TAXPAYER RESPONSIVENESS TO CHANGES IN INCOME TAX RATES IN INDIA

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Abstract

Taxpayer responsiveness to changes in tax rates is computed by separating it out from the effects of dynamic progressivity, the income growth effect, and the technical (as distinguished from behavioral) effect of tax-rate changes. Year-to-year calculations of responsiveness thus calculated for 3 decades, from 1961 through 1989, for India, produce an overwhelming evidence of a negative relationship between taxpayer responsiveness and changes in tax rates. An estimation of the determinants of taxpayer responsiveness suggests that an increase of 1 percent in the overall index of personal income tax rates in India (during the priod when income tax rates varied up and down between 97 percent and 50 percent) in probability uses approximately the same percentage declinee in tax revenue.

TAXPAYER RESPONSIVENESS TO CHANGES IN INCOME TAX RATES IN INDIA*

Thirty and two years ago, in 1959, the first study of the stochastic responsiveness of tax revenue to changes in come and other economic variables in developing countries was done for India [Sahota, 1961]. The main finding of the study was that, contrary to theoretical predictions and intuitive expectations, India's direct taxes were highly inelastic with respect to income (with a built-in elasticity coefficient for personal income tax revenue of approximately 0.4), while her indirect taxes were elastic (with an elasticity coefficient exceeding one). Even the buoyancy elasticity of personal income tax was less than one.

The irony of India's fisc is that, despite an early awareness and quite a stir that was created by the findings of the reference study, both in government and academic circles, about a third of a century ago, personal income tax and corporate income tax have remained stagnant. If anything, the direct tax revenue in terms of GDP has declined since then, as may be seen from Table 1.

On the other hand, the buoyancy elasticity in most other developing countries has exceeded unity. Their direct taxes as a percentage of GDP have increased. Some of the comparative

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between South Asian and East Asian countries are collected in Table 2, which clearly indicate how much distance most East Asian countries have advanced with their elastic direct taxes, while India stands pat!

Recently, the taxpayer responsiveness to changes in tax rates has become an even more critical aspect of direct taxes, both for revenue and growth in general. The income tax rates in India have varied almost annually since the 1950s, and by large percentages, from the highest marginal tax rate of 84 percent in the early 1960s to 97 percent in the early 1970s to 50 percent in the late 1980s. The effect of changes in tax rates on tax revenue, however, remains controvertial, though hardly any study on the topic is rigorous enough to be convincing on either side.

For instance, Peerzade finds some evidence for a negative relationship between tax rates and tax revenue. Those who find support for a positive relationship include several NIPFP studies, e.g., those by Bagchi [1989] and Bagchi and Rao [1982].

A number of studies on the topic have been done in the United States and other western countries in recent years. Several tax law experts have minimized the economic explanation in terms of costs and returns of tax evasion and assert that high tax rates induce enhanced auditing and enforcement and, consequently, reduce evasion (see, e.g., Spicer [1989]). In other words, tax collector's responsiveness is more critical variable for tax evasion than the responsiveness of the tax payer. Naturally, analytical studies by economists tend to emphasize economic

reasons and the taxpayer response, and in general find support for a positive relationship between tax rates and unreported income (e.g., Clotfelter [1983], Aaron and Galper [1985]).

For testing this relation, the Indian experience provides a rich set of data, inasmuch as in this country's income tax rates have varied widely and the response in terms of changes in tax evasion is believed to be quicker and more prominent than that due to changes in work effort. In this note, we explore the reasons for the stagnation of India's direct taxes and estimate taxpayer responsiveness to changes in tax rates. For this purpose, we decompose changes in tax revenue into its various components; calculate indices of annual changes in marginal and average tax rates; separate out the effects of income expansion and dynamic tax progressivity; and derive taxpayer responsiveness to changes in tax rates. The measures of built-in and buoyancy elasticities come out as byproducts from an improved methodology.

Methodology

With the objective of measuring the effect of changes in tax rates on tax revenue, the following decomposition is relevant and was carried out in this study.

A. Effects of Changes in tax rates: Two effects, among others, of changes in tax rates need to be distinguished, namely:

1. The effect of technical relationship between tax rates and tax revenue: No matter what the behavioral reactions of taxpayers to tax rate changes, for given reported incomes, an increase (decrease) in tax rates will cause consonant rise (fall) in tax revenue--a more than proportionate change when the tax is progressive.

2. Behavioral effec: A change in income tax rates is a change in the price of income or the price of one's resources. A change in tax price, like any other price, has a substitution effect and an income effect.

a. <u>The substitution effect</u>: With higher (lower) marginal tax rates, the cost of earning the marginal unit of net-of-tax income goes up (down). The taxpayer tends to avoid the increased cost of income by one or more of such reactions as:

   i. reallocating resources towards untaxed sources of income and other activities.

   ii. working less. By "work" here is meant all efforts for the earning of one's income, such as change in labor supply (work hours, work speed, conscienciousness in work, productivity of work, and the like), saving, risk-taking, increasing the productivity of all resources, investing in oneself, one's children, and one's assets, and so forth

   iii. being tempted to underreport income, i.e., increasing tax evasion, as the gain from such activities is higher than when marginal tax rates were lower' while the cost can be lowered, if possible, by bribing the tax collector out of increased gains

b. The income effect: Steeper the tax rate, the lower the disposable ncome, and the higher the utility of the marginal income unit, which implies an increase of work effort to earn more income or a rise in tax evasion.

Thus, the income effect and the substitution effect offset each other insofar as work effort is concerned. For tax evasion, however, the two effects are additive. Moreover, the substitution effect has wider repercussions in the form of suboptimal allocation of resources due to distortions, which is a net social cost. Accordingly, the negative substitution effect is likely to dominate the positive income effect, especially at higher income levels.

B. The income growth effect: The income effect of changes in tax prices just discussed is to be distinguished from the effect of income growth, i.e., changes in GDP. The latter effect may also be decomposed into two components:

1. The income expansion effect, which materializes even for a proportionate income tax.

2. The progressivity effect of the income tax schedule, which is effectuated only when incomes change. For an estimation of the effect of changes in tax rates, the exogenous income effects must be taken out.

In brief, we have to identify at least four components of the relationship between tax rates and tax revenue: the income expansion effect, the dynamic progressivity effect, the technical effect of tax rate changes, and the taxpayer responsiveness to tax rate changes.

The process consists of a calculation of several indices, including the four just discussed, which are derived below. These are preceded by a description of data and variable definitions.

The calculations of these indices for one year are given in Appendix Table A1 by way of elaborating the methodology. To understand the methodology, Table A1 should be read. The calculations will also be explained briefly in the text after the derivation of the indices algebraically below. The column numbers noted against the indices refer to those of Table A1.

Dynamic progressivity, as derived here, differs from the conventional static concept of progressivity in two respects. The latter refers to the progression of statutory marginal tax rates across income brackets. Closer to 100 percent the highest statutory marginal tax rate, the higher in general the static progressivityx, irrespective of the rates of change (declining or increasing) of the progression.

In contrast, dynamic progressivity has meaning only over time and is effectuated only when tax rates interact with the growth rates of income. It will also differ according to the distribution of taxpayers among income brackets. It is a realized, as distinguished from statutory, measure. Thus, dynamic progressivity will be zero when either the tax is at proportionate rate or when the growth rate of income is zero. It will be higher the steeper the schedule of marginal tax rates, the higher the rates of growth of nominal income (bracket creep), and the higher ordinarily the proportions of taxpayers in the upper prackets. The

Y_i = Income reported by ith bracket, $Y = \sum_i Y_i$ (Col. 4)

A_i = Number of taxpayers in ith bracket, $A = \sum_i A_i$ (Col. 3)

T_i = Taxes paid by ith bracket, $T = \sum_i T_i$ (Col. 5)

s_i = Statutory tax rate on ith bracket (Cols. 12-13)

HMTR = Highest statutory marginal tax rate, including surcharge (Cols. 12-13)

Definitions

Subscripts 1 and 2 stand, respectively, for year 1 (previous year) and year 2 (the current year), and subscript i denotes ith income bracket, and i-1 one lower bracket

1. $t_i = T_i/Y_i$, average, effective, realized tax rate, $T = \sum_i T_i$, $Y = \sum_i Y_i$ (Col. 6)
2. $t' = T/Y$ national average tax rate (Col. 6, last line)
3. T_{22} or simply $T_2 = \sum_i t_{i2} Y_{i2}$, actual tax collection in year 2 (Sum Col. 16)
4. T_{11} or simply $T_1 = \sum_i t_{i1} Y_{i1}$, actual tax collection in year 1 (Sum Col. 5)
5. $Y'_{i2} = Y_{i1}(1+g)$, income predicted for current year, assuming it grew at the uniform rate g across all income brackets, where $g=g_2$, but the subscript 2 has been omitted for simplicity (Col. 7)
6. $Y^*_i = Y_i(1+g) - Y_i g + Y_{i-1} g$, taxable income of ith bracket predicted for the current year, when gA_i taxpayers move up to the next higher bracket (Col. 10)

7. $Y^* = \sum_i Y^*_i$ Inter-bracket income distribution after GDP growth (g) (Sum Col. 10)

8. $T'_{12} = \sum_i t_{i1} Y'_{i2}$, Predicted tax yield in year 2 under proportionate tax rates of year 1 (Sum Cols. 6*7)

9. $T^*_{12} = \sum_i t_{i1} Y^*_{i2}$, Predicted tax yield in year 2 under progressive tax rate of year 1 (Sum Col. 11)

10. $T^*_{22} = \sum_i t_{i2} Y^*_{i2}$ Predicted tax yield in year 2 under progressive tax rate of year 2 (Sum Col. 15)

Indices calculated

11. Predicted income effect due to the interaction of tax schedule and actual changes in GDP T^*_{12}/T_{11} (Col 5/Col. 5)

12. T^*_{12}/T'_1 (Col. 11/Cols 6*7)

13. Change in average tax rate, t_2/t_1, same as technical effect on revenue, ceteris paribus $\sum_i (s_{i2}/s_{i1})\, T^*_{12}$ [Sum(Col. 14*Col. 11)]

14. Taxpayer responsiveness (net of technical effects of t_2/t_1 and of changes in GDP)—the index of special interest T_{22}/T^*_{22} (Col. 16/Col. 15)

15. Built-in elasticity (realized) $[T_{22}/(t_2/t_1)]\,/T'_{12}$ [Sum(Col. 16/Col. 15)/Cols. 6*7)]

16. Buoyancy elasticity (realized) T_{22}/T'_{12} [Sum(Col. 16/Cols. 6*7)]

Stated differently, built-in elasticity = progressivity*responsiveness and buoyancy elasticity = progressivity*tax-rate changes*responsiveness.

dynamic concept is operational and is an important component of built-in and buoyancy elasticities. Thus, in terms of the indices calculated here, these elasticities can also be stated as follows: Built-in elasticity=dynamic progressivity*responsiveness; buoyancy elasticity=dynamic progressivity *responsiveness*tax-rate changes.

Two main steps in this methodology are the calculation of Y^*_i and T^*_{22i} of Eqs. 6 and 10. We first separate out the substitution effect, synonymously referred to here as responsiveness (RESP) from the other three effects by the methodology of Relation (6). We start in 1960 to and calculate various changes for 1961. As a first step, we raise 1960 incomes by the rate of growth of nominal GDP (1+g) of 1961 uniformly across all brackets. In the second step, we move g times expanded incomes up into the next higher bracket by subtracting the same from the respective bracket. The initial bracket is augmented by the same amount of reported incomes as are moved up from it. The resulting bracket incomes are labelled Y^*_{2i}. In the third step, we multiply the resulting incomes by the respective bracket's 1960 tax rates, calculated simply as $T_i/Y_i = t_i$. The product $t_i Y^*_i$ is T^*_i, which is the predicted tax revenue due to the increase in incomes, under the assumption of no change in tax rates in 1961.

The next step is to calculate the ratios of the 1961 statutory tax rates (s_{i2}) to the 1960 statutory tax rates (s_{i1}) that is, s_{i2}/s_{i1} (based on marginal tax rates) and s'_2/s'_1 (based on average tax rate). These are more elaborately defined in the

footnotes to Table 3b. The product $T^*_{22} = d_i T^*_{11}(s_{12}/s_{11})$ is the predicted tax revenue due to changes in both incomes and tax rates.

One such table was prepared for each year from 1961 through 1989 (except 1974). Only one of the 28 such tables is appended to this paper. The main indices calculated from this table are shown at the bottom of Table A1. Those for the entire period of 28 years are summarized in Tables 3a and 3b.

All calculations are made at the bracket level and are summed up as $dt_{ii}y_{ii}$, where i stands for ith bracket. Where no ambiguity is foreseen, the summation notation and the subscripts are dropped and its short form t^1y^1 ($=dt^{11}y^{11}$) is used.

The foregoing indices are calculated arithmatically from year to year. By hypothesizing that T = f(TECH, P, t_2/t_1, RESP), the effects of the first 3 arguments were calculated nonstochastically, while RESP was measured residually. The long-run quantitative relations and the determinants of RESP (=T/T*) were estimated by running the following regressions:

$$T_2/T^*_2 = f(t_2/t_1, P, HMTR) \qquad (17)$$

In these equations, P and t^2/t^1 are autonomously determined policy variables: P = progressivity as embodied in the tax schedule and the distribution of taxpayers among brackets; t^2/t^1 = change in average effective tax rate.

Any difference in actual tax payments (T_{22}) from T^*_{22}, written as $_{T22}/T^*_{22}$ or simply T/T*, is interpreted to be due to taxpayer responsiveness to changes in tax rates, defined earlier. Since T/T* is measured residually, it will also pick up the impact of special occurrences.

A major type of such occurrences consists of concessions by government to induce people to report black money with immunity from penalty. This happened in particular during three years of the reference period, namely 1965, 1975 and 1985. During these three years, the outcome for all direct taxes is estimated as follows:

1965 : income disclosed = Rs 146 crore
1975 : taxes paid on disclosed income = Rs 250 crore
1985 : taxes paid on disclosed income = Rs 459 crore

Source: S.B. Gupta [1991].

These amounts will be appropriately treated in the empirical part.

Data

All estimates of this study are based on 5 variables: the number of assessees, incomes assessed, tax revenue, tax rates, and annual rates of growth of nominal GDP. They were taken from the All India Income Tax Statistics (AIITS, annual) and other standard sources. The gaps were filled up from the records of the Ministry of Finance Library.

A major weakness of the series of direct tax data of India is its partial nature. The number of assessees is not comprehensive. The shortfall of tax revenue reported in the AIITS from the values given in the central budget, moreover, varies from period to period.

There are two points in defense of using this data set. One, no other data are available and numerous researchers have used the same to derive their results. Broad results obtained over a long sample period of 28 years are probably meaningful. Two, during the reference period analyzed in this study, four epochs can be clearly identified, within each of which the shortfalls of the AIITS values from the budget accounts are roughly consistent, to make annual changes within those epochs reflect, by and large, real changes.

Empirical Results Ostochastic Calculations

Annual indices of Eqs. (10) through (14) are presented in Tables 3a (using <u>marginal</u> rates to calculate the overall weighted average change in statutory tax rates, s_2/s_1) and 3b (using <u>average</u> statutory tax rates to calculate the overall weighted average change in statutory tax rates, s'_2/s'_1). A striking result of Tables 3a and 3b is the overwhelming evidence for a negative relationship between changes in tax rates (t_2/t_1) and the responsiveness of the taxpayer to these changes (T_2/T^*_2), as a quick glance at the signs of the indicated changes in Cols. 11 and 12 of Table 3a and Cols. 3 and 4 of Table 3b would suggest, namely:

Signs of

t_2/t_1 and T_2/T^*_2	Using Marginal Tax Rates, t	Using Average Tax Rates, t'
Opposite signs	17 (61%)	18 (64%)
0 and +	1	1
0 and -	5	5
+ and +	3	2
- and -	2	2
Total	28	28

Thus, for 17 to 18 of the 28 years, or about 2/3rds of the sample, the signs of t_2/t_1 and T_2/T^*_2 are opposite, i.e., the relationship is negative. Of the six years during which no change in tax rates took place, the signs are erratic.

Only 5 of the 28 signs in Table 3a and 4 in Table 3b are identical, meaning tax revenue follow the rates. Almost all of these are explainable by special circumstances of the respective year. For instance, the calculated positive response to an increase in tax rates in 1966 was probably due largely to patriotic, social, and similar other feelings aroused by such events as the 1965 India-Pakistan War, which probably also revived the humiliating defeat at the hands of the Chinese 4 years earlier in 1962; severe drought of the year; the 36% devaluation of the rupee; and similar exogenous shocks. Likewise, the serious drought of 1987 (which was the main reason for the imposition of a surcharge of 5% in that year) was an equally serious event which might have induced underlain patriotic positive taxpayer response to increased tax rates in that year.

The subtraction from T_{22} of the amounts of black money converted into white, in response to the amnesties of years 1965, 1975, and 1985, discussed earlier, after being apportioned to various direct tax categories, makes little difference to the results just noted.

In short, a persistently negative correlation between tax rates and tax revenue has been the experience of India.

Several other indices of Table 3 are of interest. Let us have a brief look at them to verify whether or not they are consistent with the overwhelmingly important finding of a negative correlation between tax rates and revenues.

The ratio of taxes paid to incomes reported, i.e., the effective, average tax rate, has gone up in the 1980s, exceeding those for all earlier periods (Table 3a, Col. 11). It was the lowest in the late 1970s. The ups and downs are roughly correlated with the rise and fall of the overall rate of growth of the economy . As will be seen below, the regression results strongly confirm this relationship.

The built-in elasticity of this study excludes only the technical effect of tax-rate changes, but is gross of changes in the tax base, though the base has scarcely changed perceptibly during the reference period in India. Defined as such, it has been close to unity, about as many times a little higher as a little lower than one. The deviations from unity are, by and large, to the opposite direction of changes in tax rates, as may be viewed

from Table 3a. The result is consistent with the earlier discussed relationship between tax rate changes and revenue changes. The buoyancy elasticity is highly correlated with and is not much different from the built-in elasticity in magnitudes.

A remark about buoyancy is in order at this juncture. The expession "buoyancy" of taxes, which has become a standard concept in the public finance literature of developing countries since it was first introduced in an Indian study 30 years ago (Sahota, 1961), has not drawn the attention it deserves in the country of its authorship. Buoyancy can be increased by expanding the tax base, minimizing tax evasion, rationalizing tax rates, and tightening up the tax administration. The Indian income tax is still confined to the salary and non-salary income earners of the organized sector. The remainder vast economy, for all practical purposes, escapes the tax net. This includes agriculture, small and cottage sector, the self-employed, and the entire informal sector. Even the organized sector enjoys a number of exemptions. For instance, almost all the inputs of agriculture are subsidized: fertilizer, electricity, irrigation water, farm machinery, HYV seeds, and even land in the sense that land tax is a miniscule fraction of land values or its productivity. Certain categories of agricultural debt have been written off. Yet agricultural income goes practically untaxed. Similar conditions probably prevail for the other untaxed sectors just mentioned.

Tax evasion is not an isolated phenomenon. It is linked to the overall corruption, the root causes of which are such policies as the mazes of controls, licenses, restrictions, regulations, and

overexpanded public sector in areas of production, trade, commerce, transport, construction, and product distribution. A reform of the tax administration will have to be a part of the overall policy reform.

Dynamically, the Indian tax structure is mildly progressive. Realized dynamic progressivity has increased in the late 1980s to levels never attained before. The reasons for an increase in dynamic progressivity even when marginal tax rates are lowered were discussed in the paragraphs immediately following the derivation of algebraic indices above. The change is correlated with the historically highest real rates of economic growth of the late 1980s, which also underlie the calculated higher average rates of tax revenue than in earlier years (Col. 11 of Table 3).

Thus, all results confirm the general finding that income tax revenues are inversely related to income tax rates in India.

The reasons for the negative response of Indian taxpayer to higher income tax rates are not unknown, but have been ignored. The main reason is that the higher the marginal tax rate, in particular on upper income classes, the higher the incentive and capacity on the part of taxpayers to either conceal their incomes or not strive as hard to earn more income as would have been striven were tax rates lower. Symbiotic relations between the taxpayer and the tax collector to enable the former to evade tax are widely suspected in India, where income tax payment among non-salary earners, for all practical purposes, is said to be voluntary showing a weak relationship with income.

Regression Results

To see the quantitative measures of the causal influence of changes in tax rates on tax revenue over long periods, a few regressions were run, which are reported in Table 4.

The most significant result, as was suggested by year-to-year indices, is the negative effect of tax rates on tax revenues. The sign of the coefficient of taxpayer responsiveness with respect to changes in the tax rate is persistently negative in alternatively specified regression equations. Not all coefficients are, however, measured with precision. Those which are significantly different from zero have an elasticity close to unity, between 0.85 and 1.08. See regression R5, R9 and R10 in particular.

In the regressions in which tax rate changes (t_2/t_1) are interacted with highest marginal tax rates (HMTR), the elasticity of t_2/t_1 goes down to the 0.73-0.90 range (and tends to lose its statistical significance). The coefficient of HMTR is consistently negative and is statistically significant only for observed tax revenue changes (T_2/T_1) as dependent variable, with an elasticity value of -1.23.

The coefficient of taxpayer responsiveness with respect to progressivity is also negative, whether entered linearly (allowing its independent influence) or multiplicatively (allowing interaction with tax rates), though the precision with which it is measured does not meet the conventionally acceptable standards.

The lack of precision with which the elasticities of t_2/t_1, P, and HMTR are measured is evidently due largely to the presence of multicollinearity between the stated variables.

Conclusion

On the whole, at the levels at which Indian tax rates have ranged during the past 3 decades, the relationship between income tax rates and income tax revenues is negative. A sensible prediction from this finding is that revenue will probably increase with further cuts in the marginal tax rates at the upper end. A top marginal tax rate not exceeding 40 per cent, a rate suggested in several writings by Dr. Chelliah for India, finds ample support from the findings of this study. The indicated taxpayer response is consistent with received theory.

Table 1.—TAX GDP RATIOS: 1950-51 TO 1988-89

Year	Total tax revenue (All India) (%C)			Central Taxes (Gross) (A)		
	Direct	Indirect	Total	Direct	Indirect	Total
1	2	3	4	5	6	7
1950-51	2.47	4.23	6.69	1.88	2.45	4.32
1951-52	2.45	4.97	7.42	1.91	3.23	5.14
1952-53	2.58	4.36	6.94	1.90	2.65	4.55
1953-54	2.27	4.04	6.32	1.56	2.39	3.95
1954-55	2.38	4.77	7.15	1.60	2.92	4.52
1955-56	2.52	4.96	7.49	1.67	3.06	4.73
1956-57	2.36	4.93	7.28	1.59	3.08	4.67
1957-58	2.60	5.70	8.29	1.83	3.67	5.49
1958-59	2.45	5.31	7.76	1.70	3.30	5.00
1959-60	2.56	5.66	8.22	1.82	3.55	5.37
1960-61	2.48	5.85	8.33	1.80	3.72	5.52
1961-62	2.61	6.37	8.98	1.96	4.17	6.14
1962-63	3.03	7.06	10.09	2.29	4.67	6.95
1963-64	3.26	7.68	10.95	2.59	5.10	7.69
1964-65	3.02	7.55	10.58	2.44	4.97	7.41
1965-66	2.81	8.37	11.18	2.29	5.60	7.88
1966-67	2.59	8.43	11.03	2.22	5.58	7.80
1967-68	2.26	7.73	9.99	1.89	4.91	6.80
1968-69	2.29	7.96	10.25	1.90	4.94	6.84
1969-70	2.38	8.02	10.40	2.05	4.94	6.99
1970-71	2.34	8.67	11.01	2.01	5.41	7.43
1971-72	2.53	9.52	12.05	2.26	6.11	8.37
1972-73	2.64	9.98	12.62	2.42	6.42	8.83
1973-74	2.50	9.41	11.92	2.22	5.96	8.18
1974-75	2.50	10.09	12.59	2.25	6.38	8.63
1975-76	3.17	11.03	14.20	2.80	6.86	9.66
1976-77	3.04	11.48	14.53	2.73	7.00	9.73
1977-78	2.79	10.99	13.78	2.50	6.72	9.22
1978-79	2.74	12.17	14.90	2.43	7.68	10.10
1979-80	2.71	12.76	15.46	2.46	8.01	10.47
1980-81	2.41	12.21	14.61	2.21	7.50	9.70
1981-82	2.59	12.55	15.14	2.37	7.57	9.94
1982-83	2.53	12.81	15.34	2.33	7.63	9.96
1983-84	2.37	12.87	15.24	2.17	7.84	10.02
1984-85	2.31	13.21	15.53	2.08	8.09	10.17
1985-86	2.38	14.10	16.48	2.14	8.78	10.92
1986-87	2.35	14.54	16.89	2.13	9.07	11.19
1987-88	2.25	14.88	17.13	2.03	9.30	11.33
1988-89	1.79	12.59	14.38	1.55	7.09	8.64

Source:- Govt of India, Indian Economic Statistics: Public Finance, 1990.

Table 2.—Personal income tax features in South Asian and East Asian countries

Countries	Incomes Assessed as % of GDP Year	(%)	% Taxpayers in Total Population Year	(%)	% Top Marginal Tax Rate	Multiple of PCGDP at Which Top Rate Applies	Customs Range of Tariffs in %	Multiple of PCGDP: At Min Tax Rate 1989 Multiple	Tax Rate	Multiple of PCGDP: At Max Tax Rate 1989 Mult	Rate	As % of GDP: Personal IT	Corp. IT	All ITs as % of Total Revenues 1988
	(1)		(2)		(3)	(4)	(5)	(6)		(7)		(8)	(9)	(10)
SOUTH ASIA														
1. India	1970	4.36	1978	0.30	66	71.3	40-150	6.3	(20)	34.9	(55)	0.94	1.33	14.5
2. Pakistan					66	40.5		4.8	(5)	45.1	(45)			11.9
3. Bangladesh									(10)		(50)	1.08	0.06	11.7
4. Nepal									(10)		(50)	0.38	0.15	8.4
5. Sri Lanka									(15)		(40)	.74	1.96	11.1
6. Bhutan														
7. Maldives														
SOUTH ASIA														
1. Kor a	1981	23.6	1981	3.33	60	53.9	5-30	1.1	(5)	36.3	(50)	2.32	2.05	30.3
2. Taiwan														
3. Hong Kong														
4. Malaysia			1979	6.95	55	30.1	0-55	0.5	(5)	10.1	(40)	2.28	8.05	32.2
5. Thailand	1975	8.8	1980	4.39	65	128.7	0-50	2.0		97.9		1.54	1.49	19.9
6. Singapore	1980	27.6	1980	2.18	45	68.6	0-5	0.3		48.8	(3.5)		(33)	
7. Indonesia			1973	0.14	50	549.9	5-40	18.6	(15)	93.1	(35)	0.45	14.78	55.9

Sources: Ved Gandhi, ed., Supply-Side Tax Policy (IMF, 1987.
A. Bagchi, "Tax Reform in Developing Countries: Agenda for the 1990s," ADB Symposium, Manila, June 4-6, 1991.

Table 3a.—Changes in tax responsiveness (T/T*), tax rates (t_2/t_1), mean marginal tax rate, elasticity, and other indices

				INDEX		SIGN					
N	YEAR	A2/A1	(P)	t2/t1	T2/T#2	t2/t1	T2/T#2	e	b	t̄	g
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	1960										
2	1961	1.135	1.011	1.000	1.076	0	+	1.088	1.088	0.127	1.055
3	1962	1.023	1.020	1.094	0.883	+	-	0.900	0.985	0.128	1.069
4	1963	1.078	1.038	1.056	0.782	+	-	0.811	0.857	0.121	1.143
5	1964	1.187	1.029	1.028	0.893	+	-	0.919	0.944	0.117	1.168
6	1965	1.192	1.041	0.937	1.108	-	+	1.152	1.080	0.113	1.047
7	1966	1.130	1.034	1.095	1.018	+	+	1.052	1.153	0.132	1.138
8	1967	0.849	1.031	1.000	0.875	0	-	0.911	0.911	0.141	1.175
9	1968	1.190	1.010	0.969	1.198	-	+	1.209	1.171	0.137	1.055
10	1969	1.024	1.025	0.881	1.073	-	+	1.041	0.968	0.139	1.100
11	1970	0.821	1.014	1.019	0.657	+	-	0.666	0.679	0.105	1.064
12	1971	1.340	1.015	0.990	1.383	-	+	1.369	1.410	0.155	1.064
13	1972	1.002	1.010	1.042	0.756	+	-	0.770	0.803	0.153	1.100
14	1973	0.779	1.051	1.000	0.725	0	-	0.762	0.762	0.205	1.223
15[a]	1974			1.000							
16	1975	0.657	1.015	0.862	1.105	-	+	1.121	0.967	0.112	1.062
17	1976	0.969	1.083	0.979	1.074	-	+	1.078	1.144	0.125	1.074
18	1977	1.144	1.041	0.836	1.021	-	+	1.063	0.888	0.106	1.141
19	1978	0.715	1.025	1.036	0.925	+	-	0.949	0.983	0.131	1.075
20	1979	0.938	1.027	1.000	0.877	0	-	0.900	0.900	0.135	1.091
21	1980	0.759	1.053	1.044	0.706	+	-	0.743	0.776	0.158	1.193
22	1981	1.481	1.052	0.892	1.846	-	-	0.893	0.797	0.176	1.169
23	1982	0.880	1.031	0.880	0.965	-	-	0.878	0.876	0.177	1.112
24	1983	0.851	1.026	1.006	0.895	+	-	0.918	0.923	0.196	1.131
25	1984	2.088	1.010	1.014	1.858	+	+	1.876	1.902	0.176	1.185
26	1985	1.326	1.041	0.892	1.165	-	+	1.161	1.043	0.164	1.127
27	1986	1.148	1.053	0.808	1.242	-	+	1.307	1.057	0.167	1.114
28	1987	1.004	1.088	1.008	1.075	+	+	1.180	1.170	0.178	1.134
29	1988	1.050	1.104	1.000	0.941	0	-	1.039	1.039	0.178	1.175
30	1989		1.105	1.000	0.887	0	-	0.979	0.979		0.185

Definitions

A_2, A_1: Number of taxpayers in period 2 and 1, respectively

P: Progressivity index

t: Tax rate, effective, realized

T: Tax revenue

T*: Tax revenue predicted

e: Built-in elasticity

b: Buoyancy elasticity

$\bar{t}$: Average tax rate for aggregate taxpayers

g: Rate of growth of nominal GDP

Signs of t_2/t_1 and T_2/T^*_2

Opposite	17
0+	1
0-	5
++	3
--	2

[a]The data for 1974 are not available.

Table 3b.—Changes in T/T^*, t'_2/t'_1, and other indices[a]

Year	Indices of		Signs of		e	b
	t'_2/t'_1	T/T^*	t'_2/t'_1	T/T^*		
	(1)	(2)	(3)	(4)	(5)	(6)
1961	1.000	1.076	0	+	1.088	1.088
62	1.075	0.900	+	-	0.916	0.985
63	1.114	0.741	+	-	0.769	0.856
64	1.014	0.905	+	-	0.931	0.944
65	0.941	1.103	-	+	1.106	1.080
66	1.085	1.027	+	+	1.062	1.153
67	1.000	0.875	0	-	0.910	0.910
68	0.967	1.200	-	+	1.211	1.171
69	0.949	0.996	-	-	1.020	0.968
1970	1.028	0.651	+	-	0.660	0.679
71	0.998	1.518	-	+	1.503	1.500
72	1.030	0.764	+	-	0.780	0.803
73	1.000	0.725	0	-	0.762	0.762
74						
75	0.816	1.167	-	+	1.185	0.967
76	0.967	1.092	-	+	1.182	1.144
77	0.811	1.052	-	+	1.095	0.888
78	1.015	0.945	+	-	0.968	0.983
79	1.000	0.877	0	-	0.900	0.900
1980	1.053	0.710	+	-	0.747	0.776
81	0.909	0.833	-	-	0.876	0.797
82	0.684	1.240	-	+	1.280	0.876
83	1.003	0.900	+	-	0.920	0.923
84	0.985	1.910	-	+	1.931	1.902
85	0.899	1.155	-	+	1.276	1.147
86	0.832	1.207	-	+	1.270	1.057
87	1.005	1.079	+	+	1.174	1.180
88	1.000	0.941	0	-	1.040	1.040
1989	1.000	0.887	0	-	0.979	0.979

Opposite signs			18
0	-		5
0	+		1
+	+		2
-	-		2
Total			28

[a]The term t'_2/t'_1 differs from t_2/t_1 of Table 3a by being based on s'_2/s'_1 instead of s_2/s_1, where variable s' denotes the overall weighted mean of the statutory rates based on the average tax rates of different brackets (s'_i) instead of the marginal tax rates (s_i). The average statutory tax rate of bracket i was calculated by summing the products of the ranges ($R_i = Y_i - Y_{i-1}$ in rupees) of all lower brackets and the respective marginal tax rates (s_i) with the tax payable by the median taxpayer of bracket i in bracket i. Algebraically,

Table 3b--Contd.

$$s'_i = \left(\sum_{j=1}^{i-1} R_{i-j} t_{i-j} + \tfrac{1}{2} R_i t_i\right)/\left(Y_{i-1} + \tfrac{1}{2} R_i\right), \quad i=1,2, \ldots, I,$$

where Y_i is the upper limit of bracket i.

For the definitions of variables in column headings, see the notes to Table 3a.

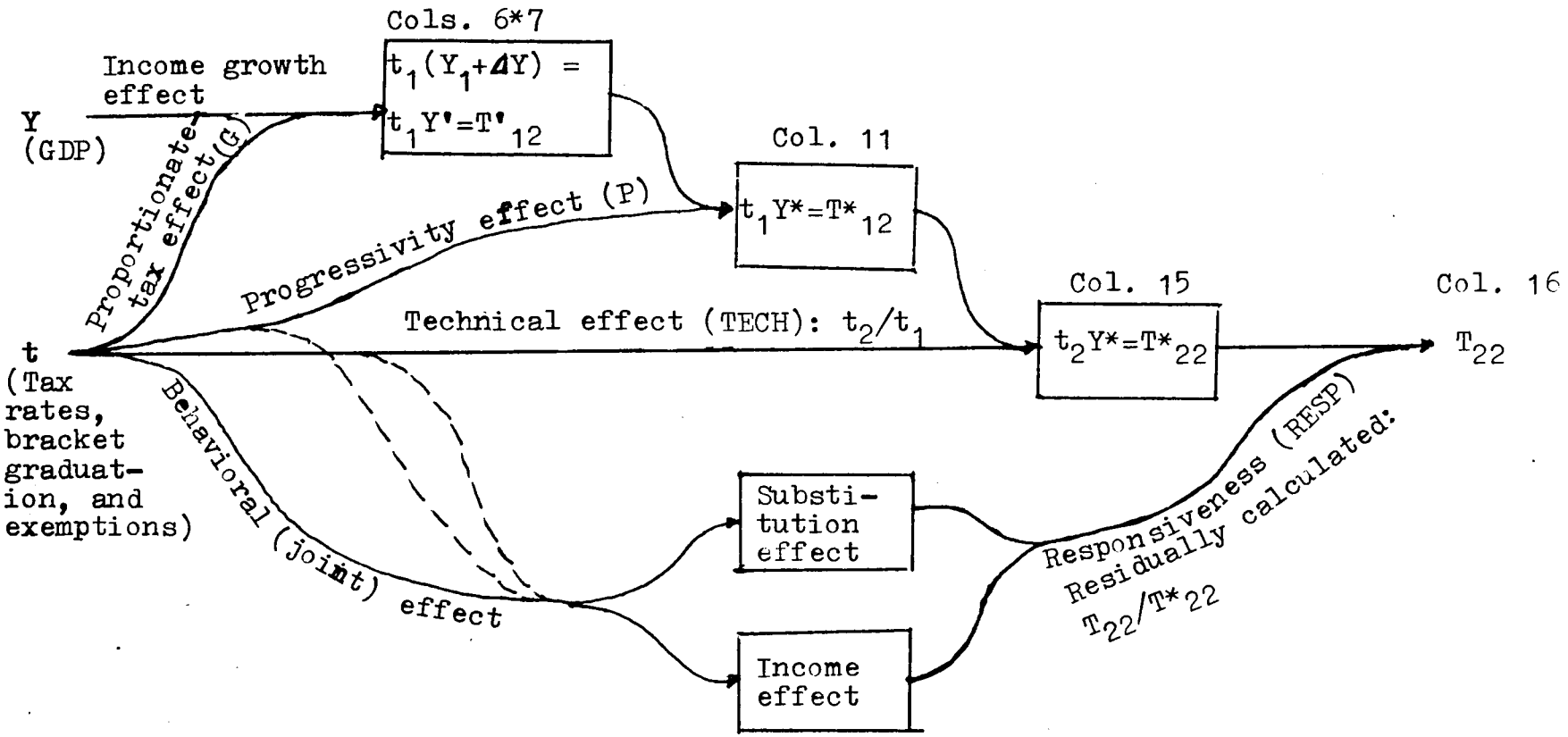
Table 4.—Regressions of tax revenue on tax rates and other variables, 1960-89[a]

	Dep. Var.	Independent Variables: t_2/t_1 (2)	P (3)	HMTR (4)	Constant (5)	R^2 (6)	Elasticity of T/T* wrt t_2/t_1 (7)
Based on National Means of Marginal Bracket Rates: Linear							
(R1)	T/T*	-1.18 (-1.71)	-1.04 (-0.45)		3.262 (1.29)	0.1111	-1.18
(R2)	T/T*	-0.895 (-1.21)	..	-0.345 (-0.78)	2.188 (3.26)	0.1257	-0.895
(R3)	T_2/T_1	1.388 (1.30)	..	-1.225 (-1.92)	0.762 (0.787)	0.1425	1.388
(R4)	T/T*	-0.747 (-0.99)	-2.91 (-1.07)	-0.658 (-1.24)	5.294 (1.77)	0.167	-0.747
Based on National Means of Marginal Bracket Rates: Log-Linear							
(R5)	T/T*	-1.066 (-1.92)	-0.748 (-0.36)	..	0.02 (0.23)	0.1342	-1.083 (-0.726 wrt P)
(R6)	T/T*	-0.849 (-1.41)	..	-0.216 (-0.80)	-0.067 (-0.75)	0.1518	-0.862 (-0.992 wrt HMTR)
(R7)	T/T*	-0.717 (-1.17)	-2.606 (-1.04)	-0.42 (-1.26)	-0.033 (-0.35)	0.1896	-0.728
Log-Linear (based on the National Mean of Average Bracket Rates, s'_2/s'_1							$\bar{-}$
(R8)	T/T*	-0.706 (-1.50)	-3.015 (-1.48)	-0.355 (-1.13)	-0.029 (-0.34)	0.229	-0.724
(R9)	T/T*	-0.934 (-2.20)	-1.638 (-1.00)	..	0.02 (0.21)	0.187	-0.958
(R10)	T/T*	-0.848 (-1.80)	..	-0.075 (-0.29)	-0.06 (-0.76)	0.156	-0.870
Dependent Variable: Mean Effective Tax Rate, $\bar{t}$ (Linear)							
(R11)	$\bar{t}$ =	0.022(t'_2/t'_1) (0.38)	+ 0.318g (3.33)	-0.23;	R^2=0.319		0.022 (0.289 wrt g)

[a]The numbers in parentheses are t values. Variable HMTR was entered in ratios and not in percentages. The elasticities of Col. 7 were calculated at the sample mean values of the variables concerned. The term wrt stands for "with respect to." Each regression has 27 observations.

Fig 1.—Causal flow chart of the determinants of tax revenue (T_{22})

Step I: Nonstochastic calculations (made in the indicated columns of Table A1)



Step II: Stochastic estimation

$$RESP = T_{22}/T^*_{22} = f(\text{Tax base/GDP, Work Effort, tax evasion, exemptions, administration}),$$ theoretical relation

$$= f(t_2/t_1, \text{HMTR, P}),$$ empirical relation

Note: For variable definitions, see the text.

Table A1.--Calculations of progressivity, tax rate changes, responsiveness, built-in elasticity, and buoyancy elasticity, 1972
(All absolute values are in thousands of rupees)

Data for Previous Year, 1971									Statutory Tax Rate				Data
Tax Bracket	No. of Taxpayers	Taxable Incomes	Taxes Paid	5/4	4*(1+g)= 4*1.1000	-7*g	+7*g of Lower Slab	7+8+ 9	6*10	1971	1972	13/12	11*14	Tax 1972
	(A_i)	(y_i)	(T_i)	$(t_{71,i})$	$(y^*_{72,i})$	$(-y^*_{72,i}g)$	$(y^*_{72,i-1}g)$	$(y^*_{72,i})$	$(t_{71,i})(y^*_{72,i})$	$(s_{71,i})$	$(s_{72,i})$	$(s_{72}/s_{71})_i$	$(t_{72}*y^*_{72})$	(T_{72})
(1-2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
0-4	4902	90	5	.0556	99	-10	10	99	6	0	0	1	6	3
4-5	195104	8583	114	.0133	9441	-944	10	8507	113	0	0	1	113	101
5-7.5	633206	39595	1161	.0293	43554	-4355	944	40143	1176	11	11	1	1176	1223
7.5-10	312097	27022	1592	.0589	29724	-2972	4355	31107	1832	11	11	1	1832	1747
10-12.5	220165	24589	1842	.0749	27048	-2705	2972	27315	2046	19	19	1	2046	1607
12.5-15	134521	18380	1543	.0839	20218	-2022	2705	20901	1754	19	19	1	1754	1801
15-17.5	88144	14246	1371	.0962	15671	-1567	2022	16126	1551	25	27	1.08	1675	1362
17.5-20	66639	12470	1422	.1140	13717	-1371	1567	13913	1586	25	27	1.08	1713	1285
20-25	89196	19860	2547	.1282	21816	-2182	1371	21005	2693	33	35	1.061	2857	2215
25-30	43998	11925	2203	.1847	13118	-1312	2182	13988	2584	44	46	1.046	2703	2090
30-40	44576	15295	3873	.2532	16825	-1683	1312	16454	4166	55	58	1.055	4395	2950
40-50	19290	8562	2730	.3189	9418	- 942	1683	10159	3240	66	69	1.046	3389	2092
50-60	10641	5803	2105	.3630	6383	- 638	942	6687	2430	66	69	1.046	2542	1469
60-70	5939	3828	1544	.4033	4211	- 421	638	4428	1786	77	81	1.052	1879	1167
70-100	8340	6678	3135	.4558	7566	- 757	421	7230	3295	81	84.3	1.041	3430	2214
100-200	5316	7105	3955	.5065	7816	- 782	757	7791	3946	88	92	1.046	4128	2224
200-300	892	2151	1328	.6174	2366	-237	782	3385	2090	94	96	1.043	2180	790
300-400	327	1123	762	.6785	1235	- 124	237	1348	915	94	98	1.043	954	387
400-500	155	686	458	.6676	755	- 76	124	803	536	94	98	1.043	559	227
500 & •	320	2987	2020	.6763	3286	0	76	3362	2273	94	98	1.043	2371	4575
Total	1883768	231187	35717	.1545	254306	-25431	25441	254352	40018				41702	31539

Progressivity: Col. 11/Cols. 6*7 = 40018/39290 = 1.019

t_{72}/t_{71}: Col. 15/Col. 11 = 41702/40018 = 1.042

Responsiveness: Col. 16/Col. 15 = 31539/41702 = 0.756

Built-in elasticity: (Col. 16/(t_{72}/t_{71}))/Cols. 6*7 =(31539/1.042)/39290 = 0.770

Buoyancy elasticity: (Col. 16/Cols. 6*7 = 31539/39290 = 0.803

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