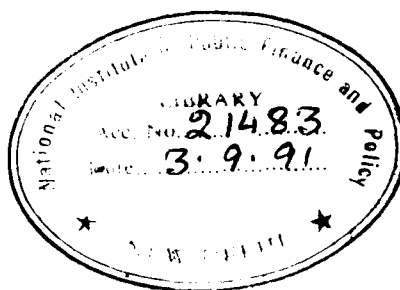


**A NEW HYBRID MEASURE OF
TAX PROGRESSIVITY**

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A NEW HYBRID MEASURE OF TAX PROGRESSIVITY

Abstract

The proposed new measure—relative tax share progressivity (RTSP) is as simple and informative as the existing measure—relative income share progressivity (RISP). The two measures are found complementary. While the existing measure is better suited for indicating redistributive effect of a tax, the new measure is more suitable for reflecting progressivity of the tax. RTSP can be used in comparing tax progressivity of different tax structures even with varied tax yield whereas RISP is suitable for comparing tax progressivity of equi-revenue tax structures. RTSP along with the level of tax rates helps in better understanding of the redistributive impact of a tax schedule that is indicated by RISP. During the period 1961-62 to 1983-84, but for substantial rise in average tax rate the redistributive impact of personal income tax in India as indicated by RISP would have sharply declined following the decline in RTSP.

A NEW HYBRID MEASURE OF TAX PROGRESSIVITY

1. Introduction:

Progression in the income tax rate schedule implies departure from proportionality in the distribution of tax burden. It is characterised generally by an increasing average tax rate with income. There are several measures of tax progression which are classified generally into two broad categories, namely, local (also known as structural or schedular) and global (also known as summary or distributional). There however, is another class of measures, which can be referred to as hybrid. A local measure constructs a schedule of tax rate or tax liability or post-tax income along the income scale. A global measure takes the form of a single number and it focuses, in general, on the distributional aspect of the tax in terms of tax liability or pre- and post-tax incomes. A hybrid measure combines character of both local and global measures. It focuses on the distributional aspect of the tax as well as gives rise to a schedule of numbers, instead of a single number, that describes the overall progressivity of the tax. The trend in the schedule of numbers along the low income to high income groups of taxpayers gives the extent of progressivity.

Development of the class of hybrid measures of tax progressivity is a recent phenomena. A beginning has been made by Baum (1987). A measure has been defined in terms of changes in relative income shares of different groups of taxpayers caused directly by the imposition of a tax. This measure can be referred

to as relative income share progressivity (RISP). It has been argued that RISP "is useful both because of its simplicity and because of the amount of information it provides about the impact of the tax". This paper reviews the salient features of relative income share progressivity (RISP) and proposes a new measure of tax progressivity. The new measure is complementary to RISP, as simple as RISP and more suitable as a measure of tax progressivity. Unlike RISP, it is useful in comparing tax progressivity of the tax structures with varied tax yield.

The plan of the paper is as follows. The salient features of relative income share progressivity (RISP) are discussed in Section 2. A new measure of tax progressivity is proposed and its applications explored in Section 3. The use of new measure of tax progressivity is illustrated with data on personal income tax payers in India, in Section 4. Findings are presented in Section 5.

2. Relative Income Share Progressivity (RISP)

Relative income share progressivity (RISP) is based on the notion that a personal income tax that is not proportional, leaves the distribution of post-tax income different from that of pre-tax income. RISP gives rise to progressivity schedule over the groups of taxpayers. This, for the i th ($i=1,2,\dots,k$) group of taxpayers, is defined as the ratio of the share of i th group in post-tax income to that in pre-tax income. It can be expressed as:

$$\begin{aligned}
 RISP_i = S^*_i/S_i &= \frac{(Y_i - T_i)/(Y - T)}{Y_i/Y} \\
 &= \frac{1 - a_i}{1 - a} \dots\dots\dots (1)
 \end{aligned}$$

Where S_i and S^*_i denote the shares of i th group of taxpayers in pre- and post-tax incomes respectively; ' a_i ' and ' a ' denote the average tax rates respectively of the i th group and all the taxpayers.

The sequence $RISP_i$ ($i=1,2,3,\dots,k$) describes the overall progressivity of the tax. Descending (ascending) $RISP_i$'s along the low income to high income groups of taxpayers indicate progressivity (regressivity), and $RISP_i=1$ for all i indicates proportionality of the tax. The stronger, the trend of decrease (increase) in $RISP_i$'s the higher, the progressivity (regressivity).

It has been shown that a proportional¹ as well as additive² positive (negative) translation of the average tax rates of all the taxpayers increases (decreases) the relative income share progressivity of the tax.

RISP is neutral to those tax changes which leave the distribution of post-tax income unchanged. Such tax changes require higher tax hikes or tax cuts for low income taxpayers as compared to those for high income taxpayers.

RISP is sensitive to changes in the distribution of pre-tax income. An increase (decrease) in inequality in the distribution of pre-tax income increases (decreases) the progressivity of the tax. This suggests that RISP can be used in comparing progressivity of different tax structures only when the distribution of pre-tax income remains unchanged or is held constant.

RISP is free from cross over problems associated with summary indices or global measures of tax progressivity³. In a comparison of two tax structures, it shows variation in progressivity for each sub-group separately.

RISP indicates redistributive effect of a tax structure that depends on both the tax level (scale) and graduation in the tax rates. It can not distinguish between the effects of changes in tax level and graduation in the tax rates. It is for this reason that RISP can not be applied in comparing the progressivity of different tax structures with varied tax yield. A new measure of tax progressivity similar to RISP, that depends on graduation in the tax rates and is independent of tax level is proposed in the following section. The new measure allows comparison of different tax structures even with varied tax yield.

3. A New Measure: Relative Tax Share Progressivity (RTSP)

A new measure of tax progressivity, similar to RISP, is being proposed, based on the notion that a personal income tax which is not proportional, results in distribution of tax different from that of pre-tax income. The new measure is defined in terms of shares of different groups of taxpayers in total tax yield vis-a-vis their shares in pre-tax income, and it is referred to as relative tax share progressivity (RTSP). This measure, for the *i*th (*i*=1,2,...,k) group of taxpayers, is defined as the ratio of the share of *i*th group in total tax liability of all the taxpayers to that in pre-tax income. It can be expressed as:

$$RTSP_i = \frac{T_i/T}{Y_i/Y} = \frac{a_i}{a} \dots\dots\dots(2)$$

An $RTSP_i=1$ means that the average tax rate of this group is the same as that of all the taxpayers implying that the relative position of the group has not been affected by the tax. For a proportional tax, like $RISP_i$, $RTSP_i=1$ for all i ($i=1,2,\dots,k$). $RTSP_i < 1$ (> 1) indicates that the i th group pays lower (higher) share of taxes than it would have paid under a proportional tax.

The sequence $RTSP_i$ ($i=1,2,\dots,k$) describes the overall progressivity of the tax. The ascending (descending) $RTSP_i$'s along the low income to high income groups of taxpayers indicate progressivity (regressivity), and $RTSP_i=1$ for all i , indicates proportionality of the tax. The stronger, the trend of increase (decrease) in $RTSP_i$'s the higher, the progressivity (regressivity).

Properties of the new measure 'RTSP' are discussed below. A comparative picture of salient features of RTSP and RISP is given in Table 1.

RTSP, unlike RISP, is independent of the tax level in the sense, that a proportional translation of average tax rates or tax liabilities of all groups of taxpayers leaves RTSP schedule unchanged (This has been shown in the Annexure, proposition 1). RISP depends on both tax level and graduation in the tax rates. It is indicative of redistributive impact of the tax that increases (decreases) with increase (decrease) in tax level or graduation in the tax rates⁴. A schedule of RTSP can be said to be representing graduation in the tax rates or distribution of tax among different groups of taxpayers. The measures of progression indicative of income redistribution and tax distribution have been distinguished⁵. The measures, RTSP and RISP seem to reflect on two aspects of a tax schedule. The former indicates graduation in

the tax rates and the latter indicates redistributive impact of the tax. In this sense, the two measures can be said to be complementary. Clearly, RTSP is more suitable as a measure of tax progressivity and RISP is more suitable as a measure of redistributive impact of the tax. A highly progressive tax schedule may not result in much redistribution of income if the tax rates are very low. Given the extent of redistribution of income, there is trade off between the level of tax rates and the degree of progression in the tax schedule. The new measure 'RTSP' along with the level of tax rates helps in better understanding of the redistributive impact of a tax schedule that is represented by RISP schedule.

Baum points out that tax rate hikes (cuts) which leave distribution of post-tax income unchanged leave RISP schedule unchanged too, and such changes require larger tax hikes (tax cuts) for low income taxpayers as compared to those for high income taxpayers. Clearly, such tax rate hikes (cuts) will decrease (increase) RTSP. Further, a change in the tax schedule that results in distribution of positive (negative) additional tax revenue, raised to be the same as distribution of post-tax income before the change decreases (increases) RTSP, and leaves RISP unchanged (This has been shown in the Annexure, propositions 2 and 3).

A constant positive (negative) additive translation of the average tax rates decreases (increases) RTSP while it increases (decreases) RISP (see the Annexure, propositions 4 and 5). It is noteworthy that positive (negative) additive translation results in increase (decrease) in RISP inspite of decrease (increase) in RTSP. This implies that for a constant additive translation of

the average rates of all taxpayers, the effect of rise (fall) in tax level dominates the effect of the corresponding change in RTSP, on RISP.

RTSP, like RISP, is sensitive to changes in the distribution of pre-tax income. Ceteris paribus a rise (decline) in inequality in the distribution of pre-tax income with the rich (poor) gaining at the expense of poor (rich) increases (decreases) relative tax share progressivity. It is so, because as the poor (rich) gains at the expense of rich (poor), under a graduated rate structure, the average tax rate of the poor (rich) tends to rise and that of the rich (poor) tends to fall.

A constant proportional change in incomes of all taxpayers may affect RTSP - it may increase, decrease or remain unchanged. A constant proportional increase in incomes of all taxpayers may increase the average tax rates of different groups of taxpayers. The extent of increase in average tax rate of a group of taxpayers depends on graduation in tax rates at their income levels and the extent of increase in their incomes. RTSP increases (decreases) if proportional increase in average tax rate of a group of low (high) income taxpayers is lower as compared to that of a group of high (low) income taxpayers. RTSP remains unchanged if average tax rates of all taxpayers rise by a constant proportion - this happens if the tax schedule is of constant average rate elasticity progression all along the income scale⁶. Similarly, a constant proportional decrease in incomes of all taxpayers may decrease the average tax rates of different groups of taxpayers. RTSP decreases (increases) if proportional decrease in average tax rate of a group of low (high) income taxpayers is lower as compared to that of a group of high (low) income taxpayers. RTSP remains unchanged if average tax rates of all taxpayers decrease by a

constant proportion - this happens if the tax schedule is of constant average rate elasticity progression at all income levels. This suggests that the impact of inflation or deflation on RTSP is not unambiguous, it depends on the tax function or graduation in the tax rates along the income scale.

Regarding the effect of a constant proportional change in incomes of all taxpayers on RISP, Baum conjectures that a constant proportional increase in incomes of all taxpayers increases RISP, regardless of the degree of graduation in the tax rates. This conjecture has been based on the argument "if all pre-tax incomes rise in the same proportion, after-tax income rises by a higher percentage at low income levels, where marginal tax rates are lower". This contention however, does not seem to be true. This can be explained with the following example. Let us assume a tax schedule as given below:

Income (Rupees)	Marginal tax rate (Per cent)
First 5,000	10.0
Next 5,000	30.0
Balance	40.0

Let us further assume that there are three groups of taxpayers each consisting of one taxpayer. Calculations of their shares in post-tax incomes before and after 100 per cent increase in their pre-tax incomes are given in Table 2. It would be noted from Table 2 that, with the above given tax schedule and with 100 per cent increase in incomes of all taxpayers, contrary to the contention of Baum, after-tax income of low income taxpayers has risen by a lower percentage as compared to that of high income taxpayers, resulting in a decline in RISP. The shares of low

income taxpayers (groups 1 and 2) in post-tax income after the increase in pre-tax incomes have declined and that of high income taxpayers (group 3) have risen. Nevertheless, the contention of Baum may hold good for some tax schedules. Thus, it would be correct to state that in general, RISP, like RTSP, may increase, decrease or remain unchanged following a constant proportional change in pre-tax incomes of all taxpayers. Specifically, if the tax schedule is of constant residual income progression all along the income scale, RISP remains unchanged, following a constant proportional change in incomes of all taxpayers⁷.

It may also be noted from Table 2 that following doubling of incomes of all taxpayers, tax level as represented by average tax rate has risen from 24.29 to 31.43 per cent and RTSP has declined (last four rows). The decline in RISP following the decline in RTSP, inspite of rise in tax level suggests that the impact of decline in RTSP has dominated the impact of rise in tax level in influencing RISP.

RTSP, like RISP, is free from cross over problems associated with global measures of tax progressivity. In a comparison of two tax structures, it also shows variation in progressivity for each sub-group separately.

4. Application

The use of the new measure of tax progressivity in comparing progressivity of different tax schedules and understanding redistributive impact of the tax schedules (as indicated by RISP) is explained with the data on personal income tax payers in India. The study covers the single major category of personal income tax

payers in India - 'individuals'. These account for more than 90 per cent of the total number and taxable income of all personal income taxpayers.

4.1. Rate Structure of Personal Income Tax in India

In India, personal income is taxed at graduated rates by income brackets. During the last three decades, the tax schedule in India has been substantially varied. A brief description of the tax schedules which were prevalent during the period 1961-62 to 1991-92 is given in Tables 3 and 4. The year-wise information on the range of statutory marginal tax rates, exemption limit and surcharge (if any) is given in Table 3. The statutory marginal tax rates by income brackets, for different years, are presented in Table 4. It would be noted from Table 3 that the period 1961-62 to 1970-71 can be characterised as the period with very low minimum marginal tax rates and high maximum marginal tax rates. During this period, minimum marginal tax rate did not exceed 6 per cent. The period 1971-72 to 1974-75 can be characterised as the period with low minimum marginal tax rates and very high maximum marginal tax rates. During this period, maximum marginal tax rate (inclusive of surcharge) has been as high as 97.5 per cent and the tax schedule has remained broadly unchanged. The period 1975-76 to 1981-82 can be characterised with moderately low minimum marginal tax rates and high maximum marginal tax rates. During the period 1982-83 to 1984-85, minimum marginal tax rate has been very high and maximum marginal tax rate has been just high. In the subsequent years the minimum as well as the maximum marginal tax rates have been lowered. The tax schedule in the year 1991-92 could be characterised as the one with moderately high minimum and maximum marginal tax rates.

4.2. The Data

The data relating to the personal income taxpayers in India have been obtained from All India Income Tax Statistics (AIITS) - the only source of data on income classwise distribution of the taxpayers in India. The data have been compiled for selected years 1961-62, 1971-72, 1977-78 and 1983-84 covering the period 1961-62 to 1983-84. The tax schedules prevalent during the selected years represent different periods with divergent tax schedules. 1983-84 is the last year for which data comparable with those of the previous years are available⁸. The limitations of these data have been widely discussed in the literature (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 which correspond to the incomes earned in the previous years with declining weight of the successive preceding years. The fraction of total number of assessments completed in a year, covered in AIITS has varied from year to year. Nevertheless, these data can be taken to reasonably reflect the changes in the distribution of income among the taxpayers.

4.3. Progression schedules

Estimates of relative income share progressivity (RISP), relative tax share progressivity (RTSP) and average tax rates are obtained for the rate schedules prevalent during the selected years 1961-62, 1971-72, 1977-78 and 1983-84. The progressivity measures are computed by deciles of population of taxpayers. For greater details about the top decile, these have also been computed for top 5 per cent and top 1 per cent taxpayers. These are reported in Table 5.

It would be noted from Table 1 that the rate schedules prevalent during the selected years represent a variety of rate schedules. The rate schedules corresponding to the years 1961-62 and 1971-72 represent the rate schedules with very low marginal tax rates at low income levels and very high marginal tax rates at high income levels. The rate schedule corresponding to the year 1977-78 represents the rate schedules with low marginal tax rates at low income levels and high marginal tax rates at high income levels. The rate schedule corresponding to the year 1983-84 represents the rate schedules with very high marginal tax rates at low income levels and high tax rates at high income levels.

A comparison of RTSP schedules for the years 1961-62, 1971-72, 1977-78, 1980-81 and 1983-84 (columns 2,4,6,8, and 10 in Table 5) seems to reveal that tax progressivity has continued to decline during the period 1961-62 to 1980-81 with marked sharp decline during 1977-78 to 1980-81, and has slightly increased thereafter during 1980-81 to 1983-84. This is corroborated by the trend growth rates of progression over low to high income deciles which were 39, 32, 30, 17 and 18 per cent during the years 1961-62, 1971-72, 1977-78, 1980-81 and 1983-84 respectively.

From Table 5, it may also be noted that during the period 1961-62 to 1971-72, decline in progressivity is marked by decline in tax progression at top income decile (columns 2 and 4), whereas during the period 1971-72 to 1977-78 the decline is marked by relatively greater rise in tax progression at first income decile associated with decline in progression at third, fourth and seventh deciles (columns 4 and 6). The sharp decline in tax progressivity during the period 1977-78 to 1980-81 is accompanied by sharp rise in progression at first four deciles and sharp decline in progression at fifth and top income deciles (columns 6

and 8). The increase in progressivity during 1980-81 to 1983-84 has come through decline in tax progression at low income deciles and rise in progression at high income deciles (columns 8 and 10). Broadly, it can be said that progressivity of Indian personal income tax during the period 1961-62 to 1983-84 has substantially declined following sharp increases in progression at low income deciles and sharp decreases in progression at high income deciles. The decline in progressivity during the period 1971-72 to 1977-78 has been small inspite of sharp cuts in high marginal tax rates at high income levels. It has been so, because simultaneously, the marginal tax rates at low and middle income levels were also reduced (Table 4, columns 7 and 10). The sharp decline in progressivity during 1977-78 to 1980-81 is attributable to increase in marginal tax rates at low income levels and decrease in marginal tax rates at high income levels (Table 4, columns 10 and 11).

A comparison of RISP schedules for the years 1961-62, 1971-72, 1977-78, 1980-81 and 1983-84 (columns 3,5,7,9 and 11 in Table 5) seems to reveal that tax progressivity or redistributive impact of the tax (as indicated by the declining trend in progression over low to high income deciles) has increased during the period 1961-62 to 1971-72, decreased during 1971-72 to 1977-78, again increased during 1977-78 to 1980-81 which was followed by a decline during 1980-81 to 1983-84. This rise or decline in RISP in contrast with continuous decline in RTSP during 1961-62 to 1980-81 and rise during 1980-81 to 1983-84 needs to be explained. The rise or fall in tax progressivity and average tax rate during different periods are shown in Table 6.

For understanding change in RISP vis-a-vis RTSP over time, it is noteworthy that an increase (decrease) in RTSP or average rate tends to increase (decrease) RISP. From Table 5, it would be noted that decline in both the average tax rate and RTSP resulted in decline in RISP during the period 1971-72 to 1977-78 (columns 4 to 7), and the rise in both led to rise in RISP during the period 1980-81 to 1983-84 (columns 8 to 11). The changes in tax progressivity and average tax rates during the periods 1961-62 to 1971-72 and 1977-78 to 1980-81 (columns 2 to 9) clearly bring out the role of the latter in influencing RISP. During these periods, RISP has risen inspite of decline in RTSP because of rise in average tax rate. In general, during the period 1961-62 to 1983-84, but for substantial rise in average tax rate RISP would have sharply declined following marked decline in RTSP.

5. Conclusions

The proposed new measure - relative tax share progressivity (RTSP) is as simple and informative as the existing measure-relative income share progressivity (RISP). The two measures are found complementary. While RISP is better suited for indicating redistributive effect of a tax that depends on both the level of and graduation in the tax rates, RTSP is more suitable for reflecting progressivity of the tax as it depends only on graduation in the tax rates. RTSP can be used in comparing tax progressivity of different tax structures even with varied tax yield whereas RISP can be best applied to equi-revenue tax structures. RTSP along with the level of tax rates helps in better understanding of the redistributive impact of a tax schedule that is indicated by RISP.

In general, during the period 1961-62 to 1983-84, the redistributive impact of personal income tax in India as indicated by RISP has increased and the progressivity as indicated by RTSP has declined. But for substantial rise in average tax rate, the redistributive impact of the tax would have sharply declined following decline in RTSP. The changes in the average tax rate and RTSP are found to explain for the changes in RISP.

TABLE 1

Salient Features of Hybrid Measure of Progressivity:
Effects of Changes in Tax Rates and Income

Change in tax rate/income	Effect of the Change on	
	Relative tax share pro- gressivity (RTSP)	Relative income share pro- gressivity (RISP)
(1)	(2)	(3)
1. Proportional increase (decrease) in average tax rates of all taxpayers	Neutral	↑ (↓)
2. Changes in the rate schedule which result in positive (negative) additional tax revenue that follows the same distribution as post-tax income.	↓ (↑)	Neutral
3. Increase (Decrease) in average tax rates or tax liabilities of all taxpayers by constant percentage points.	↓ (↑)	↑ (↓)
4. Rise (decline) in inequality in distribution of pre-tax income	↑ (↓)	↑ (↓)
5. Proportional change in pre-tax incomes of all taxpayers	Ambiguous	Ambiguous

- Notes:
- ↑ (↓) indicates increase (decrease) in measured tax progressivity following a specific change in the tax schedule or income.
 - Neutral means progressivity remains unchanged following a change.
 - Ambiguous means that increase or decrease in tax progressivity following a change is not unambiguous.

TABLE 2

Effect of Proportional Rise in Incomes
of all Taxpayers on RISP

Characteristic (income/tax)	Before (b) or after(a) rise in income	Groups of Taxpayers			
		Group 1	Group 2	Group 3	All
(1)	(2)	(3)	(4)	(5)	(6)
Pre-tax income(Rs)	b	5000	10000	20000	35000
	a	10000	20000	40000	70000
Tax liability(Rs)	b	500	2000	6000	8500
	a	2000	6000	14000	22000
Post-tax income(Rs)	b	4500	8000	14000	26500
	a	8000	14000	26000	48000
Group shares in pre- tax income (per cent)	b/a	14.29	28.57	57.14	100.00
Group shares in post-tax income (per cent)	b	16.98	30.19	52.83	100.00
	a	16.67	29.17	54.17	100.00
RISP	b	1.1882	1.0567	0.9246	
	a	1.1666	1.0210	0.9480	
Average tax rate (per cent)	b	10.00	20.00	30.00	24.29
	a	20.00	30.00	35.00	31.43
RTSP	b	0.4117	0.8234	1.2351	
	a	0.6363	0.9545	1.1136	

Notes: 1. Each group of taxpayers is assumed to consist of a single taxpayer.

2. Tax rate schedule is assumed to consist of three marginal tax rates - 10 per cent for first Rs. 5,000, 30 per cent for next Rs. 5,000, and 40 per cent for the balance income.

3. RISP : Relative income share progressivity
RTSP : Relative tax share progressivity.

TABLE 3
Range of Marginal Tax Rates Applicable to Individual Taxpayers
in the Years 1961-62 to 1991-92

Assessment years	Exclusive of surcharge (Per cent)	Surcharge on income tax (Per cent)	Inclusive of surcharge (Per cent)	Exemption limit (Rs. thousand)
(1)	(2)	(3)	(4)	(5)
1961-62	3.00 - 70.00	5.0 - 20.0 ¹	3.150 - 84.000	3
1962-63 & 1963-64	3.00 - 72.50	5.0 - 20.0 ¹	3.150 - 87.000	3
1964-65	6.00 - 75.00	0.0 - 24.167 ²	6.000 - 93.125	3
1965-66	5.00 - 65.00	10.0 - 35.0 ³	5.500 - 89.375	3
1966-67 to 1968-69	5.00 - 65.00	10.0 - 35.0 ³	5.500 - 89.375	4
1969-70 & 1970-71	5.00 - 75.00	10.0	5.500 - 82.500	4
1971-72	10.00 - 85.00	10.0	11.000 - 93.500	5
1972-73 to 1974-75	10.00 - 85.00	10.0 or 15.0 ⁴	11.000 - 97.750	5
1975-76	12.00 - 70.00	10.0	13.200 - 77.000	6
1976-77	17.00 - 70.00	10.0	18.170 - 77.000	8
1977-78	15.00 - 60.00	10.0	16.500 - 66.000	8
1978-79 & 1979-80	15.00 - 60.00	15.0	17.250 - 69.000	8 ⁵
1980-81	15.00 - 60.00	20.0	18.000 - 72.000	8 ⁵
1981-82	15.00 - 60.00	10.0	16.500 - 66.000	8 ⁵
1982-83 & 1983-84	30.00 - 60.00	10.0	33.000 - 66.000	15
1984-85	25.00 - 60.00	12.5	28.125 - 67.500	15
1985-86	20.00 - 55.00	12.5	22.500 - 61.875	15
1986-87 to 1988-89	25.00 - 50.00	Nil	25.000 - 50.000	18
1989-90 & 1990-91	25.00 - 50.00	Nil or 10.0 ⁷	25.000 - 55.000	18
1991-92	20.00 - 50.00	Nil or 10.0 ⁸	20.000 - 55.000	22

- Notes:
1. 5 per cent on tax on income upto Rs. 7,500 and 20 per cent on tax on income exceeding Rs. 7,500.
 2. Nil, 12.5., 15, 17.5 and 24.167 per cent respectively on tax on the income ranges 0-10, 10-25, 25-75, 75-100 and above 100 thousand rupees.
 3. 10, 30 and 35 per cent respectively on tax on the income ranges 0-15, 15-50 and above 50 thousand rupees. These rates are inclusive of 10 per cent special surcharge.
 4. Surcharge on total tax is 15 per cent if taxable income exceeds Rs. 15,000 and 10 per cent otherwise.
 5. If income does not exceed Rs. 10,000, it is treated as exempt.
 6. If income does not exceed Rs. 12,000, it is treated as exempt.
 7. Surcharge on total tax is 10 per cent if taxable income exceeds Rs. 50,000 and otherwise 'nil'.
 8. Surcharge on total tax is 10 per cent if taxable income exceeds Rs. 75,000 and otherwise 'nil'.

Source: Budget of Union Government of India, for different years.

TABLE 4

Marginal Tax Rates Applicable to Individual Taxpayers in the Assessment Years 1961-62 to 1990-91

(Per cent)

Taxable income (Rs. thousand)	Assessment year(s)															
	1961-62	1962-63 & 1963-64	1964-65	1965-66 to 1966-67	1968-70 & 1970-71	1971-72 to 1974-75	1975-76	1976-77	1977-78	1978-79 to 1981-82	1982-83	1983-84	1984-85	1985-86	1986-87 to 1988-89	1989-90
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
0 - 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 - 4	3.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4 - 5	3.0	3.0	0.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5 - 7	7.0	7.0	10.0	10.0	10.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 - 7.5	7.0	7.0	10.0	10.0	10.0	10.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.5 - 10	10.0	10.0	15.0	10.0	10.0	10.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10 - 10	10.0	10.0	15.0	10.0	10.0	10.0	12.0	17.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10 - 12.5	12.0	12.0	15.0	15.0	15.0	17.0	15.0	17.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0
12.5 - 15	15.0	15.0	20.0	15.0	15.0	17.0	15.0	17.0	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0
15 - 17.5	20.0	20.0	20.0	20.0	20.0	23.0	20.0	20.0	10.0	10.0	30.0	30.0	25.0	20.0	0.0	0.0
17.5 - 18	20.0	23.0	20.0	20.0	20.0	23.0	20.0	20.0	10.0	10.0	30.0	30.0	25.0	20.0	0.0	0.0
18.0 - 20	20.0	23.0	20.0	20.0	20.0	23.0	20.0	20.0	10.0	10.0	30.0	30.0	25.0	20.0	25.0	20.0
20 - 25	20.0	33.0	35.0	30.0	30.0	30.0	30.0	30.0	25.0	25.0	30.0	30.0	30.0	25.0	25.0	20.0
25 - 30	33.0	43.0	40.0	40.0	40.0	40.0	40.0	40.0	30.0	30.0	34.0	34.0	35.0	30.0	30.0	30.0
30 - 40	43.0	47.0	55.0	50.0	50.0	50.0	50.0	50.0	40.0	40.0	40.0	40.0	40.0	35.0	30.0	30.0
40 - 50	47.0	57.0	55.0	50.0	50.0	50.0	50.0	50.0	40.0	40.0	40.0	40.0	40.0	40.0	30.0	30.0
50 - 60	57.0	65.0	70.0	60.0	60.0	60.0	60.0	60.0	50.0	50.0	50.0	50.0	50.0	45.0	40.0	40.0
60 - 70	65.0	70.0	70.0	60.0	60.0	70.0	60.0	60.0	50.0	50.0	50.0	52.5	52.5	45.0	40.0	40.0
70 - 80	70.0	72.5	75.0	65.0	65.0	70.0	70.0	70.0	55.0	55.0	55.0	55.0	55.0	50.0	40.0	40.0
80 - 85	70.0	72.5	75.0	65.0	65.0	75.0	70.0	70.0	55.0	55.0	55.0	55.0	55.0	50.0	40.0	40.0
85 - 100	70.0	72.5	75.0	65.0	65.0	75.0	70.0	70.0	55.0	55.0	55.0	57.5	57.5	50.0	40.0	40.0
100 - 200	70.0	72.5	75.0	65.0	70.0	80.0	70.0	70.0	60.0	60.0	60.0	60.0	60.0	55.0	50.0	50.0
200 - 250	70.0	72.5	75.0	65.0	70.0	85.0	70.0	70.0	60.0	60.0	60.0	60.0	60.0	55.0	50.0	50.0
250 - 300	70.0	72.5	75.0	65.0	75.0	85.0	70.0	70.0	60.0	60.0	60.0	60.0	60.0	55.0	50.0	50.0
300 - 400	70.0	72.5	75.0	65.0	75.0	85.0	70.0	70.0	60.0	60.0	60.0	60.0	60.0	55.0	50.0	50.0
400 - 500	70.0	72.5	75.0	65.0	75.0	85.0	70.0	70.0	60.0	60.0	60.0	60.0	60.0	55.0	50.0	50.0
Above 500	70.0	72.5	75.0	65.0	75.0	85.0	70.0	70.0	60.0	60.0	60.0	60.0	60.0	55.0	50.0	50.0

Note: The marginal tax rates presented here do not include surcharge or special surcharge if any. Thereon, however include surtax prevalent in the years 1961-62 to 1964-65, that was applicable to high income taxpayers.

Source: Budget of Union Government of India, for different years.

TABLE 5

Relative Tax (Income) Share Progressivity in Selected Years
During 1961-62 to 1983-84

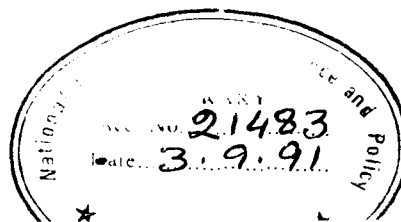
Percentage of taxpayers		Tax progressivity in the year									
		1961-62		1971-72		1977-78		1980-81		1983-84	
		RTSP	RISP	RTSP	RISP	RTSP	RISP	RTSP	RISP	RTSP	RISP
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
First	10 per cent	0.093	1.132	0.091	1.166	0.167	1.142	0.431	1.127	0.412	1.143
Second	10 per cent	0.069	1.136	0.186	1.149	0.186	1.139	0.359	1.143	0.392	1.148
Third	10 per cent	0.069	1.136	0.190	1.148	0.188	1.139	0.359	1.143	0.370	1.153
Fourth	10 per cent	0.081	1.134	0.190	1.148	0.188	1.139	0.359	1.143	0.353	1.158
Fifth	10 per cent	0.163	1.122	0.315	1.125	0.447	1.095	0.359	1.143	0.353	1.158
Sixth	10 per cent	0.163	1.122	0.381	1.113	0.450	1.094	0.540	1.102	0.399	1.146
Seventh	10 per cent	0.250	1.109	0.479	1.095	0.450	1.094	0.610	1.087	0.623	1.092
Eighth	10 per cent	0.345	1.096	0.535	1.085	0.677	1.055	0.724	1.061	0.786	1.052
Ninth	10 per cent	0.547	1.066	0.718	1.052	0.833	1.029	0.975	1.006	1.086	0.979
Top	10 per cent	2.238	0.819	2.139	0.792	2.262	0.784	1.995	0.779	1.964	0.765
Top	5 per cent	2.797	0.738	2.616	0.705	2.738	0.703	2.306	0.710	2.208	0.706
Top	1 per cent	3.957	0.569	3.508	0.542	3.820	0.518	2.900	0.578	2.699	0.586
Average Tax Rate		0.127	0.127	0.154	0.154	0.146	0.146	0.182	0.182	0.196	0.196

TABLE 6

Changes in Tax Progressivity and Average Tax Rate during different Periods

Period	Rise (↑) or fall (↓) in		
	Relative income share progressivity (RISP)	Relative tax share progressivity (RTSP)	Average tax rate
(1)	(2)	(3)	(4)
1961-62 to 1971-72	↑	↓	↑
1971-72 to 1977-78	↓	↓	↓
1977-78 to 1980-81	↑	↓	↑
1980-81 to 1983-84	↑	↑	↑

Source: Table 5.



ANNEXURE

EFFECTS OF CHANGES IN TAX RATES ON PROGRESSIVITY

In this Annexure, some of the results relating the changes in the tax schedule and their impact on tax progressivity are stated as propositions. Their proofs have also been provided. The following notations are used:

$RTSP_i(RISP_i)$ = Relative tax (income) share progressivity for the i th group of taxpayers.

$RTSP^*_i(RISP^*_i)$ = $RTSP_i(RISP_i)$ after the change in tax schedule.

Y_i = Pre-tax income of i th group of taxpayers.

T_i = Tax liability of i th group of taxpayers.

a_i = T_i/Y_i , average tax rate of i th group of taxpayers.

Y = Pre-tax income of all taxpayers.

T = Tax liability of all taxpayers.

a = T/Y , average tax rate of all taxpayers.

Proposition 1: A constant proportional change in average tax rates or tax liabilities of all taxpayers leaves the relative tax share progressivity (RTSP) unchanged.

Proof: Let the proportional change in average tax rate or tax liability of each group of taxpayers be denoted by fraction p .
Now,

$$RTSP_i = a_i/a$$

$$RTSP^*_i = a_i (1+p)/a((1+p))$$

$$\text{or } RTSP^*_i = RTSP_i$$

Hence the result.

Proposition 2: A Change in the tax schedule that results in distribution of positive (negative) additional tax revenue raised to be the same as distribution of post-tax income before the change, decreases (increases) relative tax share progressivity (RTSP).

Proof: Let δ_i and δ denote changes in tax liabilities of the i th group and of all taxpayers respectively. Since δ follows the same distribution as post-tax income, (δ_i/δ) can be expressed as:

$$\frac{\delta_i}{\delta} = \frac{Y_i - T_i}{Y - T} = \frac{T_i}{T} \cdot \frac{Y_i/T_i - 1}{Y/T - 1}$$

or,

$$\frac{\delta_i}{\delta} = \frac{T_i}{T} \cdot \frac{1/a_i - 1}{1/a - 1} = \frac{T_i}{T} \cdot \frac{1 - a_i}{1 - a} \cdot \frac{a}{a_i}$$

or,

$$\delta_i = \frac{T_i}{T} \cdot \frac{1-a_i}{1-a} \cdot \frac{a}{a_i} \cdot \delta$$

Now,

$$RTSP_i = (T_i/T) / (Y_i/Y)$$

$$RTSP^*_i = \frac{(T_i + \delta_i)}{(T + \delta)} / (Y_i/Y)$$

or,

$$RTSP^*_i = \left(\frac{T_i + (T_i/T) \cdot ((1-a_i)/(1-a)) \cdot (a/a_i) \cdot \delta}{T + \delta} \right) / (Y_i/Y)$$

$$RTSP^*_i = \left(\frac{(T_i/T) \cdot \{T + ((1-a_i)/(1-a)) \cdot (a/a_i) \cdot \delta\}}{T + \delta} \right) / (Y_i/Y)$$

or,

$$RTSP^*_i = \left(\frac{T + ((1-a_i)/(1-a)) \cdot (a/a_i) \cdot \delta}{T + \delta} \right) RTSP_i$$

For $\delta > 0$; $RTSP^*_i \underset{\geq}{\leq} RTSP_i$ according as $a_i \underset{\leq}{\geq} a$.

This suggests that for positive additional tax revenue mobilisation, relative tax share progressivity rises (declines) for lower (higher) income groups, implying a decrease in overall progressivity of the tax.

For $\delta < 0$; $RTSP^*_i \underset{\leq}{\geq} RTSP_i$ according as $a_i \underset{\geq}{\leq} a$.

This suggests that for negative additional tax revenue mobilisation, relative tax share progressivity rises (declines) for higher (lower) income groups, implying an increase in overall progressivity of the tax.

Hence the result.

Proposition 3: A change in the tax schedule that results in distribution of positive (negative) additional tax revenue raised to be the same as distribution of post-tax income before the change, leaves relative income share progressivity (RISP) unchanged.

Proof: Let δ_i and δ denote change in tax liabilities of the i th group and of all taxpayers respectively. Since δ follows the same distribution as distribution of post-tax income, (δ_i/δ) can be written as:

$$\frac{\delta_i}{\delta} = \frac{Y_i - T_i}{Y - T}$$

Now,

$$RISP_i = \left(\frac{Y_i - T_i}{Y - T} \right) / (Y_i/Y)$$

$$RISP^*_i = \left(\frac{Y_i - T_i - \delta_i}{Y - T - \delta} \right) / (Y_i/Y)$$

or,

$$RISP^*_i = \left(\frac{Y_i - T_i - ((Y_i - T_i)/(Y - T)) \cdot \delta}{Y - T - \delta} \right) / (Y_i/Y)$$

$$RISP^*_i = \left(\frac{((Y_i - T_i)/(Y - T)) \cdot (Y - T - \delta)}{(Y - T - \delta)} \right) / (Y_i/Y)$$

$$RISP^*_i = \left(\frac{Y_i - T_i}{Y - T} \right) / (Y_i/Y)$$

$$RISP^*_i = RISP_i$$

Hence the result.

Proposition 4: A constant positive (negative) additive translation of the average tax rates decreases (increases) relative tax share progressivity (RTSP).

Proof: Let $RTSP_i$ and $RTSP^*_i$ denote tax progressivity for the i th group of taxpayers before and after 'k' percentage point change in the average tax rates. Now,

$$RTSP_i = a_i/a$$

$$RTSP^*_i = (a_i+k)/(a+k)$$

$$\frac{RTSP^*_i}{RTSP_i} = \frac{1+(1/a_i)k}{1+(1/a)k}$$

For $k > 0$, $RTSP_i/RTSP^*_i \geq 1$ according as $a_i \leq a$ respectively. This implies that a positive additive translation of the average tax rates decreases relative tax share progressivity. For $k < 0$, $RTSP^*_i/RTSP_i \leq 1$ according as $a_i \leq a$ respectively. This implies that a negative additive translation of the average tax rates increases relative tax share progressivity.

Hence the result.

Proposition 5: A constant positive (negative) additive translation of the average tax rates increases (decreases) relative income share progressivity (RISP).

Proof: Let $RISP_i$ and $RISP^*_i$ denote relative income share progressivity for the i th group of taxpayers before and after 'k' percentage point change in average tax rates of all taxpayers respectively. Now,

$$RISP_i = (1-a_i)/(1-a)$$

$$\begin{aligned} RISP^*_i &= (1-a_i-k)/(1-a-k) \\ &= \frac{(1-a_i) \cdot \{1-(1/(1-a_i)) \cdot k\}}{(1-a) \cdot \{1-(1/(1-a)) \cdot k\}} \\ &= \frac{1-\{(1/(1-a_i)) \cdot k\}}{1-\{(1/(1-a)) \cdot k\}} RISP_i \end{aligned}$$

For $k > 0$; $RISP^*_i \geq RISP_i$ according as $a_i \leq a$. This suggests that for positive additive translation of the average tax rates relative income share progressivity increases (decreases) for lower (higher) income groups implying an increase in overall progressivity of the tax.

For $k < 0$; $RISP^*_i \leq RISP_i$ according as $a_i \geq a$. This suggests that for negative additive translation of the average tax rates relative income share progressivity decreases (increases) for lower (higher) income groups implying a decrease in overall progressivity of the tax.

Hence the result.

NOTES

- 1 A proportional translation of average tax rates a_i 's ($i=1,2,3,\dots,k$) is defined as $(1+c).a_i$ ($i=1,2,3,\dots,k$), where c is a constant fraction. For $c>0$ ($c<0$), it is called positive (negative) proportional translation.
- 2 An additive translation of average tax rates a_i 's ($i=1,2,3,\dots,k$) is defined as a_i+c ($i=1,2,3,\dots,k$), where c is a constant fraction. For $c>0$ ($c<0$), it is called positive (negative) additive translation.
- 3 For a lucid discussion on summary indices/global measures of tax progresivity see, for example, Kiefer (1984) and Pfahler (1987). Also see Aggarwal (1991) for an exposure to a recently developed new global measure of tax progressivity.
- 4 For an attempt at isolating the impact of tax level, progressivity and non-tax parameters on redistributive impact of personal income tax, see Aggarwal (1990a).
- 5 See, for example, Kakwani (1977), Kiefer (1984) and Pfahler (1987).
- 6 A tax function of the form $T = \alpha Y^\theta$ satisfies the condition of constant average rate elasticity progression all along the income scale. The average rate elasticity progression 'AREP(Y)' at an income level y , is the ratio of proportional change in average tax rate to the proportional change in income. This suggests that a porportional change in income by a fraction p would result in a proporitonal change in the average tax rate by a fraction $p.AREP(Y)$. For a constant average rate elasticity progression at all income levels, i.e., for $AREP(Y) = k$ for all y , average tax rate of all taxpayers changes by a fraction $p.K$ following a proportional change in their incomes by a fraction p . The result that RTSP remains unchanged can be shown as follows. Let $RTSP_i$ and $RTSP^*_i$ denote relative tax share progressivity before and after proportional change in incomes of all taxpayers. Now,

$$RTSP_i = (a_i y_i / a y) / (y_i / y)$$

$$RTSP^*_i = \left(\frac{a_i(1+p.k) y_i(1+p)}{a(1+p.k) y(1+p)} \right) / \left(\frac{y_i(1+p)}{y(1+p)} \right)$$

$$= (a_i y_i / a y) / (y_i / y)$$

or $RTSP^*_i = RTSP_i$

Hence the result.

- 7 Residual income progression is defined as the ratio of proportional change in post-tax income to that in pre-tax income. For characteristics of the measure, see Aggarwal (1990b), Jackobsson (1976), and Musgrave and Thin (1948).
- 8 From the year 1984-85, the data are published on the basis of income as reported by the taxpayers instead of income as assessed by the income tax officers.

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