to vary asymptotically with a change in average taxable income. These specifications are thought appropriate as the average tax rate at high income levels is expected to rise asymptotically with income. It is so, because of lower increase in marginal tax rates with increase in income at high levels of income and because of ceiling on maximum marginal tax rate in general. The choice between these specifications has to depend on the parameter estimates and allied statistics.

Let us denote the estimated value of α_1, β_1, γ_1, α_2, β_2 and γ_2 at the rate structure of the reference year by α_1^*, β_1^*, γ_1^*, α_2^*, β_2^* and γ_2^* respectively. Now, the estimates of average tax rates in each of the years at the rate structure of the reference year can be obtained by simulating these specifications as follows:

$$ATR_{ij}^* = \alpha_1^* + \beta_1^* ATI_{ij} + \gamma_1^* (1/ATI_{ij}) \quad ...(8)$$

$$LogATR_{ij}^* = \alpha_2^* + \beta_2^* LogATI_{ij} + \gamma_2^* (1/ATI_{ij}) ...(9)$$

ATR_{ij}^* can be obtained with the empirically preferred specification of the average tax rate function.

(ii) **Steps 3 & 4:**

Tax revenue of an income class, in different years, at the rate structure of the reference year by accounting for the change in distribution of taxable income in the income class can be obtained as:

$$TR_{ij}^* = TI_{ij} \cdot ATR_{ij}^* \qquad ...(10)$$

Tax revenue of the taxpayers of all the income classes can be obtained as:

$$TR^*_i = \sum_{j=1}^{k} TR^*_{ij} \qquad \qquad ...(11)$$

TR^*_i gives the series of hypothetical tax revenue at the rate structure of the reference year.

4. The Data, Limitations and Remedy

The only source of data on income class-wise distribution of the taxpayers in India is **All India Income Tax Statistics** (AIITS). The limitations of these data have been widely discussed (see for example, Gupta and Aggarwal, 1982, Chapter II; and Bagchi and Aggarwal, 1983). These data are based on the assessments completed in a year. These data for a year can be taken to correspond to a fraction of the total number of taxpayers in that year and these relate to the incomes earned in the previous year.

The fraction of total number of taxpayers covered in AIITS has not remained unchanged over time. So the time series of hypothetical tax revenue require adjustments. The adjustment multiplier for the ith year `M_i` can be taken as the ratio of total number of taxpayers (N^*_i) to those covered in AIITS (N_i) in the ith year (i.e., $M_i = N^*_i/N_i$). For this purpose, the data on the total number of taxpayers in the books of the department at the end of a year are taken from the **Report of the Comptroller and Auditor General of India**, Direct Taxes (Civil).

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5. Reference Period, Coverage and Rate Structure

Reference period is taken from 1966-67 to 1983-84. Prior to 1966-67, the legal definition of taxable income differed significantly from that in the later years, and 1983-84 is the latest year for which comparable data are available. From 1984-85, the data published are return-based instead of assessment-based, i.e., the published data are based on the information as furnished by the taxpayers instead of information on the taxpayers after their assessments are completed. AIITS was not published for the years 1971-72 and 1973-74. Excluding these two years, our reference period covers 16 years.

The study covers the single major category of personal income tax payers - `individuals`. These account for more than 90 per cent of the number and taxable income of all the taxpayers.

Estimates of elasticity are obtained at the rate structure of the latest year in the reference period, i.e., 1983-84.

6. Estimation of Series of Hypothetical Tax Revenue at the Rate Structure of 1983-84

The estimates of series of hypothetical tax revenue at the rate structure of 1983-84 are obtained in the following two stages:

(1) Estimates of average taxable income

Average taxable income of each income class is computed for different years in the reference period. In each income class, a substantial variation in average taxable income over time is observed - the variation is specifically marked in the high level income classes. The range of variation in the average taxable income, in the income classes Rs. 15-20 thousand, Rs. 30-40 thousand, Rs. 100-200 thousand, and above Rs. 500 thousand was Rs. 16.83-17.83 thousand, Rs. 34.12-37.13 thousand, Rs. 123.86-133.66 thousand and Rs. 903.03-2050.96 thousand respectively (Table 2, column 2). This suggests that the distribution of income within the income classes has not remained unchanged over time. This would have caused substantial variation over time in the average tax rate of an income class even at an unchanged rate structure. Therefore, we have estimated hypothetical tax rates for each of the income classes in different years at the rate schedule of a reference year by accounting for changes in the distribution within the income classes.

(ii) Estimates of hypothetical average tax

rates and tax revenue

Average tax rate is obtained for each income class for different
years in the reference period. As one would have expected, the average
tax rate of each income class has shown wide variation over time (Table
2, column 3).

For estimating hypothetical average tax rates, equations 6 and 7
are estimated with and without the inverse of average income variable
with the cross-section of income classes for the year 1983-84. The
parameter estimates alongwith allied statistics are given in Table 3.

From Table 3 it would be noted that the parameter estimates of
both the specifications of the tax rate function are significant at 99
per cent level of confidence. As expected, in both the specifications,
the variable - inverse of average taxable income - is an important
variable, as dropping it from the specifications leads to substantial
reduction in their explanatory powers (Column 6). So the specifications
with the inverse variable are preferable to those without it. Between
equations 6 and 7, the latter gives better fit in terms of explanatory
power of the equations, and the range of deviation of simulated values
from the actual values of the average tax rates (columns 6 and 7). This

suggests that equation 7 is preferable to equation 6. Therefore, *equation (1) is* used for estimating hypothetical average tax rates in different years at the rate schedule of the assessment year 1983-84. The ranges of estimates of hypothetical average tax rates by income classes, thus obtained at the rate schedule of the year 1983-84, are given in Table 4.

From Table 4 it may be noted that hypothetical average tax rate of an income class has shown a substantial variation during the reference period. The ranges of variation in the hypothetical average tax rates for the income classes Rs. 15-20 thousand, Rs. 100-200 thousand, and above Rs. 500 thousand are respectively 7.02-8.03 per cent, 45.41-46.42 per cent and 59.65-61.50 per cent. This suggests that failure of the earlier researchers to account for this variation in the average tax rate of an income class might have introduced an unknown bias in their series of estimated hypothetical tax revenue at a constant rate structure and hence in their estimates of elasticity of the tax.

Hypothetical tax revenue in different income classes of the taxpayers, with taxable income exceeding Rs. 15,000[4] in each of the years in the reference period, at the rate schedule of 1983-84 is obtained by using the hypothetical average tax rates in equation 10. Hypothetical tax revenue in a year is obtained by adding the

hypothetical tax revenue in different income classes. This gives a time series of hypothetical tax revenue at the rate schedule of 1983-84.

Hypothetical tax revenue as well as taxable income of different years is not comparable over time because of variation in coverage of the taxpayers in different years. These series need to be corrected. This is done by multiplying the revenue and taxable income in a year by the adjustment multiplier which is the ratio of total number of taxpayers in a year to the number of taxpayers covered in our data set. The adjustment multipliers of individuals computed for different years are presented in Table 5 (column 3). The corrected series of taxable income and of hypothetical tax revenue are given in Table 6 along with gross domestic product (GDP) at factor cost and current prices (with one-year lag) and Gini index of taxable income of taxpayers. Gini index of taxable income in each year is estimated for individuals with taxable income greater than Rs. 15,000.

7. **Estimates of Elasticity of the Tax**

Estimates of elasticity of the tax are obtained by estimating the following two specifications of the tax function (3) with exclusion of tax rate variable:

$$\text{Log } TR_i^{**} = \alpha_3 + \beta_3 \quad \text{Log } GDP_{i-1} + \gamma_3 \text{Log } G_i \qquad \ldots(12)$$

$$\text{Log } TR_i^{**} = \alpha_4 + \beta_4 \quad \text{Log } GDP_{i-1} \qquad \ldots(13)$$

where TR_i^{**} is corrected hypothetical tax revenue in the ith year at the rate schedule of the year 1983-84. β_3 and β_4 can be interpreted respectively as partial and total elasticities of the tax with respect to GDP.

All the parameter estimates of equations 12 and 13 along with allied statistics are given in Table 7. Estimates of partial and total elasticities of the tax with respect to taxable income are also obtained by re-estimating equations 12 and 13 by replacing GDP_{i-1} by taxable income of the ith year. These are also reported in Table 7.

From Table 7, it would be noted that partial elasticity of the tax with respect to inequality in the distribution of taxable income is significantly positive (column 4), with all the income variables used. This suggests that the decline in inequality in taxable income during the reference period would have had negative impact on the total elasticity of the tax. If the distribution of taxable income had remained unchanged during the reference period then the total elasticity of the tax with respect to GDP would have been around 1.33 instead of 1.04 {equations (i) and (ii), column 2}. These findings are also supported by the estimates of elasticity with respect to taxable income.

If the distribution of taxable income had remained unchanged during the reference period, then the total elasticity of the tax with respect to taxable income would have been around 1.00 instead of 0.94 {equations (iii) and (iv), column 2}. This implies that the government policies directed at mitigating inequality in the distribution of income in general and in the distribution of taxable income in particular dampen growth of the tax yield. This seems to be an important ingredient for tax revenue forecasting exercises, that has so far been ignored or its effect has not been made explicit.

8. Conclusions

A change in inequality in the distribution of income is found to have significant impact on growth of revenue from the personal income tax. A rise (decline) in the inequality increases (decreases) the tax yield. The decline in inequality in the distribution of taxable income during 1966-67 to 1983-84 had substantial negative impact on elasticity of the personal income tax. The effect of inequality in income distribution on the tax yield has implications for forecasting the tax yield. Therefore, this effect should be explicitly taken into account in the tax revenue forecasting exercises.

If the inequality in incme distribution can be held constant, then the total elasticity of the personal income tax with respect to GDP can

be taken to be around 1.33, and if it is expected to decline at a rate lower than that in the reference period, then it would be in the range 1.04 to 1.33. Further, if the inequality is expected to decline at a rate higher than that in the reference period, then the elasticity of the tax may be well below 1.04.

Notes

1   The elasticity of a tax reveals how the tax yield at a constant tax structure grows in response to growth in national income or the tax base. It is defined as the ratio of proportional change in the tax yield at a constant tax structure to the proportional change in national income or the tax base.

2   Buoyancy of a tax is defined as the ratio of proportional change in the historical tax yield to the proportional change in national income.

3   The type of change in the distribution of taxable income within an income class that would not be affecting the average taxable income of the income class, is unlikely to have any significant impact on average tax rate of the income class, at an unchanged tax structure.

4   Rs. 15,000 was the exemption limit in the assessment year 1983-84.

Table 1

**Results of Earlier Studies on Income Elasticity
of the Personal Income Tax in India**

Methodological category/study	Reference Period	Estimate of elasticity	Remarks
1	2	3	4

A. Estimates Based on Proportional Adjustment Method

Methodological category/study	Reference Period	Estimate of elasticity	Remarks
Sahota (1961)	1951-52 to 1957-58	0.56	
Cutt (1969)	1955-56 to 1960-61 1960-61 to 1964-65	0.50 0.65	Based on data for first and last years of the the reference period.
Rao (1979)	1960-61 to 1973-74	0.76	.
Khadey (1981)	1960-61 to 1974-75 1960-61 to 1978-79	0.77 0.88	
Gupta & Aggarwal (1982)	1961-62 to 1975-76	0.93	
Bagchi & Rao (1982)	1965-66 to 1979-80	1.08	With three sets of estimated revenue effects of discretionary changes[1]
Aggarwal (1984)	1970-71 to 1981-82	0.86 to 1.04	---do---[2]
Bagchi (1988)	1965-66 to 1973-74 1973-74 to 1984-85	0.99 0.62	

B. Estimates based on Inclusion of Tax Rate Variable in Elasticity Equation

Methodological category/study	Reference Period	Estimate of elasticity	Remarks
Srivastava (1975)	1961-62 to 1972-73	1.00	Progressive rate structure is represented by an estimated initial rate and an incremental factor.

C. Estimates based on Constant Rate-Base Method

Methodological category/study	Reference Period	Estimate of elasticity	Remarks
Gulati (1962)	1949-50 to 1958-59	2.70	At the rate structure of 1958-59. Based on data corresponding to first and last years of the reference period.
Gupta (1975)[3]	1951-52 to 1964-65	0.63	At the rate structure of 1954-55 with exemption limit at Rs.4200 and Rs. 3000 respectively.
Gupta & Aggarwal (1982)[4]	1954-55 to 1964-65 1965-66 to 1975-76	0.53 0.56	At the rate structure of 1972-73.
	1954-55 to 1964-65 1965-66 to 1975-76	0.63 0.54	At the rate structure of 1974-75.
Rao (1987)[5]	1953-54 to 1974-75	0.91	At the rate structure of 1961-62.
		0.92	At the rate structure of 1974-75.

D. Estimates based on Cross-Section Data

Methodological category/study	Reference Period	Estimate of elasticity	Remarks
Rao (1987)	1961-62 1966-67 1971-72 1974-75	1.33 1.25 1.32 1.36	

Notes:

[1] Budget estimates of revenue effects of discretionary changes made in different years ignore the revenue effects of some of the discretionary changes on the optimism that the effect would be compensated for by better tax compliance. In the absence of any evidence in favour of such an optimism, Bagchi and Rao have accounted for also the revenue effects of such discretionary changes and obtained three alternative sets of estimates of the revenue effects.

[2] Aggarwal used three alternative sets of revenue effects. First, as per the budget estimates; second, accounts for also the revenue effects of the change made outside the budget, third, accounts for also the revenue effects ignored on the optimism of better tax compliance, but only to the extent of 50 per cent of such revenue effect.

[3] Elasticity estimates by Gupta (1975) are with respect to assessed income, whereas by others are with respect to GDP at factor cost (at current prices).

[4] Covers the categories of taxpayers: Individuals, Hindu Undivided Families, Unregistered Firms, and Associations of Other Persons.

[5] Covers only Individuals and Hindu undivided families

Table 2

Range of Average Incomes and Average Tax Rates
of Individual Taxpayers By Income Classes
(1966-67 to 1983-84)

Income Class (Rs. thousand)	Range of average taxable income (Rs. thousand)	Range of average tax rates (per cent)
(1)	(2)	(3)
15-20	16.83 - 17.87	6.92 - 12.72
20-25	21.89 - 22.37	11.64 - 16.74
25-30	27.01 - 27.50	15.62 - 20.47
30-40	34.12 - 37.73	22.07 - 26.77
40-50	44.01 - 45.43	25.36 - 34.57
50-70	57.42 - 58.78	32.23 - 42.42
70-100	81.27 - 82.76	39.30 - 51.28
100-200	123.86 - 133.66	49.28 - 65.04
200-300	234.65 - 244.45	52.52 - 74.81
300-400	337.21 - 347.10	49.06 - 75.79
400-500	436.00 - 461.54	50.54 - 80.15
above500	903.03 -2050.96	63.49 - 87.64
All		13.23 - 19.58

Table 3

Estimates of Parameters of the Equation of Average Tax Rate at the Rate Schedule of 1983-84

Equation No.	Dependent variable	Constant term	Average taxable income	Log of average taxable income	Inverse of average taxable income	R^2	Range of deviation of estimated values from actuals (per cent)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
i.	LogATR	4.04867 (18.83)		0.01151 (0.32)	-35.71960 (13.30)	0.99	(-12,13)
ii.	LogATR	1.40934 (3.94)		0.43447 (5.78)		0.75	(-51,44)
iii.	ATR	47.94967 (21.87)	0.01322 (4.46)		-791.01408 (11.23)	0.96	(-14,260)
iv.	ATR	27.82315 (6.00)	0.03061 (3.30)			0.48	(-76,55)

1. Estimates are based on cross-section of income classes for the relevant assessment year.

2. Estimates correspond to the taxpayers with taxable income greater than Rs. 15,000.

Table 4

**Range of Estimated Hypothetical Average
Tax Rates of Individual Taxpayers at the
Rate Schedule of 1983-84, during
1966-67 to 1983-84 by Income classes**

Income Class (Rs.thousand)	Range (per cent)
15-20	7.02 - 8.03
20-25	11.62 -12.03
25-30	15.87 -16.25
30-40	20.96 -23.19
40-50	26.59 -26.88
50-70	32.24 -32.72
70-100	38.85 -39.17
100-200	45.41 -46.42
200-300.	52.42 -52.76
300-400	55.13 -55.32
400-500	56.66 -56.93
above500	59.65 -61.50

Table 5

Adjustment Multipliers of Individuals to Correct for Varied Coverage of the Taxpayers in different Years

Year	Total No.of taxpayers (thousand)	Taxpayers covered in AIITS (thousand)	Adjustment multipliers for Individuals (1)/(2)
(1)	(2)	(3)	(4)
1966-6,7	2234	1586	1.409208
1967-68	2214	1510	1.466258
1968-69	2146	1753	1.224515
1969-70	2366	1793	1.319778
1971-72	2569	1967	1.306296
1972-73	2692	1966	1.369066
1974-75	2885	2119	1.361128
1975-76	2981	2131	1.399013
1976-77	2877	2139	1.344958
1977-78	3038	2228	1.363668
1978-79	3052	1667	1.831141
1979-80	3160	1549	2.040309
1980-81	3489	1237	2.821003
1981-82	3521	1200	2.934072
1982-83	3612	1055	3.423878
1983-84	3638	886	4.103614

N.A. = Not available

Source: For column (1) **Report of the Comptroller and Auditor General of India** for different years, and for column (2) **All India Income Tax Statistics** for different years.

Table 6

Estimates of Taxable Income, Hypothetical Tax Revenue at the Rate Schedule of 1983-84, National Income and Gini Index of Taxable income

Assessment year	Taxable assessed income	Hypothetical tax revenue at the rate schedule of 1983-84	Gross domestic product at factor cost, at current prices	Gini Index of taxable income
	(Rs.crore)	(Rs.crore)	(Rs.crore)	
(1)	(2)	(3)	(4)	(5)
1966-67	835.00	191.02	22030.00	0.32666
1967-68	916.27	213.69	25480.00	0.33236
1968-69	998.71	221.27	29870.00	0.30933
1969-70	1136.55	251.32	30548.00	0.30466
1971-72	1475.14	324.37	36736.00	0.30442
1972-73	1159.32	258.43	39274.00	0.31207
1974-75	1347.32	275.60	53826.00	0.28609
1975-76	1579.71	310.33	63342.00	0.27037
1976-77	2012.28	419.60	66630.00	0.28720
1977-78	2277.15	457.49	71665.00	0.27757
1978-79	3090.79	611.66	80931.00	0.27673
1979-80	3416.41	685.39	87214.00	0.27916
1980-81	4260.41	889.27	95358.00	0.28852
1981-82	4482.10	925.81	113548.00	0.28696
1982-83	5836.87	1119.08	130770.00	0.25305
1983-84	7233.83	1503.27	145961.00	0.28921

Note: 1. Gross Domestic Product (GDP) shown against the ith assessment year corresponds to the (i-1)th financial year, i.e., column 4 gives one year lagged values of GDP.

2. Gini index of taxable income corresponds to the individuals with taxable income greater than Rs. 15,000.

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Table 7

Estimates of Elasticity of the Personal Income Tax

Eq. No.	Constant term	Coefficient of log of			R^2
		Gross domestic product (GDP)	Taxable income (TI)	Gini index (G)	
	(1)	(2)	(3)	(4)	(5)
(i)	.4.392 (5.12)	1.333 (10.05)		3.024 (2.70)	0.93
(ii)	3.889 (3.86)	1.039 (11.32)			0.89
(iii)	-0.559 (7.90)		0.999 (166.83)	0.801 (13.66)	.0.99
(iv)	-0.563 (2.10)		0.940 (59.34)		0.99

Notes: 1. Figures in parentheses give t-statistic.

2. All the elasticity estimates are significant at 99 per cent level of confidence.

References

Aggarwal, Pawan K. (1984), Elasticity and Buoyancy of Major Central Taxes (1970-71 to 1981-82). Report submitted to the Sub-Group on Central Resources for the Seventh Five Year Plan. National Institute of Public Finance and Policy, (Mimeo).

Auld, D.A.L. (1971), "Automatic Fiscal Stabilizer: Problems of Indentification and Measurement", Public Finance, Vol. 26, No. 4, pp 513-31.

Bagchi, Amaresh (1988), "Recent Initiatives in Enforcement and Trends in Income Tax Revenues: An Appraisal", Economic & Political Weekly.

Bagchi, Amaresh and Aggarwal, Pawan K. (1983) Reform of Statistical Information System in the Income Tax Department, Report submitted to the Economic Administration Reforms Commission. National Institute of Public Finance and Policy, (Mimeo).

Bagchi, Amaresh and Rao, M.G. (1982), "Elasticity of Non-corporate Income Tax in India", Economic & Political Weekly, September 4.

Becker, Gary S., (1968), "Crime and Punishment: An Economic Approach", Journal of Political Economy, March-April.

Chelliah, Raja J. and Chand, Sheetal K. (1974), "A Note on Techniques of Adjusting Tax Revenue Series for Discretionary Changes", Fiscal Affairs Department, Working Paper No. FAD/74/1, IMF.

Cutt, James (1969), Taxation and Economic Development in India, Fredrick, A. Praeger Publishers, New York.

Choudhry, Nurun, N. (1979), "Measuring the Elasticity of Tax Revenue: A Divisia Index Approach", IMF Staff Papers, Vol. 26, No. 1, March, pp. 87-122.

Gulati, Kuldip, S.(1962), "Income Elasticity of Indian Taxes", Economic Weekly, March 31.

Gupta, Anupam (1975), A Study of Personal Income Taxation In India. Progressive Publishers, Calcutta.

Gupta, Anupam and Aggarwal, Pawan K., (1982), The Impact of the Personal Income Tax. National Institute of Public Finance and Policy, New Delhi.

Khadye, I.K., (1981), "The Responsiveness of Tax Revenue to National Income in India (1960-61 to 1978-79)", Reserve Bank of India, Occasional Papers, Vol. 2, No. 1.

Mishan, E.J. and Dicks-Mireaux, L.A., (1958), "Progressive Taxation in an Inflationary Economy", American Economic Review, Vol. 68, Sept., pp. 590-606.

Prest, A.R., (1962), "The Sensitivity of the Yield of Personal Income Tax in the United Kingdom", Economic Journal, Vol. 72, September, pp. 576-96.

Rao, A. Krishna (1987), Personal Income Taxation in India. Chugh Publications, Allahabad.

Rao, V.G., (1979), The Responsiveness of the Indian Tax System 1960-61 to 1973-74. Allied Publishers Pvt. Ltd., New Delhi (p.79).

Sahota, G.S., (1961), Indian Tax Structure and Economic Development. Asia Publishing House, New Delhi.

Singer, N.M., (1968), "The Use of Dummy Variables in Estimating the Income-Elasticity of State Income-tax Revenues", National Tax Journal, Vol. 21, No.2, June.

Singer, N.M., (1970), "Estimating State Income-tax Revenues: A New Approach", Review of Economics & Statistics, Vol. 52, Sept, pp. 427-33.

Srivastava, D.K. (1975), "On Forecasting Non-Corporate Income Tax Revenues in India", Public Finance, Vol. 30, No.3, pp. 428-44.

Tanzi, Vito (1969), "Measuring the Sensitivity of the Federal Income Tax from Cross-Section Data: A New Approach", Review of Economics and Staticists, Vol. 51, May, pp. 206-209.

Tanzi, Vito (1976), "The Sensitivity of the Yield of the U.S. Individual Income Tax and the Tax Reforms of the Past Decade", IMF Staff Papers, Vol. 23, July, pp. 441-54.

Wasylenko, M. (1975), "Estimating the Elasticity of State Personal Income Taxes", National Tax Journal, Vol. 28, No.1, March.

Wilford, W.T. (1965), "State Tax Stability Criteria and the Revenue Income Elasticity Coefficient Reconsidered", National Tax Journal, Vol. 18, No.3, September, pp. 304-312.

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