Decomposing Revenue Effects of Tax Evasion and Tax Structure Changes*

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Decomposing Revenue Effects of Tax Evasion, Base Broadening and Tax Rate Reduction

Abstract

This paper proposes a method for evaluating the impact of tax structure changes on tax revenue. The technique consists of decomposing the gap between actual revenue and potential revenue into components attributable to (i) changes in the tax rate structure (ii) deductions and (iii) tax evasion. Our results indicate that, for the Indian reform episode we examine, there were initial gains which could not be sustained over time. The magnitude of the gains from the reform were limited and failed to significantly curtail losses from tax evasion.

JEL Classification: H20, H24, H23, H26

1. INTRODUCTION

This paper proposes a method for examining the impact of changes in the structure of a tax on tax revenue. The technique consists of decomposing, via an identity, the gap between actual and potential revenue from the tax into components attributable to changes in (i) the tax rate structure (ii) exclusions and (iii) tax evasion. Potential revenue is taken here to mean the revenue that would have resulted from the tax in the absence of base-narrowing exclusions and tax evasion. The decomposition can be extended further, if data are available, to sub-categories of these components or to different taxpayer groups. Our method can be used to analyze structural changes in any broad-based tax. Here we focus on the personal income-tax.

Two types of studies are related to the methodology developed here. The first studies fiscal capacity and fiscal effort. This is done, for example, by the Advisory Commission on Intergovernmental Relations (ACIR) in the United States.[1] The purpose of the ACIR's exercises is to compare revenue performance across states in the U.S. Confining attention to the income tax, the ACIR notion of taxable capacity plays the same conceptual role that potential revenue plays here. However, taxable capacity is defined in terms of the average performance of the group of states being examined. Thus, the tax base for the taxable capacity estimate is the total Federal income tax base of a state's residents, and the tax rate applied to this is the *average* rate prevailing across states. Tax effort is then found residually by comparing actual revenue with taxable capacity.

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[1]Similar studies are carried out in other federations, notably Australia, Canada and India, though the methodologies may not be identical. We are indebted to an anonymous referee for suggesting this comparison.

Since states are treated impartially, the ACIR method is of use in making inter-state comparisons. The ACIR estimates cannot, however, be used to shed any light on the sources of low effort in any individual state, for example, whether low effort is due to relatively extensive tax evasion or relatively generous exclusions. Furthermore, ACIR estimates cannot be used to evaluate how the performance of any given state has changed over the years.

The second type of study partitions the difference between potential revenue and tax collection into components reflecting taxpayer identification, non-filing, under-reporting and underpayment.[2] This amounts, essentially, to a further disaggregation of the evasion component of our decomposition, which can easily be incorporated if data are available.

We illustrate the use of the decomposition methodology by examining income-tax reforms in India during 1984-89. Besides data availability, the selection of the Indian example is motivated by the following considerations. Standard policy advice for reform of the income tax consists of a package emphasizing tax base broadening, simplification and moderate tax rates. For example, such advice has been given in the past by multilateral financial agencies such as the International Monetary Fund and the World Bank to developing countries (see, for example, Shome, 1995). In broad outline this is the type of tax reform India underwent in the mid 1980's. Such advice has not been restricted to developing countries alone, as is suggested by the 1984 and 1986 reforms in the United States. There have been, however, no formal studies that we are aware of that analyze the effect of such reforms on the performance of the income tax in developing countries and trace the

[2]See, for example, Vasquez-Caro, Reid and Bird (1992).

effects to different components of the reform package.[3] In developed countries there has, of course, been extensive evaluation of tax reform packages.[4] Developing countries differ from developed countries in several ways including their administrative ability, the nature of their tax base and the sophistication that can be expected of taxpayers, especially in informal sectors. Consequently, the effects of an actual tax rate reform and base broadening package of reforms in a developing country are of interest.

Our results indicate that, for the reform episode we examine, reform did lead to revenue gains but that the magnitude of the gains was limited and failed to curtail losses from tax evasion. These losses can only be curbed by reforming tax administration and strengthening tax enforcement -- a dimension of tax reform that has received relatively little attention.[5]

In the next section the decomposition methodology is described. In Section 3 we discuss empirical implementation. We present the results of the decomposition for the Indian income tax in Section 4. Section 5 concludes.

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[3]Das-Gupta, Lahiri and Mookherjee (1995) find some support for the positive effect of moderate tax rates. They, however, do not address the issue of deductions.

[4]For the United States, see for example Lindsey (1987), Feldstein (1993) and Feenberg and Poterba (1992) and the papers on the Tax Reform Act of 1986 in *The Journal of Economic Perspectives*, 1992. For developing countries and a selection of developed countries see Boskin and McClure (1990).

[5]For example, The World Bank (1988) devotes less than 2 pages to tax administration reform of the 25 page chapter on reforming tax systems. That this is not due to any inherent limitations in the scope of tax administration reform can be ascertained by examining, for example, Bird and Casanegra de Jantscher (1992) or Bagchi, Bird and Das-Gupta (1995). For the Indian case, see the Tax Reforms Committee (1992) and Das-Gupta, Lahiri and Mookherjee (1994).

2. Decomposing Income Tax Revenue Changes

Before formally setting out the decomposition, we explain its logic. Comparisons of revenue performance are made with a pre-selected (here pre-reform) base year. In order to examine revenue loss, we define *potential revenue at base year tax rates* as the revenue that would obtain in the absence of base erosion due to deductions and evasion, if the base year tax rate structure was in operation. Conceptually, to arrive at potential revenue we tax potential income, which we take as given.[6] Deductions and exclusions (other than for costs of earning income) cause taxable income to be narrower than potential income. Due to tax evasion by, for example, failing to file a return, understating receipts or overstating expenses, potential income itself may not be fully revealed to tax authorities. What the decomposition analysis does is to separate the difference between potential revenue and revenue actually collected in any year into components reflecting losses due to tax schedule changes, base erosion, and evasion.

Potential revenues will, however, differ across years, even if the tax schedule is unchanged, due to changes in aggregate income and its distribution. To account for this, we normalize the difference between potential and actual revenue in each year with respect to potential revenue in that year before comparing across years. We now turn to a formal presentation.

In the rest of the paper, all tax and income variables are expressed in constant base year currency units using an appropriate price deflator. In principle, the analysis could include other taxable entities such as partnerships or companies, but attention is restricted here to individuals. Let $T_t(.)$ denote the personal income tax function (or schedule) for year t, and $T_0(.)$ denote the tax

[6]This definition is usually a practical approximation to Schanz-Haig-Simons comprehensive income given the well known problems with taxing Schanz-Haig-Simons. An accessible recent review of these issues are the sections by King and Stotsky in Chapter VI of Shome (1995).

function of the pre-selected base year, denoted year *0*. Let y_{it} denote the income of the *ith* individual actually brought to tax in year *t*, z_{it} this individual's taxed income before exclusions in year *t*, and q_{it} the legally defined gross or potential income of the *ith* individual in year *t*.[7] The amount of the tax base under-reported is q_{it}-z_{it}, while base erosion due to exclusions is z_{it}-y_{it}. Potential revenue from the *ith* individual in year *t* but at *base-year* tax rates is $T_0(q_{it})$, while the tax actually collected from the individual is $T_t(y_{it})$.

Let N_t be the total number of individuals who, by law, ought to have paid taxes in year *t* and M_t be the number of individuals who actually paid taxes in that year. If total taxed income from all individuals in year *t* is denoted Y_t, Z_t denotes aggregate income before exclusions that is assessed by the tax authorities and Q_t represents the total potential income of all N_t individuals in year *t*, then

$$Y_t \equiv \sum_{i=1}^{M_t} y_{it} \ , \quad Z_t \equiv \sum_{i=1}^{M_t} z_{it} \ , \quad Q_t \equiv \sum_{i=1}^{N_t} q_{it} \ . \qquad \textbf{(1)}$$

It follows that, if actual tax collection in year *t* is denoted R_t we have $R_t = a_t Y_t$, where a_t is the average tax rate for the year ($\equiv R_t/Y_t$). The final concept needed is potential tax revenue at base year rates, $c_{0t}Q_t$, where c_{0t} is the average tax rate that would obtain if the base year tax schedule were used and taxes were paid on incomes q_{it} rather than y_{it}. That is

$$c_{0t} \equiv \frac{\sum_{i=1}^{N_t} T_0(q_{it})}{Q_t} \ . \qquad \textbf{(2)}$$

Using these aggregate concepts, we can decompose revenue losses as:

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[7]If some exclusions are through tax credits rather than deductions, then the definition of y_{it} should be modified to y'_{it} so that credits are replaced by a deduction resulting in the same tax liability. That is y'_{it} is the taxable income such that $T_t(y'_{it}) = T_t(y_{it})$ - *tax credits.*

$$c_{0t}Q_t - a_tY_t \equiv (c_{0t} - a_t)Y_t + c_{0t}(Z_t - Y_t) + c_{0t}(Q_t - Z_t). \quad \textbf{(3)}$$

The first term on the right hand side of (3) represents the revenue change due to tax schedule changes. The second term shows base erosion due to exclusions, also valued at base year tax rates. The third term is the loss in revenue due to under-reporting of income, valued at base year tax rates. Dividing both sides of (3) by $c_{0t}Q_t$ yields the normalized decomposition of revenue loss:

$$\frac{c_{0t}Q_t - a_tY_t}{c_{0t}Q_t} \equiv \frac{(c_{0t} - a_t)}{c_{0t}}\frac{Y_t}{Q_t} + \frac{Z_t - Y_t}{Q_t} + \frac{Q_t - Z_t}{Q_t}. \quad \textbf{(4)}$$

The first term on the right hand side of (4) is the *Tax Rate Effect*. The second term measures the loss in tax revenue due to deductions or the *Statutory Base Effect*. The third term measures the loss in tax revenue due to tax being underpaid, which we term the *Evasion Effect*. That is,

Revenue Loss ≡ Tax Rate Effect + Statutory Base Effect + Evasion Effect. (4a)

The *Evasion Effect* will capture any and all differences that cause gross assessed income, Y_t to differ from potential income, Q_t. Besides under-reporting of income *per se*, it will reflect mistakes in reporting income by taxpayers and mistakes in assessing income by revenue inspectors. Nevertheless, evasion should account for the bulk of this difference since the two types of inadvertent errors should largely net out. In examining the effect of tax reform on period *t* revenue, the difference between (4) for period *t* and period 0 provides the necessary information.

With a proportional tax rate structure, (4) is the final decomposition equation. With progressive income taxes, the term $(c_{0t} - a_t)$ mixes up the effects of base year tax progressivity and changes in the tax rate structure. To disentangle these effects, define b_{0t} as the average tax rate with

the base year tax structure on gross reported income Z_t, and a_{0t} as the average tax rate on Y_t at base year rates. That is

$$b_{0t} \equiv \frac{\sum_{i=1}^{M_t} T_0(z_{it})}{Z_t}, \quad a_{0t} \equiv \frac{\sum_{i=1}^{M_t} T_0(y_{it})}{Y_t}. \tag{5}$$

Add and subtract $b_{0t}Y_t$ and $a_{0t}Y_t$ on the right hand side of (3) and re-arrange to get (after normalization):

$$\frac{c_{0t}Q_t - a_tY_t}{c_{0t}Q_t} \equiv \left[\frac{(a_{0t}-a_t)}{c_{0t}}\frac{Y_t}{Q_t}\right] + \left[\frac{(Z_t-Y_t)}{Q_t} + \frac{(b_{0t}-a_{0t})}{c_{0t}}\frac{Y_t}{Q_t}\right] + \left[\frac{(Q_t-Z_t)}{Q_t}\right] \tag{6}$$

Equation 6 is the decomposition in the presence of progressive taxes. With progressive taxes, the statutory base and evasion effects each consists of a *Pure Base Effect* identical to that in (4) and an additional *Progressivity Effect*. Progressivity effects arise because average tax rates will differ at different income levels if taxes are not proportional to income. Consequently, the increase in revenue resulting from a higher base can be decomposed into a component proportional to the increase in the base and a second component - the progressivity effect - reflecting the impact of a rising average tax rate.

The decomposition has several desirable properties. The *Tax Rate Effect* goes to zero in the absence of tax structure reform (i.e. if $a_{0t} = a_t$). Second, both base effects go to zero in the absence of base loss due to evasion ($Z_t=Y_t$ and $b_{0t}=a_{0t}$) and deductions ($Q_t=Z_t$ and $c_{0t} = b_{0t}$). Third, the decomposition separates the effects of tax progressivity and actual base loss. Fourth, disaggregation of tax base loss into additional components without sacrificing additivity is easily done. Fifth, on

subtracting the revenue loss for any period *t* from the revenue loss in period 0 to examine, say, the gains from reform, the full tax rate effect continues to be reflected since this effect in the base year is zero by construction.[8]

To carry out a decomposition, annual data are required on the four average tax rates and the three aggregate income magnitudes. Taxable income Y_t and income before deductions Z_t (corresponding to Adjusted Gross Income in the United States) present no conceptual problems. The major difficulty is in the measurement of potential income, Q_t, particularly in light of tax evasion, though several well known methods of estimating tax evaded income exist.[9] Furthermore, the average tax rates require information not only on aggregate income but also on its distribution. The methods we devise to estimate Q_t, c_{i0}, b_{i0} and a_{i0} are now described.

3. Empirical Issues and Data

Estimating potential income and average tax rates. One way to obtain an estimate of Q_t is to use an available estimate of aggregate tax evasion for any one year, if available, and project this estimate on the rate of growth of a "suitable" national income aggregate such as personal income. A second approach is to focus on evasion *relative to the sample year with minimum evasion.* This is done by assuming, in turn, $Q_t=Z_t$ for each year in the sample and projecting the growth of potential

[8]This decomposition is an identity, devoid of behavioral assumptions, thus separating measurement from theory. Direct and induced behavioral effects (such as Laffer curve effects of tax changes on the tax base) will both be reflected in the relevant measured category. Measured effects from a non-partisan decomposition exercise, such as this one, can be used to test the validity of different theories when combined with other variables that figure in the theory.

[9]For instance, a review and also the most recent reliable estimates of tax evaded income for India (for 1980-81) are in Acharya and Associates (1985). For estimates for other countries see, for example, Cowell (1990) or Manasan (1988).

income at the rate of growth of the selected national income aggregate for other years. For at least one of these sets of estimates, potential income will be at least as great as reported income in every year. This will be the set of estimates corresponding to the year with minimum evasion under the maintained assumption that potential income grows at the rate of national income. We adopt both approaches below. A problem which arises is that no national income aggregate is entirely suitable as a proxy for the base of the personal income tax since the latter includes components not reflected in national income aggregates.[10] This is a problem that cannot, as far as we are aware, be resolved in the absence of independent annual estimates of aggregate tax evasion.

To compute average tax rates we make use of grouped individual data on z_{it} and y_{it}. For the distribution of q_{it}, the assumption we adopt is that the distributions of y_{it} and q_{it} are identical up to a multiplicative constant. The multiplicative constant must, however, be chosen with care. Two extreme situations are when (i) the entire difference between potential and reported income is due to non-filers (implying that $q_{it}=z_{it}$ for all M_t filers) with non-filers having the same income distribution as filers; and (ii) there are no non-filers ($N_t=M_t$) and the same proportion of income is under-reported at all income levels. Option (i) results in $c_{0t} = b_{0t}$. Option (ii) assumes that $h_t(q_{it}) = g_t(Z_t q_{it}/Q_t)$, where h(.) is the density of potential income and g(.) is the density of reported income. We report both sets of estimates below. To the extent that evasion is actually greater, proportionately, among the poor (rich) our estimates will be biased upward (downward).[11]

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[10]The income tax base in a country may or may not include imputed items like owner-occupied housing and may also value such income in kind differently from national accounts. Also, valuation and timing differences arise in comparison with national income, such as with capital gains or loss set-offs.

[11]We are indebted to Jack Mintz for suggestions that have helped improve our presentation of problems which arise from deficient data on income distribution and income aggregates.

In summary, the four sets of decompositions reported below are: *Cases 1a, 2a:* In Case 1a evasion is calculated relative to the year with minimum evasion (i.e. $Q_t=Z_t$ for some year t in the sample and $Q_t \geq Z_t$ for other years), while Case 2a uses an exogenous estimate of potential income. Both Cases 1a and 2a assume that evasion is due entirely to non-filing. *Cases 1b, 2b*: The same estimates of aggregate evasion are used under the assumption that evasion is entirely due to under-reporting. We add a fifth decomposition, *the Benchmark Case*, which ignores tax evasion ($Q_t=Z_t$ for all sample years).

The Indian Reform Episode: To illustrate the decomposition methodology we examine Indian data for the five financial years (April to March) 1984-85 to 1988-89. During this period, the exemption limit (or tax threshold), at Rs 18,000 during the late '80s, was about 9.7 times the per capita NNP (which stood at Rs 1856 in 1986-87)[12] or about 3.7 times the income per worker of Rs 4826. Even so, based on rough calculation, the number of individual assesses (474,000 in 1986-87) was much lower than expected, suggesting a high incidence of non-filing. The seriousness of the problem of evasion and, latterly, the alleged deterioration in the climate of tax compliance have been noted by various authors.[13] As a result, revenue from the income tax, which was about 13 of total tax revenue in 1925-26 and 15 percent in 1970-71 fell to below 9 percent in 1984-85 recovering to just under 10 percent in 1989-90.[14]

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[12]The exchange rate stood at Rs 11.89 per US dollar in 1984-85. It depreciated to 12.78 per US dollar in 1986-87 and 16.69 per US dollar by 1989-90.

[13]For early references, see Rao and Vakil (1931) and the references there and for a widely cited recent work see Acharya and Associates (1985).

[14]See Government of India, Tax Reforms Committee (1991)

During the term in office of prime minister Rajiv Gandhi, which began in late 1984, and especially following the recommendations of the Study Group on Expenditure Taxes (1986), the income tax was extensively overhauled. Here we compare the pre-reform year, 1984-85, with the remaining reform and post-reform years in the sample. Major changes in the income tax include the following.[15]

1. A tax schedule reform for individuals in 1985-86 from a schedule with 8 tax-brackets and a (surcharge inclusive) maximum marginal tax rate of over 61 percent to one with 4 tax brackets and a maximum marginal tax rate of 50 percent. A 5 percent surcharge affecting taxpayers in the upper 2 income tax-brackets was re-introduced in 1987-88.
2. The exemption limit was raised in 1985-86 and its real value remained higher than in 1984-85 until 1986-87. However, the exemption limit fell markedly in relation to growing per capita incomes.
3. Extensive changes in tax concessions particularly with respect to business investment, depreciation provisions and individual saving, to broaden the tax base. These included withdrawal of accelerated depreciation for new plant and machinery and of a deduction for expenditure on approved programs of rural development in 1985-86; less liberal conditions for claiming the investment allowance and a simplified depreciation schedule in 1986-87; a provision allowing the government to pre-emptively acquire properties at the declared sales price to curb capital-gains under reporting in 1986-87; and a flat 40 percent tax on gross winnings from races and lotteries. The combined effect of these and other minor measures

[15]This description is based on the annual budget speeches made by the different Finance Ministers in the Indian parliament.

was expected by the Indian government to be a revenue gain of over 2 percent, other things equal.

Our data on individual income taxpayers are from three main sources: the Annual Reports of the Comptroller and Auditor General (CAG), the All India Income Tax Statistics (AIITS), and grouped, return-based, data on income tax assesses from the National Institute of Public Finance and Policy (NIPFP). The NIPFP data are aggregated from computer-tapes of assessee level data from the Income Tax Department.[16] Following established practice in India, the national income aggregate used for projections is Non-Agricultural Gross Domestic Product (NAGDP). The exclusion of Agricultural GDP is because this sector is not subject to the central income tax. Furthermore, no smaller income aggregate (such as non-agricultural personal income) is available for the non-agricultural sector. NAGDP, as mentioned above, has the limitation that different valuation and timing conventions are present for some items in the income tax base (such as capital gains and loss-offsets) compared to national income aggregates. Taxed income (Y) in India is known as "Total Income" (TI) while gross reported income before deductions (Z) corresponds approximately to "Gross Total Income" (GTI).[17] Potential Income, Q, is denoted PI below.

Besides valuation and timing problems, a further limitation of our data is that taxes during a year depend on income from previous years due to averaging provisions.[18] Fortunately, except for

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[16]These data-tapes, being confidential, were not made available to us. Data issues are discussed further in an Appendix, which is available from the authors.

[17]TI is defined as GTI less Chapter VIA deductions less losses set off less other deductions. The bulk of the difference is accounted for by Chapter VIA deductions which encompass savings incentives, interest and dividend deductions and various business incentives.

[18]We are indebted to the editor, Jack Mintz, for drawing this to our attention.

a provision for carrying forward business losses only one other, minor, averaging provision is on the statute book.[19] The neglect of the impact of changes in the income distribution between those above and those below the exemption limit on the tax base is also a potential source of bias. Though data on India's income distribution during this period are, unfortunately, not available we do not regard this as serious.[20]

Computing income distributions and average tax rates: Information available on the distribution of taxpayers is grouped into 9 ranges according to TI. Using this information, we need to estimate complete TI and GTI and PI distributions. The steps we adopt to do this and to estimate average tax rates are as follows.

Step 1: The number of taxpayers at different levels of TI is estimated assuming a Pareto distribution, $F_t(x)$, of TI where $F_t(x)$ is the cumulative density up to x:[21]

$$\log[Prob(y_{it}>x)] = \log[1-F_t(x)] = \alpha_t[\log(K_t)-\log(x)]. \quad \textbf{(7)}$$

K_t is the lower limit of the distribution and is therefore equal to the exemption limit. The distributions in Table 1 were estimated using (7) by Weighted Least Squares with K_t being set equal to the real exemption limit.

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[19]Under Section 89 of the Indian Income Tax Act, 1961, averaging over 3 years is permitted when salary arrears are received for several years at once.

[20]Sensitivity calculations with Pareto distributions with initial values in the range 1.5 to 2.25, typical of actual income distributions and allowing the Pareto parameter to change at 1% a year lead to only small movements in potential income.

[21]In this we follow Acharya and associates (1985) and Feenberg and Poterba (1992).

Table 1: Estimated Pareto Distributions of Real Total Income (1984-85 Rupees; Weighted Restricted Least Squares)					
Item	1984-85	1985-86	1986-87	1987-88	1988-89
α (t-statistic)	2.1248 (44.2727)	2.0399 (14.6439)	1.8276 (13.7620)	1.7431 (13.2053)	1.7567 (20.5944)
K	15000	16822	15652	14286	13235
R-Squared	0.9895	0.9203	0.8934	0.8763	0.9476
Observations (groups)	9	9	9	9	9
Taxpayer Population ('000)	2708	2631	3569	4012	4289

Source: Our calculations based on CAG and AIITS data.

Step 2: The relationship between TI (or y_{it}) and GTI (or z_{it}) is estimated using the parametric specification in equation (8).

$$\log[y_{it}] = \gamma_t + \beta_t \log[z_{it}] \qquad \textbf{(8)}$$

Estimates are in Table 2.[22]

[22]This specification is strongly suggested by the near straight line graph of log GTI versus log TI for all years. The very high R-squared statistics merely reflect the strong effect of grouping - whereby individual variation is averaged out - on what can be expected to already be closely related variables. Second, since data used to estimate (8) are grouped by GTI it was treated as the independent variable in the regression to avoid stratification by the dependent variable. The estimated equation is then inverted. Regressions were estimated in nominal terms and the constant term was then adjusted to obtain the real relationship. Note that for all years with slope coefficients below unity, TI exceeds GTI only at implausibly high income levels.

Table 2: Estimates of Total Income as a Function of Gross Total Income (1984-85 Rupees; Weighted Least Squares)					
Item	1984-85	1985-86	1986-87	1987-88	1988-89
Constant (γ) (t-statistic)	-0.4064 (1.2828)	-0.2792 (1.0101)	-0.6521 (0 .4435)	-0.1694 (0.6345)	-0.2302 (0.7795)
Exponent (β) (t-statistic)	1.0158 (33.9732)	1.0094 (39.8972)	1.0346 (23.8938)	0.9990 (41.1127)	0.9874 (37.4015)
R-Squared	0.9998	0.9993	0.9995	0.9991	0.9996

Source: Our calculations based on NIPFP grouped data.

Step 3: Parameters (denoted μ and π) for equations giving GTI as a function of TI, found by inverting (8), are in Table 3. The distribution of GTI is then estimated by using (7) and (8). This distribution will also be Pareto with the parameters (dropping time subscripts without risk of confusion) $K_1 \equiv K^{\pi}\mu$ and $\alpha_1 \equiv \alpha/\pi$. The exponents for 1984-87 are below unity, suggesting that the true GTI versus TI relationship may vary across income groups. However, given the excellent fit of the estimated regressions, this is unlikely to distort decomposition estimates seriously.

Table 3: Estimates of Gross Total Income as a Function of Total Income (1984-85 Rupees)					
Item	1984-85	1985-86	1986-87	1987-88	1988-89
Constant (μ)	1.4919	1.3177	1.8694	1.1851	1.2606
Exponent (π)	0.9844	0.9907	0.9665	1.0010	1.0026

Source: Calculated from Table 2.

Step 4: The distribution of potential income is then estimated, for cases 1b and 2b, where evasion is entirely due to under-reporting, using the relationship discussed earlier, $h_t(q_{it}) = g_t[Z_t q_{it}/Q_t]$.

Table 4: Average Tax Rates on Alternative Bases (Percent)					
Base	1984-85	1985-86	1986-87	1987-88	1988-89
AT CURRENT TAX RATES					

Total Income	17.55	16.52	19.44	21.50	21.24
AT BASE YEAR TAX RATES					
Total Income	17.55	20.98	23.28	23.47	21.85
Gross Total Income	22.03	24.29	27.70	26.71	26.49
Potential Income (Case 1b)	27.89	30.95	27.70	27.80	26.73
Potential Income (Case 2b)	44.99	47.05	44.23	43.77	42.95
Note: In Cases 1a and 2a the average tax rate on PI is identical with that on GTI					

Source: Our calculations based on CAG, AIITS and NIPFP data.

Step 5: Average tax rates at base year and current year tax rates are then calculated analytically (Table 4) taking advantage of the fact that all income tax schedules during the period are piecewise linear in taxable income. For cases 1a and 2a recall that the average tax rates on GTI are identical to those on PI.

Estimation of Income Aggregates: In principle, aggregate TI and GTI can be computed directly from their estimated Pareto distributions given the number of taxpayers. However, this will result in estimation errors cumulating. Consequently, we estimate TI by directly adding TI across the different income groups using primary data. GTI is then estimated by scaling-up of the expected value of GTI from its estimated distribution by the taxpayer population reported in Table 1. Once again, the direct estimate of TI rather than that implied by the fitted distribution is used.[23]

For Case 1 decompositions, the year with minimum evasion in the sample turned out to be 1986-87, which was during the episode of stepped up enforcement while V.P. Singh was the Finance Minister. The resulting estimates of PI under the relative evasion alternative are given, along with

[23]That is, aggregate income given Pareto distributions can be computed to be (dropping time subscripts) $TI=N\alpha K/(\alpha-1)$ or $GTI=N\alpha_1 K_1/(\alpha_1-1)$ where N is the number of taxpayers. Substituting for TI in the expression for aggregate GTI, using the definitions of K_1 and α_1 yields $GTI=N(TI)(\alpha-1)\mu K^{(\alpha-1)}/(\alpha-\mu)$.

other estimated aggregates in Table 5. The estimate of PI for Case 2 which is based on the evasion estimate of Acharya and Associates (1985) for 1981.[24]

Table 5: Estimated Aggregate Income for Taxable Individuals
(in Millions of 1984-85 Rupees)

	1984-85	1985-86	1986-87	1987-88	1988-89
Potential Income (Case 1)	131965	141097	150240	158458	171183
Potential Income (Case 2)	349938	374153	398398	420191	453932
Gross Total Income	98057	99770	150240	149064	168920
Total Income	77423	83628	115567	124416	130285
GTI as a percentage of NAGDP	*7.53*	*7.16*	*10.13*	*9.53*	*10.00*

Source: Our calculations based on CAG, AIITS and NIPFP.

4. Decomposition Results

Using the information in Tables 3 to 5, the decomposition in equation (6) is calculated. Revenue gains relative to the base year are reported in Tables 6, 7 and 8. The evasion inclusive decompositions in Tables 7 and 8 are encouraging in that there are no sign conflicts for any component.

We start by examining the decomposition in Table 6, which ignores evasion (i.e. taking GTI equal to PI). The results of this decomposition are striking on three counts. Firstly, the aggregate effects of reforms amounted to as much as 11 percent of revenue. Secondly, the revenue effects of reforms were, on average *negative.* Thirdly, the pure base effect was negative for two years -- if there had been no change in tax progressivity, there would have been a negative statutory base effect.

[24]According to their estimate, income escaping assessment amounted to Rs 172 billion out of a potential income of Rs 243 billion. Details of how we project this to 1985, as also year by year decomposition results for Tables 6 to 8 below are in the Appendix.

Thus, base broadening efforts during this period were inadequate and failed to counter the decline in revenue due to tax rate reduction.

Table 6: Income Tax Revenue Gain Relative to 1984-85: No Evasion Assumption (Percent)				
	1985-86	1986-87	1987-88	1988-89
Tax Rate Effect	-17.8	-12.7	-7.0	-2.2
Statutory Base Effect	9.5	1.7	10.4	0.7
of which Progressivity Gain	*4.6*	*3.8*	*5.9*	*2.6*
Total Revenue Gain	-8.3	-11.0	3.4	-1.5

Source: Our calculations based on CAG, AIITS and NIPFP.

What happens if we now allow for evasion? While, reiterating that the possibility of measurement errors must be borne in mind, the decompositions yield a number of interesting inferences:

i. Revenue gains did occur during the reform period. However, as pointed out earlier, the share of total revenue from the income tax did not recover to the level prevailing in the 1970's despite these gains. The revenue gain relative to potential decreases with the level of tax evasion assumed, as can be seen by comparing Tables 7 and 8.

Table 7: Income Tax Revenue Gain Relative to 1984-85: Minimum Evasion Assumption: Case 1 (Percent)				
	1985-86	1986-87	1987-88	1988-89
a: If Evasion is due to Non-Filing				
Tax Rate Effect	-10.9	-10.7	-5.8	-1.8
Statutory Base Effect	8.1	-7.8	2.5	-8.3
of which Progressivity Gain	*3.9*	*-0.4*	*2.4*	*-1.4*
Evasion Effect	-3.6	25.7	19.8	24.4
Total Revenue Gain	-6.4	7.2	16.4	14.3
b: If Evasion is due to Under-reporting				
Tax Rate Effect	-8.5	-10.7	-5.6	-1.8
Statutory Base Effect	7.3	-10.3	0.4	-10.7

of which Progressivity Gain	*3.1*	*-2.9*	*0.3*	*-3.8*
Evasion Effect	-4.0	38.0	29.0	36.0
of which Progressivity Gain	*-0.4*	*12.3*	*9.3*	*11.7*
Total Revenue Gain	-5.3	17.0	23.8	23.5

Source: Our calculations based on CAG, AIITS and NIPFP.

ii. Comparing Table 6 with either Tables 7 or 8 shows that revenue gains were not due so much to tax base changes as to the induced decrease in tax evasion due, possibly, to rate reform. This inference is reinforced by the fact that revenue gains decreased in 1988-89, the year in which tax rates were highest following the reform (due to inflationary bracket creep and the reimposition of a surcharge). Nevertheless, the revenue gain cannot be attributed to rate reduction alone, as there was a simultaneous increase in income-tax enforcement activity.[25]

iii. This inference is strengthened by the evasion and statutory base effects being significantly negatively correlated with a coefficient of about 0.8. This suggests the hypothesis that taxpayers treat evasion and tax saving via deductions as substitutes. If this is correct, then base-broadening measures alone without steps to improve tax enforcement will be relatively ineffective.

iv. Finally, in Table 7 and particularly Table 8, the progressivity components of the two base effects, are seen to be smaller, on average, than the pure base effects. This suggests that lowering tax rates *per se* was of more importance than reducing the progressivity of the tax code.

[25]For an analysis of the impact of tax rates and tax enforcement on revenues see Das-Gupta, Lahiri and Mookherjee (1992).

Table 8: Income Tax Revenue Gain Relative to 1984-85: Exogenous Evasion Estimates: Case 2 (Percent)				
	1985-86	1986-87	1987-88	1988-89
a: If Evasion is due to Non-Filing				
Tax Rate Effect	-4.1	-4.0	-2.2	-0.7
Statutory Base Effect	3.0	-2.9	0.9	-3.1
of which Progressivity Gain	*1.5*	*-0.1*	*0.9*	*-0.5*
Evasion Effect	-1.4	9.7	7.5	9.2
Total Revenue Gain	1.7	6.8	8.4	6.1
b: If Evasion is due to Under-reporting				
Tax Rate Effect	-2.3	-2.4	-1.3	-0.4
Statutory Base Effect	2.1	-3.3	0.04	-3.5
of which Progressivity Gain	*0.5*	*-0.5*	*0.01*	*-0.9*
Evasion Effect	-0.04	9.1	7.2	9.5
of which Progressivity Gain	*1.3*	*-0.6*	*-0.2*	*0.3*
Total Revenue Gain	2.1	5.7	7.2	6.0

Source: Our calculations based on CAG, AIITS and NIPFP.

Our findings may have implications for the theory of tax compliance if they are valid for individual taxpayers and are not merely due to aggregation. The substitutability of deductions and evasion would not be predicted by extending the standard Allingham-Sandmo (1972) model of tax evasion to incorporate deductions. Such a model could have, for example: the income of a taxpayer if evasion is undetected being given by $Y-(Y-D)xt+[R(t,D)]D$, and by $Y-(Y-D)t-(Y-D)(1-x)tf+[R(t,D)]D$ if evasion is detected, where Y is income, D is deductions, x is the fraction of taxable income reported, $R(t,D)$ is the discounted present value of the net of tax earnings stream per unit of deductible investments D, t is the tax rate and f is the penalty on evaded taxes.[26] $R(t,D)$ can be assumed to be sufficiently concave in D to yield an interior maximum (within any prescribed ceiling) and also to decrease at a constant rate with t. It is easy to verify that, given a constant probability of

[26]A penalty on evaded taxes rather than unreported income is the regime prevailing in India.

detection, a taxpayer (with interior x) takes less deductions if the tax rate increases. However, the impact of a tax rate increase on reported gross income xY and reported taxable income $(Y-D)x$ is *positive* for taxpayers displaying decreasing absolute risk aversion since the fraction of taxable income reported, x, increases with t. To explain a simultaneous increase in both reporting and deductions the model must be extended to incorporate, for instance, capital flows which respond to post-tax interest differentials. Such flows could either be international or between taxed and untaxed sectors (such as agriculture in the Indian case) or between the "black" and "white" economies.[27]

6. Conclusions

We develop a methodology for decomposing tax revenue changes into components due to tax base and tax rate changes and use it to examine a particular episode of base-broadening and tax rate-cum-bracket reduction in India. The direction of these effects appears to be robust to different assumptions concerning the extent of revenues lost due to tax evasion.

The application of our decomposition to Indian data is limited, firstly, by the manner in which potential income is estimated and second, by the quality of data available. It is also limited in scope in that it examines only one reform episode. Replication of this study for other reform episodes in other countries is required before any firm conclusions can be drawn about appropriate reform directions, though the importance of administrative reform seems to be borne out both by the experience of other countries (such as Mexico and Colombia)[28] and by other studies of income taxes in India.

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[27]As in, for example, Das-Gupta, Lahiri and Mookherjee (1992).

[28]See, for example Bird and Casanegra (1992).

References

Acharya, S. and Associates (1985) **Aspects of the Black Economy in India**, New Delhi: Ministry of Finance, Government of India.

Advisory Commission on Intergovernmental Relations (1990) **State Capacity and Fiscal Effort**, Washington D.C. U.S. Government Printing Office.

Allingham M.G. and A. Sandmo (1972), "Income Tax Evasion: A Theoretical Analysis", **Journal of Public Economics**, 1, 323-328.

Bagchi, Amaresh, Richard M. Bird and Arindam Das-Gupta (1995), "An Economic Approach to Tax Administration Reform", Discussion Paper No 3, International Centre for Tax Studies, University of Toronto.

Bird, Richard M. and Milka Casangera de Jantscher (eds.) (1992) **Improving Tax Administration in Developing Countries** (Washington: International Monetary Fund).

Boskin, Michael J. and Charles E. McClure, Jr., Editors (1990), **World Tax Reform: Case Studies of Developing and Developed Countries**, San Francisco: ICS Press.

Cowell, F.A. (1990), **Cheating the Government**, Cambridge, Mass: MIT Press.

Das-Gupta, Arindam, Radhika Lahiri and Dilip Mookherjee (1995) "Income Tax Compliance in India: An Empirical Analysis", **World Development**, 23, 2051-2064.

Feenberg, Daniel R. and James M. Poterba (1993), "Income Inequality and the Income of Very High-Income Taxpayers: Evidence from Tax Returns", in James Poterba, Editor, **Tax Policy and the Economy**, Vol 7, Cambridge: The MIT Press.

Government of India, Comptroller and Auditor General (Various Years), **Report, Union Government Revenue Receipts: Direct Taxes**, New Delhi: Government of India.

Government of India, Income Tax Department (Various Years), **All India Income Tax Statistics**, New Delhi: Directorate of Research, Statistics, Publications and Public Relations, Income Tax Department.

Government of India, Ministry of Finance (1985), **Speech of Shri Vishwanath Pratap Singh, Minister of Finance, Introducing the Budget for the Year 1985-86**, New Delhi: Government of India.

Government of India, Ministry of Finance (1986), **Speech of Shri Vishwanath Pratap Singh, Minister of Finance, Introducing the Budget for the Year 1986-87**, New Delhi: Government of India.

Government of India, Ministry of Finance (1987), **Speech of Shri Rajiv Gandhi, Prime Minister and Minister of Finance, Introducing the Budget for the Year 1987-88**, New Delhi: Government of India.

Government of India, Ministry of Finance (1988), **Speech of Shri N.D. Tiwari, Minister of Finance, Introducing the Budget for the Year 1988-89**, New Delhi: Government of India.

Government of India, Tax Reforms Committee (1991, 1992), **Interim and Final Reports**, New Delhi: Government of India.

King, John R. (1995), "Alternative Methods of Revenue Forecasting and Estimating", in Parthasarathi Shome (Editor), **Tax Policy Handbook**, Washington D.C. International Monetary Fund.

Lindsey, Lawrence (1987), "Individual Taxpayer Response to Tax Cuts: 1982-1984", **Journal of Public Economics**, 33, 173-206.

Manasan, Rosario G. (1988) Tax Evasion in the Philippines 1981-1985, **Journal of Philippine Development**, 15(2), 167-189.

National Institute of Public Finance and Policy (1994), Data Tapes on Grouped Returned-Based Data on Income Tax Assesses, Assessment Years 1984-85 - 1990-91, New Delhi.

Rao, V.K.R.V and C.N. Vakil (1931), **Taxation of Income in India**, Calcutta: Longmans, Green and Co. Ltd.

Shome, Parthasarathi (1995) **Tax Policy Handbook**, Washington D.C. International Monetary Fund.

Vasquez-Caro, Jaime, Gary Reid and Richard M. Bird (1992), "Tax Administration Assessment in Latin America", Latin American and Carribean Technical Department, Regional Studies Program, Report No. 13, Washington D.C: The World Bank.

World Bank (1988), **World Development Report 1988**, Oxford University Press.

Appendix *(Available from the authors: Not for publication)*

Data Sources and Issues

Gross Total Income is a narrower concept than comprehensive income due primarily to the exclusion of certain types of exempt income. The main type of excluded income is income from agriculture. Other types of exempt income are unlikely to amount to much in the aggregate, particularly for resident taxpayers. Total income is defined as GTI less specified deductions and loss offsets from earlier years. The specified deductions from GTI are those given in Chapter VI-A of the Indian Income Tax Act and do not include deductions allowed on account of costs of earning income. However, certain adjustments must be made to these magnitudes for certain years. We denote estimated potential income by PI.

The data available to estimate various magnitudes required for decompositions are generally available for samples of taxpayers. Consequently, distributions and aggregate income magnitudes have to be estimated. Data sources used are as follows.

i. Grouped data from the Income Tax Department based on samples of individuals. Sample sizes range between 17,772 and 37,073 individuals in different years (between 0.45 percent and 1.42 percent of all individual taxpayers). The data are grouped by range of Gross Total Income into 14 different income classes (we exclude individuals with negative GTI who make up a fifteenth grouping). For each income class we have the mean of GTI, TI, long-term capital gains and rebates. The data on individuals are also disaggregated into salary earners, business/professional income earners, and others, on the same variables. A taxpayer is classified as a salary earner or business-person/professional if at least fifty percent of the taxpayer's GTI is from this source. Fortunately, there are no ties so that no taxpayer is classified as both a salary earner and a business-person. The relationship between Gross Total Income and Total Income in for these categories of taxpayers, (as well as all taxpayers) in different years is estimated using these data. Furthermore, data used to adjust TI and GTI in some years to bring about comparability, as explained below, are also from this source. However, the distribution of taxpayers in the sample is biased with higher income taxpayers being over-represented so that taxpayer distributions cannot be based on this source.

ii. Data on the number of taxpayers taken from the Annual Reports of the Comptroller and Auditor General (CAG). These data are grouped into 3 broad groups according to Total Income.

iii. Data on the distribution of taxpayers and TI is also taken from the All India Income Tax Statistics (AIITS) . These data are based on a large sample of taxpayers (ranging from 42.7 to 60.1 percent of all taxpayers in different years) and grouped according to 9 different ranges of TI. We combine AIITS sample data with CAG population distribution

data to arrive at the distribution of taxpayers used in estimation. Fortunately, each taxpayer group given in the AIITS falls entirely within a single CAG group eliminating the need for further assumptions in arriving at the distribution. This technique for arriving at the distribution of taxpayers is standard practice in Indian income-tax studies (e.g. see Aggarwal, 1990).

iv. Data on NAGDP is from the annual Economic Surveys as is the Consumer Price Index for Urban Non-Manual Employees (Base 1984-85) used for inflation adjustment. Individual income tax schedules (inclusive of surcharge) are taken from the Finance Acts of the different years.

v. The exogenous estimate of potential income is based on Acharya and Associates (1985). We proceed as follows. Acharya and Associates (1985) estimate that income escaping assessment amounted to Rs 172 billion in 1980-81 rupees compared to assessed income of 70 billion rupees, yielding a total potential income of 243 billion rupees. The only figure provided on the break up between individuals and other categories of assesses is for assessed income. Individual assessed income amounted to 88.7 percent of the total. Assuming this proportion to hold for income escaping assessment yields an estimate of potential income of individuals amounting to 215 billion rupees in 1980. Projecting this at the rate of growth of real NAGDP and converting to 1984-85 rupees gives estimates of potential income which are reported in the second row of Table 5.

Adjustments to Gross Total Income and Total Income

Due to changes in definitions across years, reported GTI and TI required one adjustment each to bring about comparability across years. Since these adjustments are made to grouped data, some amount of distortion is unavoidable. However, these distortions are unlikely to be serious since the adjustments are small relative to the unadjusted figures, amounting a maximum of 1.4 percent of the unadjusted figures within any income grouping. Clearly, the aggregate effect is even smaller. Nevertheless, the disaggregated data on salary earners and businesses are not adjusted since the adjusted data shows greater variability across income groups for these data sets. Consequently, regressions reported in Table 10 are not strictly comparable across years. The data adjustments, which are done group by group on a per taxpayer basis in all cases, are as follows.

i. Tax Rebates: Rebates which result in lowering taxes instead of lowering taxable income lead to an over-estimation of TI since these are effectively a base narrowing feature. These are adjusted for by subtracting the marginal tax rate (or rates in case the threshold of a bracket is crossed) times the rebated tax from TI.

ii. Long Term Capital Gains Reporting: Prior to 1987-88, long-term capital gains were included in GTI with deductions from them being made "below the line" (under Section 80T of the Income Tax Act) to arrive at TI. Thereafter, only taxable long term capital

gains have been included in GTI. Consequently, for 1987-88 and 1988-89, estimates of tax exempt long-term capital gains were added back to GTI. These estimates were arrived at by applying the rules (in Section 48 of the Income Tax Acts of the relevant years) for determining exempt gains to data on taxable long term gains. Specifically, let TLCG stand for taxable long term capital gain, LCG represent long term capital gain, category 1 represent land, buildings, gold and jewelry and category 2 be financial assets. Then taxable long term capital gains were determined in these years by formulae of the type $TLCG_i = r_i(LCG-m_i)$ subject to $m_1+m_2 \leq m$ and the additional condition that $m_2=0$ if $TLCG1>0$. The constants r_1, r_2 and m had different values in different years.

An issue that needs to be addressed is the treatment of loss offsets. These could, in principle, bias the results for some years if carried forward losses are particularly heavy. On the other hand, the impact of loss provisions on average tax rates and tax base loss should be accounted for in the decomposition. The appropriate procedure would appear to be to adjust current statistics by the value of carried forward current losses, appropriately discounted. Such detailed data are, however, not available. Since loss offsets are small relative to total income (below 0.5 percent in any year) we do not correct reported figures for loss offsets.

Analytically deriving average tax rates from piecewise linear schedules:

If taxes due in any year for taxable income x between x_1 and x_2 is given by $c+tx$ (c will invariably be negative), then total taxes due from all individuals falling in this bracket can be computed using the parameters of the Pareto distribution given the total number of taxpayers (N) to be: $N\alpha K^{\alpha}\{(c/\alpha)[x_1^{-\alpha}-x_2^{-\alpha}] + (t/[\alpha-1])[x_1^{1-\alpha}-x_2^{1-\alpha}]\}$. In the event that $K > x_1$, K should be substituted for x_1 in this expression.

Reference:

Aggarwal, Pawan K., “An Empirical Analysis of Redistributive Impact of the Personal Income Tax: A Case Study of India.” Public Finance-Finances Publiques. Vol. 45 (2). p 177-92, 1990.

Year by Year Decomposition Results

Table A1: Decomposition of Income Tax Revenue Loss: No Evasion Assumption (Percent)					
	1984-85	1985-86	1986-87	1987-88	1988-89
Tax Rate Effect	0.0	17.8	12.7	7.0	2.2
Statutory Base Effect	37.1	27.6	35.4	26.6	36.4
Progressivity Loss	*16.1*	*11.4*	*12.3*	*10.1*	*13.5*
Total Revenue Loss	37.1	45.4	48.1	33.7	38.6

Table A2: Decomposition of Income Tax Revenue Loss: Minimum Evasion Assumption: Case 1 (Percent)					
	1984-85	1985-86	1986-87	1987-88	1988-89
a: Evasion due to Non-Filing					
Tax Rate Effect	0.0	10.9	10.7	5.8	1.8
Statutory Base Effect	27.6	19.5	35.4	25.1	35.9
Progressivity Loss	*11.9*	*8.1*	*12.3*	*9.5*	*13.3*
Evasion Effect	25.7	29.3	0.0	5.9	1.3
Total Revenue Loss	53.3	59.7	46.0	36.8	39.0
b: Evasion due to Under-reporting					
Tax Rate Effect	0.0	8.5	10.7	5.6	1.8
Statutory Base Effect	25.1	17.8	35.4	24.7	35.8
Progressivity Loss	*9.4*	*6.3*	*12.3*	*9.1*	*13.2*
Evasion Effect	38.0	42.1	0.0	9.0	2.0
Progressivity Loss	*12.3*	*12.8*	*0.0*	*3.1*	*0.7*
Total Revenue Loss	63.1	68.4	46.0	39.3	39.5

Table A3: Decomposition of Income Tax Revenue Loss: Exogenous Evasion Estimates: Case 2 (Percent)					
	1984-85	1985-86	1986-87	1987-88	1988-89
a: Evasion due to Non-Filing					
Tax Rate Effect	0.0	4.1	4.0	2.2	0.7
Statutory Base Effect	10.4	7.4	13.3	9.5	13.5
Progressivity Loss	*4.5*	*3.0*	*4.6*	*3.6*	*5.0*
Evasion Effect	72.0	73.3	62.3	64.5	62.8
Total Revenue Loss	82.4	80.7	75.6	74.0	76.3
b: Evasion due to Under-reporting					
Tax Rate Effect	0.0	2.3	2.4	1.3	0.4
Statutory Base Effect	8.1	6.0	11.4	8.1	11.6
Progressivity Loss	*2.2*	*1.7*	*2.7*	*2.2*	*3.1*
Evasion Effect	83.3	83.3	74.2	76.1	73.8
Progressivity Loss	*11.3*	*10.0*	*11.9*	*11.5*	*11.0*
Total Revenue Loss	91.4	89.3	85.6	84.1	85.4

(Source: Our calculations based on CAG and AIITS and NIPFP data)